Addis Ababa University
Addis Ababa Institute of Technology
School of Civil and Environmental Engineering

Assessment of the Impact of ISO 9001 Certification on Ethiopian Construction Companies

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A Thesis Submitted to Addis Ababa Institute of Technology, School of Civil and Environmental Engineering, in Partial Fulfillment of the Requirements for the Degree of Master of Science in Construction Technology and Management.

March, 2014
Addis Ababa - Ethiopia

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Declaration

I, the undersigned, declare that this thesis entitled '**Assessment of the Impact of ISO 9001 Certification on Ethiopian Construction Companies'** is my original work and has not been presented for a degree in any other university. All sources of materials used for the thesis have been properly acknowledged.

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Date: March, 2014

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

Dr. Ephraim Senbetta _____ _____

(Advisor) Signature Date

Acknowledgements

This thesis would not have come to an end without the support of many individuals. I owe a great debt of thanks, first and foremost to my advisor Ephraim Senbetta, PhD, P.E., LEED AP Fulbright Scholar, Ethiopia. Dr. Ephraim Senbetta deserves the highest acknowledgement because he advised me with critical and constructive comments and guided me throughout this thesis work. Dr. Ephraim Senbetta has also spent his precious time in reviewing and improving the quality of this thesis work. My thanks also go to the school of graduate studies of Addis Ababa University for its financial support. I also wish to thank the ISO 9001 certified construction companies that participated in this research project and provided me valuable company information which is really the sole base of this research. Moreover, I am also grateful to Ato Taddese Yemane, General Manager of Sur Construction Plc, for his comments, advice and moral support. Last but not least, I am grateful to my beloved wife, Tiblets Fitum, for her consistent understanding and moral support throughout this thesis work. I thank to my daughter Samrawit Teklebrhan for her time that I had to spend with her but I have allocated for my thesis work.

This work is dedicated to Ato Teweldebrhan Gebreslassie (RIP) who made me continue education in grade nine when I faced difficulty and decided to totally stop education.

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Acronyms and Abbreviations:

BEM	=	Business Excellence model
ERA	=	Ethiopian roads authority
INS	=	Inspection
ISO	=	International Organization for Standardization
QA	=	Quality Assurance
QC	=	Quality Control
QM	=	Quality Management
QMS	=	Quality Management System
RII	=	Relative Importance Index
TQM	=	Total Quality Management
UCBP	=	University Capacity Building Program

Abstract

This research has studied the impact of ISO 9001 on certified Ethiopian construction companies. The objective of this research is to determine if Ethiopian ISO 9001 certified construction companies have benefited from obtaining the certification and investigate the main reasons if they have not. To carry out this study, pieces of literatures are reviewed and briefly organized in to subtopics under the literature review part. A questionnaire is designed based on the literature review and distributed to ISO certified construction companies, then collected and analyzed. Interview was also conducted to validate the information collected through questionnaire and get additional information which was not covered in the questionnaire.

In the course, the research has identified the main challenges faced during ISO 9001 implementation, the benefits obtained by certified construction companies, how the output or performance of ISO 9001 is measured and the reasons for failures in getting possible benefits of the QMS.

Finally, conclusion is drawn from the findings. The ISO 9001 certified construction companies have not got tangible benefit. The main reason for failure is that construction companies do not give much emphasis to internal benefits of the standard such as process efficiency and effectiveness, inadequate training, inadequate motivation etc. In addition to this, the support and encouragement of governmental bodies to certified companies lacks continuity. The top main challenges that certified companies faced during ISO implementation are change resistance, inconsistency in implementing QMS and Turnover.

Lastly, recommendations are forwarded to fill the gaps observed in the findings.

Chapter One: Background of the Research

1.1 Introduction:

In developed nations, quality has been used as an important strategic weapon in winning market. Survival is the prime motivator in a highly competitive international environment. Changes in the global economy have caused Ethiopian companies to take a look at the way they and others have done business in the past [4].

The growing liberalization of trade and the globalization of market present a challenge to companies in developing countries in order to survive in today's market. On the other hand, organizations are involved in or insist that their suppliers comply with ISO 9001: 2008 QMS requirements [3].

Adoption of quality assurance in the construction industry has been mainly client led. The basic reason is that realizing enforcement of the contract in law after big nonconformance is already happened cannot reverse any damage already done. Thus, a client, when awarding a contract, takes into account the construction companies' capability to 'do it right first time and every time' which is the underlying philosophy of quality assurance. Customers both in private & public sectors are looking for confidence that can be provided by a business with an effective (or even certified) QMS and begun to insist on an effective quality system as prerequisite for tendering. The basis of competition for business is shifting from 'price only' to a combination of price and quality [2].

In order to reap internal and external benefits of ISO 9001, a company needs to properly utilize the QMS in day to day business and publicize its ISO 9001 certification [2].

In Ethiopia no specific research was conducted on impact of ISO 9001 certification on Ethiopian construction companies to the extent the researcher is able to discover. However, Yimam Abadir in his MSc thesis, entitled 'Project management maturity in the construction industry of developing countries: the case of Ethiopian contractors,' has indicated that ISO 9001 certified or in process to get certified are found to be at higher project management maturity level than the uncertified contractors and not in process to get certified. His study

was not mainly on ISO 9001 certified construction companies but some of his respondents were certified. His study was not on the detailed impact of ISO 9001[23].

Therefore, this research identifies impacts of ISO 9001 certification on Ethiopian certified construction companies.

1.2 Statement of the Problem

There are few ISO 9001 certified Ethiopian construction companies. However, to what extent the companies have benefited from implementing a QMS is not known. Therefore, this thesis will make clear to what extent the certified companies benefited.

1.3 Objective of the Research

The objective of this research is:

- To determine if Ethiopian ISO 9001 certified construction companies have benefited from obtaining the certification and investigate the main reasons if they have not
- In in line with the above objective, the study will answer the following two questions:
    - How the certified companies measure the benefits of implementing ISO 9001?
    - What are the main challenges faced in implementing ISO 9001 standard?

1.4 Scope of the Research

- Geographical limitation: data collection is limited to Addis Ababa area.
- Primary data collection is limited to ISO 9001 certified construction companies.

1.5 Research Methods

The research overall approach was desk study of archival documents and piece of literatures together with surveying and interviews with ISO 9001 certified construction companies. Both qualitative and quantitative approaches are used in analyzing the primary data collected.

The above mentioned objective is achieved through literature review, questionnaire design, data collection, analysis, examining the data through interview and interpretation. The details are presented in chapter three.

Chapter Two: Literature Review

2.1 Quality and Quality Management Basics

2 .1.1 Understanding Quality

Definition of Quality:

There is a challenge in defining quality because quality is a subjective concept, like beauty. Everyone has a different definition based on their personal experiences [6].

Some of the definitions of quality are [2]:

- Quality is the ongoing process of building and sustaining relationships by assessing, anticipating, and fulfilling stated and implied need.
- Attainment of prescribed standards
- The degree to which a set of inherent characteristics fulfill requirements (ISO 9000:2005)

Definition of quality in terms of different perspectives is described below [5, 6, 28].

- **For Engineers:** quality is conformance to specifications
- **From manufacturing point of view:** quality is fitness for use (Juran).
- **For marketing personnel:** it is the degree of excellence at an acceptable price that will influence the market share.
- **From customer point of view:** Quality means fitness for use and meeting customer satisfaction.
- **From process point of view:** Quality means conformance with the process design, standards and specifications.
- **From product point of view:** Quality means the degree of excellence at an acceptable price.
- **From the cost point of view:** Quality means best combination between costs and features.
- **Quality is all about reducing variations:** precision and accuracy of production. There are natural (unavoidable variation) and assignable (avoidable, caused simply by mistake and random) variations (Deming).

There are three key elements of quality. The three quality elements which influence a product or serviceability to satisfy customer needs are presented below [6].

- **Quality of Design:** A product needs to be designed to satisfy customer needs.
- **Quality of Conformance:** Closeness with which the finished product or supplied service matches the specifications of the original design.
- **Quality of Reliability:** ability of the finished product to provide trouble free performance in the field, over an acceptable time period.

Quality of construction is more difficult to define because the product is usually not a repetitive unit but a unique piece of work with specific characteristics. The builder can judge the quality of his/her work by the degree of compliance with conditions in the contract, not only the technical specifications but also the contract sum and the contract period. The client will be satisfied if the construction is executed as specified, within budget and on time. Therefore, a quality product of building construction is one that meets all contractual requirements (including statutory regulations) at optimum cost and time [2].

Quality in general terms is 'fitness for purpose', but in building construction it is more appropriately interpreted as 'compliance with contractual requirements' [2].

"*Taking customers into consideration, the central idea in quality is about customer satisfaction. Accordingly, quality can be defined as "exceeding customers' expectation not for once but continuously". The challenge towards this definition is the value of customers' expectation. It is actually a combination of subjective-emotional and objective-functional attributes, naturally dynamic that changes with time*" [28].

2.1.2 Quality Management Basics

2.1.2.1 Tenets of Quality Management:

"*Based on Deming, Juran, Crosby and other scholar's common ideas, there are four tenets of quality management: customers' satisfaction, continuous improvement, process focus and management commitment*". The details are presented below [28].

i. **Customers' Satisfaction:** one of the most important quality management concepts is customers' satisfaction. In today's market, a customer making a purchase decision is faced with a great deal of choice and customers can compare and contrast products quality without boundary. External alignment with customers is achieved when the organization is capable of meeting the customer's requirements. On the other hand, internal alignment is attained when each department and each employee understands both the organization's vision and how the specific work they accomplish fit into that vision.

ii. **Continuous Improvement:** In the age of globalization, organizations feel heavy pressure from the rapid changes in their environment as to customer demands, product life-cycles, competitions, autonomy needs of employees and government regulations and legislations. To be able to cope with this situation, constant development and learning will become mandatory. Organizational transformation demands proper planning and implementation, especially in these days where competition is severe and level of uncertainties is very high.

Continuous improvement can be defined as a culture of sustained improvement targeting the elimination of waste in all systems and processes of an organization. It involves everyone working together to make improvements without necessarily making huge capital investments. Improvement can occur through evolutionary improvement, in which case improvements are incremental or through radical changes that take place as a result of an innovative idea or new technology. Often, major improvements take place over time as a result of numerous incremental improvements.

iii. Process Focus: At every supplier-customer interface, there is a transformation process and every task throughout an organization should be viewed as a process. Defining the scope of a process is vital since it will determine both the required inputs and the resultant outputs. The key to success is to align the employees of the business, their roles and responsibilities, with the organization and its processes. Many outstanding organizations have achieved and maintained their leadership through process improvement.

iv. Management Commitment: In emphasizing management's responsibility, Deming noted that workers are responsible for 10% to 20% of the quality problems in a factory and the majority 80% to 90% is under management's control.

Managers set policy & strategy that addresses internal culture, structure and operations in both short-term and long-term with regard to priorities, direction and needs of customers, resources, government initiatives and the community at large. Organizations should establish and clearly communicate their policies & strategies including their processes and plans and justify their continual existence. Managers are also responsible for the five major resources: people, material, equipment & machines, information & financial resources.

2.1.2.2 Basic Concepts of Quality Management:

The primary objective of the construction management function is the control of three main factors or values. They are time, cost and quality. These three factors are commonly referred to in the construction industry as the three-legged stool [9].

However, there is one more very important factor i.e. safety (safety for builders and users). Construction can be a dangerous business and safety must be the foundation upon which all other values are placed, without safety the whole project is at risk. Quality not only impacts aesthetics, appearance and durability `but it also impacts performance. Poor performance can lead to failures in everything. Failures due to poor quality; costs money and time but in some instances, poor quality can even cost lives or result in serious injury [9].

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 [2]:

- 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 [8].

"*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 [7].

Defects arising in construction are mostly caused by poor management and communication. It is unrealistic to assume that mistakes appearing on site are actually made on site. These mistakes may be traced back to the purchase of incorrect or incompatible materials and the failure to retrieve the outdated drawings. Thus, site problems can be the consequence of negligence or malpractice in the head office. 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 [2].

Therefore, the performance of an individual in an organization could directly or indirectly affect the quality of the finished product. Responsibility for quality therefore stretches from the chief executive right down to the person on the job. If consistent quality is to be assured, all staff in the organization, both in the head office and on site, must [2]:

- Know what their authorities are: have appropriate organization structure, clear lines of responsibility and communication
- Know what their duties are: have clear definition and description of duties
- Know what to do: have correct specifications and drawings
- Know how to do it: have proper training, appropriate procedures, and ready access to necessary instructions
- Want to do it: have proper motivation
- Be able to do it: have the right resources, equipment, plant and materials
- Know that it is done: have appropriate checking, measurement or testing of products
- Record that it has been done: keep proper records, specified certificates

To practice quality assurance, an organization has to establish and maintain a quality management system (usually abbreviated to quality system) in its day to day operation. A quality system contains, among other things, a set of documented procedures for the various processes carried out by the organization. Implementing a quality system does not replace the existing quality control functions, nor does it result in more inspection and testing. It just ensures that the appropriate type and amount of verification is performed when and where it is planned to be done. Actually, a quality system embraces quality control as its technical arm. Quality assurance is oriented towards prevention of quality deficiencies. It aims at minimizing the risk of making mistakes in the first place, thereby avoiding the necessity for rework, repair or reject [2].

The aim of implementing QMS is not to standardize the unique output of construction project but to standardize the process of carrying out an activity. If the process is standardized, the output is likely to meet quality requirements. The corporate procedures apply to all projects in varying degrees can be standardized with provision for preparation of a quality plan to cover the characteristics and specific requirements of a particular project. Typical examples are procurement, document control and record keeping [2].

2.2 Developments in Quality Management

The emphasis on quality management arises from the demand of customers for ever-increasing standards of high quality and the need by supplier's to produce **quality products consistently** at reasonable cost [3].

Conceptually, there are three hypotheses to the origin and development of quality [28]:

1. Quality is a recent development which evolved from pre and post classical management theories. This is related to the history of management thought like classical, behavioral and the different management theories developed after the Second World War: management science, system approach, contingency approach and dynamic engagement management theories. Quality management is considered as one of the dynamic dimensions of management since quality is always a moving target.

2. Based on Thomas Khun's theory of scientific advancement, quality is an outcome of a revolutionary scientific development. He proposed three epochs of quality management; pre-industrial paradigm of caveat emptor, an industrial paradigm of quality control and a postindustrial paradigm of total quality management. This model suggests that each paradigm was the result of the discipline's adaptation to environmental contingencies.

3. Quality is an evolutionary development of quality inspection. This argument emphasizes that the concept of quality started as early as human existence. But quality management movement started in Japan during the 1950s. In the 1980s, quality management became increasingly popular in the United States and Europe most likely as a result of the success of Japanese firms in global markets. Since the 1990s, quality management became one of the widely accepted main issues in many organizations.

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 [3].

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. The task 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 [9].

The evolutionary developments of quality from different sources are presented below.

2.2.1 Inspection

Under a simple inspection based system, one or more characteristics of a product, service or activity are examined and compared with a specified set of requirements to assess conformity. In service and commercial type situations the system is also applied at key points, sometimes called appraisal points, in the producing and delivery processes. The inspection activity can be carried out by staff employed specifically for the purpose or by self-inspection. In some cases inspection is used to grade the finished product. The system is an after the event screening process with no prevention content other than, perhaps, the identification of suppliers, operations or works who are producing non-conforming products/services. Simple inspection based systems are usually wholly in-house and do not directly involve suppliers or customers in the activity [4].

2.2.2 Quality Control

ISO 9000:2005 defines quality control as part of quality management focused on fulfilling quality requirements. It involves both process monitoring and eliminating the causes of unsatisfactory performance at all stages focused on fulfilling product requirements. QC prevents undesirable deviations from the planned quality of the product being supplied.

Deming W. E. divides quality control into four activities [3]:

- Plan (establish goals, standardize working procedures and train employees)
- Do (carry out the work according to plan i.e. implement the process)
- Check (verify compliance with plans)
- Act (in case of non-compliance; finding and removing its root causes)

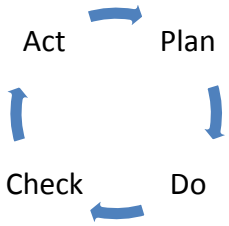

Figure 2.1: Deming/PDCA cycle [3]

QC measures led to greater process control and a lower incidence of non-conformance. Quality control in construction addresses quality at the project level and is implemented on the job site. Quality control primarily deals with issues relating to conformance to the plans and specifications. All of the materials, systems and workmanship applied to the project must conform to the requirements set forth in the contract documents. QC is accomplished using a number of different mechanisms: submittals, mock-ups, shop drawings, inspections and testing [9, 28].

"*QC will not improve quality but just highlight when products and services do not conform to requirements. Sometimes a quality control approach does not even identify the cause of the non-conformance. An overemphasis on quality control will result in people relying on their work to be checked and tends to stop them from taking responsibility for improving the processes for which they are responsible*" [4].

2.2.3 Quality Assurance

ISO 9000:2005 defines quality assurance as 'part of quality management focused on providing confidence that quality requirements will be fulfilled'. Thus, QA activities do not control quality: they establish the means for ensuring quality output. QA serves to build confidence internally among the managers of the organization and externally among its customer and the authorities. Quite often, the means to provide quality assurance has to be built into the process: this includes creating records, documenting plans, documenting specifications and reporting reviews. Such documents and activities also serve to control quality as well as assure it [3].

For this reason, the quality assurance stage came with the change away from product quality towards system quality. An organization sets up a system for controlling what is being done

and the system is audited to ensure that it is adequate both in design and use. In QA there is a use of both second party and third party audits to assess the efficiency of the system. The major characteristics of this stage are the use of quality manuals, procedures, work instructions, quality planning, quality audits etc. [28].

Finding and solving a problem after a non-conformance has been created is not an effective means of eliminating the root cause of a problem. Continuous improvement can only be achieved by directing organizational efforts towards planning and preventing problems occurring at source, finding, identifying and addressing the root-cause of non-conformances when they occur. More emphasis is placed on advanced quality planning, improving the design of the product, process and services, improving control over the process and involving & motivating people [4].

The basic difference between QA & QC is that QA is prevention based while QC is inspection based. QA is oriented towards *prevention* of quality deficiencies aiming at minimizing the risk of making mistakes in the first place, thereby avoiding the necessity for rework, repair or reject [2, 28].

QA takes a long-range view toward developing systems that produce high-quality work consistently over time. To be effective, a good QA plan must influence every aspect of the company from the management to the field. The concept implies that if the proper procedures, polices and systems are institutionalized throughout the organization up front, the outcome at the project level will be much more reliable [9].

2.2.4 Quality Management

ISO 9000:2005 defines quality management as coordinated activities to direct and control an organization with regard to quality. Thus quality management falls within the overall management function of a company. The emphasis is on understanding and meeting customer requirements and expectations and on “getting it right first time”. Quality management establishes quality policy, quality objectives and allocates responsibilities within the organization for achieving the stated quality policy and objectives. The means used to implement the quality policy and attain objectives are quality planning, quality control, quality assurance and quality improvement [3].

Similarly according to Project management body of knowledge (PMBOK), Project quality management includes the processes: Plan Quality, Perform Quality Assurance and Perform Quality control [23].

"*Quality management stage is the highest level involving the application of quality management principles to all aspects of the business. An organization going through a total quality process would have a clear and unambiguous vision, few interdepartmental barriers, time spent on training, excellent supplier and customer relations and the realization of that quality is not just product quality but also the quality of the whole organization including sales, finance, personnel and other non-manufacturing functions*" [28].

Quality awards such as Ethiopian quality awards and ISO 9001 quality management system are the major instruments or frameworks or models of quality management. The company should put quality in the first place and use the quality system as a means of achieving it. The QMS is essentially a management tool. If applied correctly, ISO 9001 ensures that the company's processes are efficient. By simply documenting the processes and ensuring that everyone follows the same process time after time, efficiency can be achieved. Processes have to be designed to be efficient because documenting existing inefficient process doesn't result to efficiency [2, 25, 28].

To maintain consistent quality of a product, be it a paper clip or a multistory building, the organization carrying out the production should have some means to ensure that every time a process is performed, the same method is adopted and the same control is exercised. Consistency of operation involves three basic functions: say what one should do, do what the one said and record what the one has done. This can be achieved by establishing a quality system in the organization and maintaining it to be effective. A quality system has to cover all the activities leading to the finished product. Depending on the scope of operation of the organization, these activities include planning, design, development, purchasing, production, inspection, storage, delivery and after-sales service. Hence, a 'quality system standard' is a reference base against which the adequacy of a quality system can be judged [2, 28].

Quality system comprises of the organizational structure, procedures, processes, and resources needed to implement quality management [4].

The quality management model (ISO 9000 series) consists of [16]:

- ISO 9000:2005 - Fundamentals and vocabulary
- ISO 9001:2008 - Quality Management System- Requirements
- ISO 9004:2000 - Guidelines for performance improvement

ISO 9001 is the only part of the ISO 9000 family against which an organization can become certified and hence the aim of this research is to assess the impact of ISO 9001ceritfication on certified Ethiopian construction companies. However, ISO 9001 is not a product standard and it contains no product requirements. It is a series of generic requirements for quality management systems. Approval to ISO 9001 does not guarantee product or service quality. Customer focused leadership, not standards produce satisfied customers. Achieving ISO 9001 certification demonstrates that a certified company meets the minimum requirements of quality management.

The principal features of ISO 9001[16]:

- Takes the basic principle of QA (the need for documented systems to support QA) and adds requirements to control system documentation to make sure it is kept up to date
- Requires companies to carry out their own internal audits of their QA system to make sure it is working properly
- Requires the QA system to be constantly monitored to ensure that it is effective and that changes are constantly made to improve it

The rules in ISO 9001, referred to as 'requirements', go beyond 'quality' matters as they are traditionally understood. These requirements fall roughly into four types [24]:

- Requirements that help assure that the organization's output (whether product, service or both) meets customer specifications i.e. making customers happy & keeping them that way
- Requirements that assure that the quality system are consistently implemented and verifiable. One must actually do what he/she say and supposed to do. This must be verifiable via independent, objective audit.
- Requirements for practices that measure the effectiveness of various aspects of the system.

- Requirements that support continual improvement of the company's ability to meet customer needs. One cannot sit still and should strive to get better all the time because customers change and competitors gain strength.

TQM is another tool of quality management which overlaps with similar concepts like the QMS laid out in ISO 9000 series that provides world standards for management based on best practices [29].

"*In the evolution of ISO 9000, there has been a general shift towards total quality management (TQM) which is a management philosophy emphasizing on quality, teamwork and decisions based on data. TQM advocates an organization-wide effort in continual quality improvement. To attain high quality in construction, all parties involved, ranging from the client, the architect, the engineer to the contractor, the subcontractor and the material supplier, must work together as a team"* [2].

TQM covers not only quality of products but also concentrates on needs and cost of quality for all its stakeholders like customer, employees, supplier, owner, partners, and market trends and changes into consideration through benchmarking etc. TQM involves valuable human resources and best utilization of available resources and uses suggestion box, quality circle, Kaizen etc. for its effectiveness [17].

The tracking down of quality is a gradual progression from quality control, through quality assurance to total quality management, the sphere of each expanding beyond the previous as illustrated in Fig. 2.2. Implementing ISO 9000 is an important part of the quality journey. ISO 9000 is moving from quality assurance towards total quality management [2].

Figure 2.2: Expanding realm of quality management [2]

TQM also involves the application of quality management principles (i.e. continuous improvement, customer focus, honesty, sincerity and care) to all aspects of the business, including customers and suppliers. TQM recognizes that customer needs and business goals are inseparable. It ensures maximum effectiveness and efficiency within a business. It secures a commercial leadership by putting in place processes and systems which will promote excellence, prevent errors and ensures every aspect of business goals are met without duplication or waste of effort [4].

Amare Matebu (June, 2006) has shown in his MSc thesis the progress in quality management concept. In his review, he described that the progress in quality management concept is originated in the manufacturing industry because most manufacturers inspect their products before shipping them. This subsequently leads to quality control and then to the development of quality assurance and quality management as shown in figure 2.3 below [5].

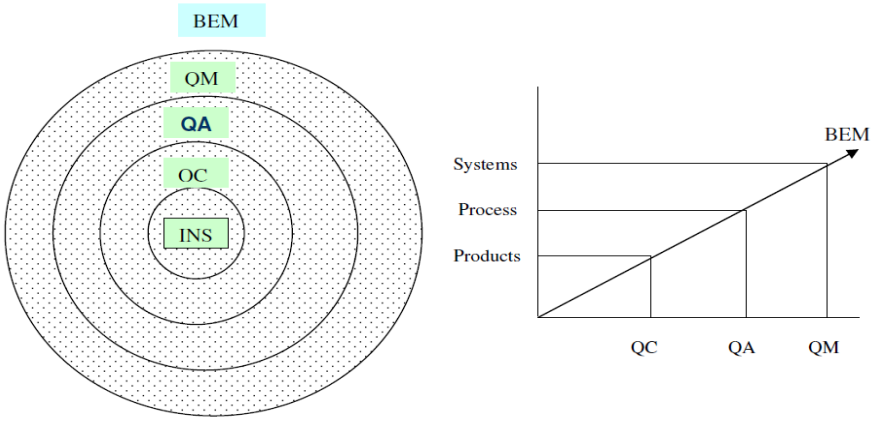

Figure 2.3 Progress in quality management concept. [5]

However, the main focus of this research is quality management system as it is discussed in the next sections.

2.3 Driving Forces for Implementing ISO 9001

For most organizations, the primary motivation for implementing a QMS is either management need or customer demand. Management's motivation for implementing a QMS usually stems from a need to improve productivity, improve product quality and reduce time to market, thus gaining a competitive advantage. Sometimes, management's motivation for implementing a QMS is driven by competitive pressure, where the similar organization's competitors have established or are in the process of establishing QMS [28].

One intent of ISO 9001 is to simplify things for organizations. ISO 9001 strives to harmonize the sometimes conflicting, sometimes redundant quality programs that have traditionally been carried out [27].

Adoption of quality assurance in the construction industry has been mainly client-led due to the reason that enforcing the contract in law cannot reverse any damage already done. A client, when awarding a contract, tends to take into account the contractor's capability to 'do it right first time and every time' which is the underlying philosophy of quality assurance. Accordingly, there is a general movement towards making the implementation of a quality system a contractual requirement. Customers both in private & public sectors are looking for confidence that can be provided by a business with an effective (or even certified) QMS and begun to insist on an effective quality system as prerequisite for tendering. The basis of competition for business is shifting from 'price only' to a combination of price and quality. If a construction company does not want to be excluded from bidding for available work, he should wait no more in establishing a QMS in his organization. Even if such external pressure is not on at the moment, he will be fighting a losing battle against his competitors who have enhanced their productivity through better quality management. The construction companies that benefit most from quality assurance are those which do so for the purpose of improving their own efficiency. Notable changes are more effective communication, both within the organization and with outside bodies, less disruption of work and reduced spending on rework. These improvements lead to higher productivity on the one hand & client satisfaction on the other [2& 3].

In addition, whether one likes it or not, every one lives in a competitive environment. If one is in business and having to compete for market share, the survival and success are largely dependent on a few very fundamental issues [11]:

a. One has to be able to win the business in the first place that is convince potential customers that he/she can provide exactly what they want better than anybody else.

b. Having won the business, one must meet fully or exceed the expectations of his/her customers, thereby giving them satisfaction and improving prospects of further business. The testimony of a satisfied client/customer is the best publicity one can have for his/her products or services. In this context the philosophy 'if satisfied, tell others; if not, tell us' is a good one to aim for.

c. It is not enough to win business and consistently deliver satisfactory results but to do this in ways which will simultaneously enable achieve business objectives. For example, profitability, return on capital employed, satisfying stakeholders and so on.

Some of the driving forces to implement ISO 9001 in companies are [3]:

- Strong competition
- Customer requirements
- Legal requirement
- To improve effectiveness and efficiency
- Strong demand for success

Similarly, source [10] describes the following as driving forces.

- For saving money: QMS ensures efficient and sound procedures
- For ensuring optimum utilization of plant, reducing scrap rework & repairs
- To ensure consistent quality improvement
- To make the system transparent through quality records
- To increase consumer satisfaction through quality of product, timely delivery, better service & speedy complaint handling.
- To ensure higher productivity
- To increase employee motivation and participation

2.4 Concept and Benefits of Quality Management System

2.4.1 Concepts of Quality Management System (QMS)

A management system of an organization can include different management systems, such as a quality management system, a financial management system or an environment management system. A QMS is the way the organization directs and controls those business activities, which are associated with quality [3].

Thorpe & Sumner defines QMS as "*a formal statement of an organization's business policy, management responsibilities, processes and their controls that reflects the most effective and efficient ways to meet or exceed the expectations of those it serves whilst achieving its own prime business objectives*" [11].

The general (0.1) 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 9000:2008 QMS requirements. The quality management principles can be used by senior management as a framework to guide their organizations towards improved performance [13].

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[16].

The eight quality management principles are presented in the table below [13]:

Table 2.1: The eight quality management principles [13(with some modification)]

Concept of the Quality management Principles	**Key benefits of the quality management principle**	**Applying the quality management principle typically leads to:**
Principle 1: Customer focus Organizations depend on their customers & therefore should understand current & future customer needs, meet customer requirements & strive to exceed customer expectations.	• Increased revenue & market share obtained through flexible & fast responses to market opportunities. • Increased effectiveness in the use of the organization's resources to enhance customer satisfaction. • Improved customer loyalty leading to repeat business.	• Researching & understanding customer needs & expectations • Ensuring that the objectives of the organization are linked to customer needs & expectations • Communicating customer needs & expectations throughout the organization • Measuring customer satisfaction & acting on the results etc.
Principle 2: Leadership Leaders establish unity of purpose & direction of the organization. They should create & maintain the internal environment in which people can become fully involved in achieving the organization's objectives.	• People will understand & be motivated towards the organization's goals & objectives. • Activities are evaluated, aligned and implemented in a unified way. • Miscommunication between levels of an organization will be minimized.	• Considering the needs of all interested parties including customers, owners, employees, suppliers, financiers, local communities & society as a whole. • Establishing a clear vision of the organization's future • Creating and sustaining shared values, fairness and ethical role models at all levels of the organization • Establishing trust & eliminating fear • Providing people with the required resources, training and freedom to act with responsibility & accountability • Inspiring, encouraging & recognizing people's contributions.

Table 2.1(continued): Eight quality management principles

Concept of the Quality management Principles	**Key benefits of the quality management principle**	**Applying the quality management principle typically leads to:**
Principle 3: Involvement of people People at all levels are the essence of an organization & their full involvement enables their abilities to be used for the organization's benefit.	• Motivated, committed and involved people within the organization. • Innovation & creativity in furthering the organization's objectives. • People being accountable for their own performance. • People eager to participate in and contribute to continual improvement.	• People understanding the importance of their contribution & role in the organization. • People identify constraints to their performance • People accept ownership of problems & their responsibility for solving them • People evaluating their performance against their personal goals & objectives • People actively seeking opportunities to enhance their competence, knowledge and experience • People freely sharing knowledge & experience, openly discuss problems & issues
Principle 4: Process approach A desired result is achieved more efficiently when activities & related resources are managed as a process.	• Lower costs & shorter cycle times through effective use of resources. • Improved, consistent & predictable results. • Focused & prioritized improvement opportunities.	• Systematically defining the activities necessary to obtain a desired result • Establishing clear responsibility& accountability for managing key activities • Analyzing & measuring of the capability of key activities • Focusing on the factors such as resources, methods & materials that will improve key activities of the organization • Evaluating risks, consequences & impacts of activities on customers, suppliers & other interested parties

Table 2.1(continued): Eight quality management principles

Concept of the Quality management Principles	**Key benefits of the quality management principle**	**Applying the quality management principle typically leads to:**
Principle 5: System approach to management Identifying, understanding & managing interrelated processes as a system, contributes to the organization's effectiveness & efficiency in achieving its objectives.	• Integration & alignment of the processes that will best achieve the desired results. • Ability to focus on the key processes. • Providing confidence to interested parties as to the consistency, effectiveness & efficiency of the organization.	• Structuring a system to achieve the organization's objectives in the most effective and efficient way • Understanding the interdependencies between the processes of the system • Structured approaches that harmonize & integrate processes • Providing a better understanding of the roles & responsibilities necessary for achieving common objectives & thereby reducing cross-functional barriers • Targeting & defining how specific activities within a system should operate • Continually improving the system through measurement & evaluation
Principle 6: Continual improvement Continual improvement of the organization's overall performance should be a permanent objective of the organization.	• Better performance through improved organizational capabilities. • Alignment of improvement activities at all levels to an organization's strategic intent • Flexibility to react quickly to opportunities.	• Employing a consistent organization wide approach to continual improvement of the organization's performance • Providing people with training in the methods & tools of continual improvement • Making continual improvement of products, processes & systems an objective for every individual in the organization • Establishing goals to guide & measures to track continual improvement • Recognizing & acknowledging improvements

Table 2.1(continued): Eight quality management principles

Concept of the Quality management Principles	**Key benefits of the quality management principle**	**Applying the quality management principle typically leads to:**
Principle 7: Factual approach to decision making Effective decisions are based on the analysis of data & information	• Informed decisions • An increased ability to demonstrate the effectiveness of past decisions through reference to factual records. • Increased ability to review, challenge & change opinions & decisions.	• Ensuring that data & information are sufficiently accurate & reliable • Making data accessible to those who need it • Analyzing data & information using valid methods • Making decisions & taking action based on factual analysis, balanced with experience & intuition
Principle 8: Mutually beneficial supplier relationships An organization & its suppliers are interdependent & a mutually beneficial relationship enhances the ability of both to create value	• Increased ability to create value for both parties. • Flexibility & speed of joint responses to changing market or customer needs & expectations. • Optimization of costs & resources.	• Establishing relationships that balance short-term gains with long-term considerations • Identifying & selecting key suppliers • Sharing information & future plans • Establishing joint development & improvement activities • Inspiring, encouraging, recognizing improvements & achievements by suppliers

Even though, the eight principles are not explicitly mentioned in the ISO 9001:2008 standard, they provide a framework for implementation of good management practice [30].

ISO 9001:2008 promotes the adoption of a process approach when developing, implementing and improving the effectiveness of a QMS to enhance customer satisfaction by meeting customer requirements [1].

Processes are an organization's operating system design and the way things are done. Inefficiency is mostly hidden in the process. Since a process is at the heart of any organization, continuous improvement is required in the process at all levels [28].

"*The application of a system of processes within an organization, together with the identification and interactions of these processes, and their management to produce the desired outcome, can be referred to as the process approach. An advantage of the process approach is the ongoing control that it provides over the linkage between the individual processes within the system of processes, as well as over their combination and interaction*. *When used within a QMS, such a process approach emphasizes the importance of" [1]:*

a) Understanding and meeting requirements,

b) The need to consider processes in terms of added value,

c) Obtaining results of process performance and effectiveness and

d) Continual improvement of processes based on objective measurement.

The model of a process-based QMS shown in Figure 2.4 illustrates the process linkages presented in Clauses 4 to 8 of ISO 9001:2008. This illustration shows that customers play a significant role in defining requirements as inputs. Monitoring of customer satisfaction requires the evaluation of information relating to customer perception as to whether the organization has met the customer requirements. The model covers all the requirements of this International Standard, but does not show processes at a detailed level. In addition, the methodology known as "Plan-Do-Check-Act" (PDCA) can be applied to all processes as discussed in section 2.2.2 of this literature review.

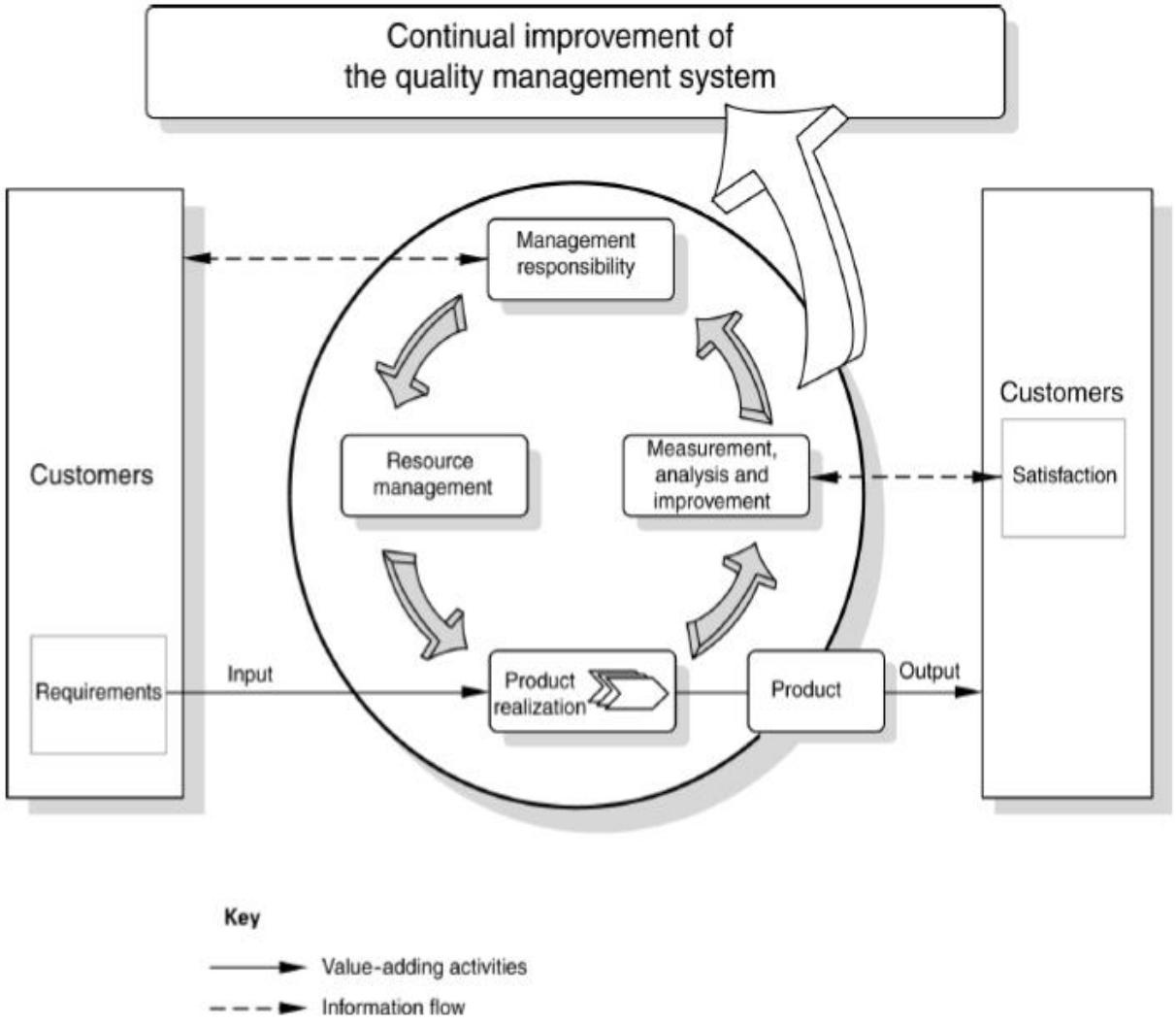

Figure 2.4: Model of a process-based quality management system [1]

2.4.2 Benefits of ISO 9001 QMS

"*Actually it costs to implement and maintain a quality system. Significant investment in terms of money and staff time is needed to maintain quality assurance, especially for document preparation and staff training. Some people see this as another item of overhead for the company. However, they should not lose sight of the savings that will accrue later with much reduced incidents of rework or reject. The overall quality related costs decrease rapidly as quality awareness among the staff increases*" [2].

By applying the continual improvement requirement of ISO 9001:2008, cost-effective improvements can be achieved [3].

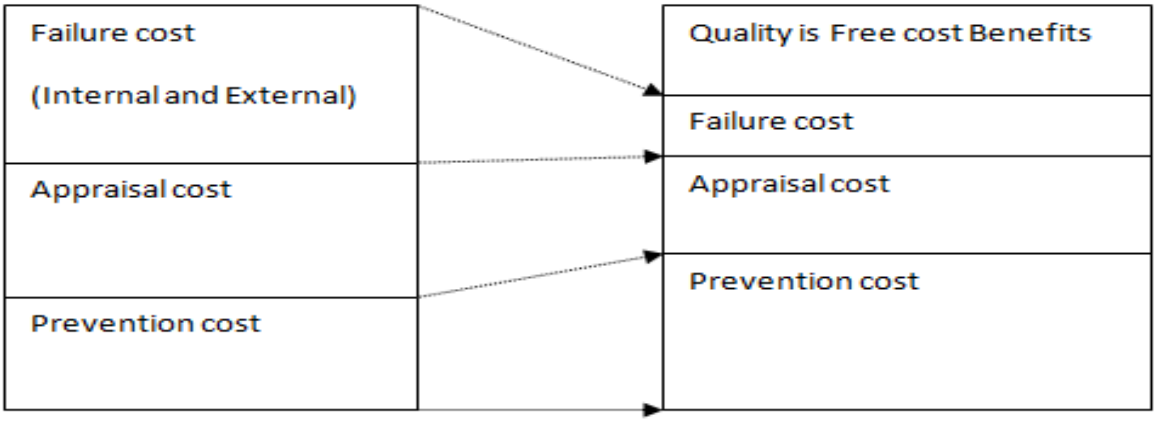

Figure 2.5: Quality system Cost Benefit [3]

Prevention Cost: costs incurred to prevent or avoid quality problems. These costs are associated with the design, implementation and maintenance of the QMS. They are planned and incurred before actual operation and could include [3]:

- **Product or service requirement:** establishment of specifications for incoming materials, processes, finished products and services.
- **Quality planning:** creation of plans for quality, reliability, operation, production and inspection.
- **Quality assurance**: creation and maintenance of the quality system
- **Training:** development preparation and maintenance of programs

Appraisal costs: are associated with measuring and monitoring activities related to quality. These costs are associated with the suppliers' and customers' evaluation of purchased

materials, processes, products and services to ensure that they conform to specifications. They could include [3]:

- **Verification:** checking of incoming material, process, setup and products against specifications.
- **Quality audits**: conformation that the quality system is functioning correctly
- **Supplier rating:** assessment and approval of suppliers of products and services

Internal Failure costs: are incurred to remedy defects discovered before the product or service is delivered to the customer. They could include waste, scrap, rework or rectification and failure analysis (activity required to establish the causes of internal product or service failure) [3].

External failure costs: are incurred to remedy defects discovered by customers. It could include repair and servicing, warranty costs, complaints and returns [3].

In line with the above quality system cost benefit, analysis of seven building projects of various sizes in Australia has confirmed that 'quality does not cost rather it pays'. The results of the analysis are summarized in Fig. 2. 6 below in which the quality related expenses are expressed as percentages of the total construction cost. Through the implementation of a proactive quality system that costs for about 1% of the project value, the expenditure as a result of repair etc which is the failure cost drops from 10% to 2%, representing a saving of 7%. Therefore, one can see that how the economic benefit of preventive measures is important [2].

In addition to saving of failure costs, the quality records generated by the quality system facilitate and strengthen the process of claims and in case of counter-claims, provide a potential line of defense [2].

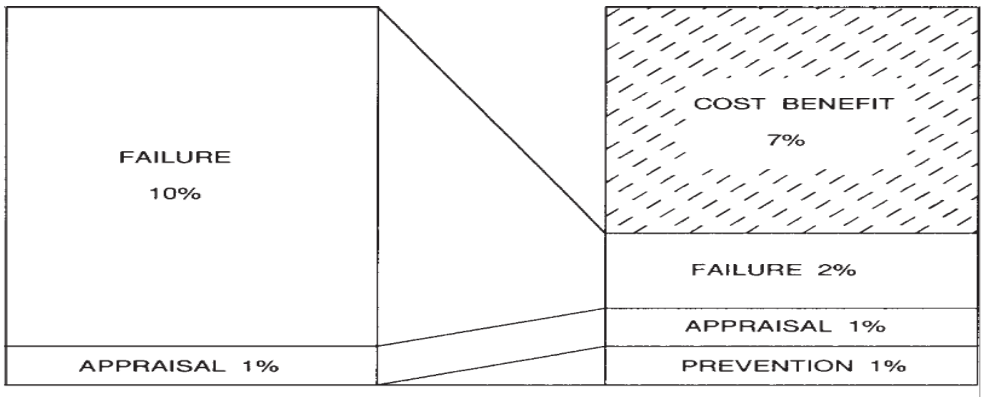

Figure 2.6: Comparison of cost savings of project with and without quality management system [2]

Some of the benefits of ISO 9001certification, taken from different literatures, to the certified company are presented below.

2.4.2.1 Internal Benefits of ISO 9001 certification to any Certified Company

Source [3] lists the following internal benefits:

- Improved management confidence
- Improved awareness of company objectives
- Improved communication
- Responsibilities and authorities are adequately defined
- Improved traceability to root causes of quality problems
- Improved utilization of resources
- Errors rectified at the earliest stage and not repeated
- Increased productivity
- Increased profits and company growth

In addition, source [6] describes the following internal benefits:

- Better management control and reporting
- Requiring organizations to continuous improvement
- Fewer problems with failures in service or product quality
- Greater employee awareness about quality

Source [10] also describes the following internal benefits:

- Leads to less material wastage, production down time, rework, etc. through an increase in `quality know-how' and efficiency
- Motivates all employees and ensures their involvement
- Provides stepping stone to TQM

Moreover, source [14] states the following benefits:

- Consistent and effective control of key processes and project management
- Provision of a vehicle for training new employees
- Effective management of risk and reducing crisis management
- More effective data analysis, generation of key performance metrics and continual improvement of objectives
- Greater emphasis on communication, leadership, change management & adequacy of training
- A planning and review process which will ensure that the system in place remains suitable, effective and capable of identifying new opportunities
- Effective remote site management, accountability and contractual control

2.4.2.2 External Benefits to the Certified Company

The external benefits from different information sources are summarized below.

Source [6] describes the following external benefits:

- Makes it easier to satisfy customer needs. So improved customer satisfaction
- Improved company image
- Marketing tool for sales promotion

Source [10, 13 and 14] describes the following external benefits respectively:

- Being internationally recognized, the firm's quality will have world-wide acceptance
- Consistency in quality of products and services

- Promoting control of suppliers and subcontractors and the development of effective supply chain management

2.4.2.3 Benefits to Employees

The ISO 9001 certification enables employees get the benefits mentioned below [6].

- Employees know what to do and how to do it
- Enhanced communication among employees
- Clarity in job specification

2.4.2.4 Benefits to Customer

Source [3] describes the following benefits that customers will get from a certified company.

- Improved customer satisfaction
- Consistency in quality of products and services

Source [10] also adds the following benefits that customers will get from a certified company:

- Provides assurance and satisfaction that their needs for quality will be met
- Saves time and money by reducing the need for assessment of their suppliers
- Reduces incoming inspection costs
- Simplifies purchase decisions
- Creates confidence in their suppliers because of the approval by independent third party
- Better service, better and quick complaint handling

Benefits to All: Innovation and improvement [6]

2.5 Implementation and Getting Certified Based on ISO 9001 Quality Management Standard

The ISO 9001:2008 QMS requirements are organized into the following eight clauses [1].

1. Scope
2. Normative references
3. Terms and definitions
4. Quality management system
5. Management responsibility
6. Resource management
7. Product realization
8. Measurement, analysis and improvement

It is sections 4, 5, 6, 7 & 8 which contain the requirements themselves and organizations wishing to be certified against ISO 9001 will need to demonstrate that they have addressed all of these requirements.

The requirements in ISO 9001 can be condensed into the following five key statements. The organization shall [16]:

1. Determine the needs and expectations of customers
2. Establish policies, objectives and a work environment necessary to motivate people to satisfy customer needs
3. Design resource and manage a system of inter-related processes to implement the policy and attain the objectives
4. Measure and analyze the effectiveness of each process in fulfilling its objectives
5. Pursue the continual improvement of the system from an objective evaluation of its performance.

Sub-clause 1.2 (application) of the QMS describes that "*All requirements of this International Standard are generic and are intended to be applicable to all organizations, regardless of type, size and product provided*".

"*Where any requirement(s) of this International Standard cannot be applied due to the nature of an organization and its product, this can be considered for exclusion*".

"*Where exclusions are made, claims of conformity to this International Standard are not acceptable unless these exclusions are limited to requirements within Clause 7, and such*

exclusions do not affect the organization's ability, or responsibility, to provide product that meets customer and applicable statutory and regulatory requirements"[1].

A formal QMS has the potential to change attitudes, cultures, and work procedures at any construction firm in a way the organization has never experienced before [14].

Implementing ISO 9001:2008 affects the entire company, not just the quality department. More people in the organization are affected by it than just the management representative. Implementing a QMS to the point of certification & registration is a discouraging task but is achievable with company's current resources. Implementation times can vary [12].

The following steps describe the implementation process [12]:

Step 1: Define the need for implementing an ISO quality system
Step 2: Educate top management
Step 3: Commitment from top management
Step 4: Select a management representative
Step 5: Select implementation team (QA task force)
Step 6: Understand the current system and processes
Step 7: Understand the standard
Step 8: Conduct gap Analysis
Step 9: Create an implementation plan
Step 10: Develop standard procedures and instructions
Step 11: Employee training
Step 12: Monitor
Step 13: Internal auditor training
Step 14: Internal audits
Step 15: Select registrar
Step 16: Management reviews
Step 17: Define key performance indicators to monitor continual improvement
Step 18: Pre-assessment audit
Step 19: Registration audit

It should be noted that different literatures describe different steps of implementing this standard. For example reference [12] as presented above describes 19 steps to implement. Here under are also 10 steps of implementing the standard which are more or less similar to the above but condensed in to 10 steps and described in depth [15].

Step 1: Decision

The first step is decision of company's top management if the company should pursue ISO 9001 certification or not. In doing so, the company's top management needs to have a good understanding of ISO 9001 from a business point of view. Concise training program specifically designed for the needs of executives is helpful.

Step 2: Select ISO 9001 Management Representative

One of the company's managers needs to be appointed to be the "ISO 9001 Management Representative". The ISO 9001 Management Representative is the company's point-person and expert on ISO 9001. Comprehensive training in all ISO 9001:2008 requirements and in the intent and purpose of QMS is required. When appointing the ISO 9001 Management Representative, a job description and a training plan are required. (Required by ISO 9001:2008 sections 5.5.1, 5.5.2 & 6.2.2)

Step 3: ISO 9001 Implementation Plan

In order to properly plan one's company's ISO 9001 implementation, one will first perform a gap analysis to understand which ISO 9001:2008 requirements the company already meets and where to concentrate ISO 9001 implementation efforts. Then after, one is able to plan the ISO 9001 implementation project, set important milestones, estimate time requirements and set a date for the ISO 9001 certification. The gap analysis is best performed using a questionnaire. A good ISO 9001 implementation guidebook makes the ISO 9001 implementation efficient without wasting time on unnecessary charts and committees.

Step 4: Employee Introduction

It is important to inform all employees as early as possible for the company's plan to get ISO 9001 certified by explaining the concept of ISO 9001 and how it will affect the company's employees to gain buy-in and support. This step should not be delayed because once negative

rumors have developed; ISO 9001 implementation efforts will become more difficult. A short and easy-to-understand ISO 9001 introduction course that focuses on how employees are affected & that prevents any misconceptions & fears. (Required by ISO 9001:2008 section 6.2.2)

Step 5: ISO 9001 Documentation

The reason one needs to define 'quality' is simply if one doesn't know what it is, one will never know whether achieving it or not. Not knowing where one wants to get to also makes it difficult to communicate to other people what is to be achieved and why, let alone to motivate them to act. ISO 9001 helps make this key decision by requiring top management to establish measurable quality objectives. These measurable objectives define what one means by 'quality'. Getting an easy-to-understand interpretation of the ISO 9001:2008 standard to clarify the requirements can help to carry out the documentation requirement easily.

Step 6: Realization

Put the new business processes contained in the ISO 9001 documentation into practice throughout the company. In this step, company management and staff are notified of new or changed work processes as formalized in the ISO 9001 documentation (step 5). This step also includes the writing of some detailed and position-specific work instructions. These work instructions are best written by those employees who perform the work. Forms and checklists are also prepared making the ISO 9001 implementation and compliance with ISO 9001 requirements significantly easier.

Step 7: Internal ISO 9001 Audits

ISO 9001 requires for the company periodically self-evaluate through internal audits. These internal audits will also be of help during the ISO 9001 implementation phase; a complete and successful internal audit is required before getting ISO 9001 certified. Therefore, one or more employees will need to be appointed to serve as internal ISO 9001 auditors; they will require training and then perform at least one complete internal audit.

Internal quality auditors should take comprehensive training in both the ISO 9001:2008 requirements and in auditing techniques.

Step 8: ISO 9001 Registrar

Before the company gets ISO 9001 certified, that company need to select and appoint an ISO 9001 registrar. The ISO 9001 registrar is an independent organization that is officially accredited to issue ISO 9001 certifications in a company's country or abroad. The ISO 9001 registrar will audit the company's QMS and if the audit is successful, issue the ISO 9001 certificate.

Step 9: ISO 9001 Certification

Steps 1 through 8 are designed to implement QMS so that one can achieve ISO 9001 certification. However, since the company's employees are likely not familiar with undergoing external audits, it is recommended to prepare them for the audit and how to interact with the external ISO 9001 auditor.

Step 10: Maintaining ISO 9001 Certification

It is a common misconception to think that the ISO 9001 certification is the last step. In order to maintain the ISO 9001 certification, a company needs to keep the QMS alive, use it in daily operations and continually improve upon it. To reap the marketing benefits of ISO 9001, the company needs to properly publicize its ISO 9001 certification. In addition, the company will only reap the many internal benefits of ISO 9001 by really utilizing the ISO 9001 QMS in day to day business. Processes can always be more efficient and effective, even when they are producing conforming products. The aim of a continual improvement program is to increase the chances of satisfying customers by identifying areas needing improvement. After setting improvement objectives, an organization searches for possible solutions, selects and implements the appropriate one and evaluates results to confirm that objectives are met.

2.6 Main Challenges of Implementing ISO 9001

2.6.1 General Challenges and Misconceptions Reflected by Companies

Up to the end of December 2006, at least 897,866 certificates of ISO 9001 had been issued in 170 countries of the world. Out of the 897,866 certificates issued worldwide, the share of developing countries (Africa and west Asia) is 71,438 (7.9% of the total certificates). These data shows how firms in developing countries do not utilize the benefits of implementing the system. The factor that reduces the number of certificates in developing countries may be lack of awareness of its economic benefits and due to the following misconceptions [3]:

- High quality costs more
- Emphasis on quality leads to reduced productivity
- Quality is affected by the work culture of the labor force
- Quality can be assured by strict inspection

The numbers of ISO 9001certified companies in East Africa from all sectors, up to December 2006, were in Ethiopia (3), Uganda (45), Sudan (55) and Kenya (183) certified companies. In addition to lack of awareness of its economic benefits because of the above misconceptions, the following reasons could have been contributed to the very low numbers of certificates in Ethiopia compared to its east African neighbor countries [3]:

- Lack of capacity i.e. unavailability of capable institutions (both governmental and private) that can promote and provide technical support for implementation of QMS
- Lack of making cost-benefit analysis of ISO 9001QMS development, implementation and certification costs with its internal and external advantages
- Considering implementation of ISO 9001QMS for certification only and unaware of its internal benefits of making firms effective and efficient even when there is no need for certification
- Linking systems standards such as ISO 9001-QMS to big and complex industries only against generic nature of the system standards which enables any firm to adopt the system regardless of its type, size and product it provide

2.6.2 Resistance to Change

From the point of view of the workers, it is pointless to document procedures for activities that they have been performing every day. If they can perform the tasks 'right the first time and every time', there is no need to write down the procedures. In fact, ISO 9001-2008 states that documented procedures are only necessary where the absence of such procedures could adversely affect quality except the six mandatory procedures (control of documents, control of records, internal audit, control of nonconforming product, corrective action and preventive action). It also states that the range and detail of the procedures are dependent upon the complexity of the work, the methods used, and the skill and training needed by personnel involved in carrying out the activity [1 & 2].

Implementing QMS does not alter the current practices in substance, nor does it increase the amount of inspection and testing. It arranges these activities in a planned and systematic manner. The irresponsible performance of a few individuals could jeopardize the whole system. The concept of quality should be cultivated throughout the organization and extra resources (including staff time) must be allocated. The quality drive will succeed if commitment is firm and resources are provided but will fail sadly when these conditions are not met [2].

"*Site staff and office staff to a certain extent often complain about the extra workload resulting from the use of various forms and checklists. They claim that time is better spent on performing the fundamentals. When forced to do so, they just pay lip service to the paperwork. A tick in the box does not necessarily mean that verification has been carried out. The worst scenario is that they fill in the forms and checklists on second thoughts, may be a few days before a quality audit (either internal or external) is scheduled to take place. This completely violates the purpose for which the paperwork is intended and thus jeopardizes the effectiveness of the QMS.*" [2]

Implementing QMS into an organization produces a cultural change, even though the system has been developed from existing practices. Certainly different reactions are generated among the staff. The reactions may be [2]:

- Some people jump on it as a challenging endeavor (make an effort).

- Others are confused and become unwilling.
- Yet some others become openly resistant to the change and persist in following their long held habits.
- Those in middle management are especially doubtful of the necessity for change as they cannot find tangible benefits right away.

Quality assurance is the joint responsibility of management and the workforce. Everyone in the organization must realize the importance of quality output to the company and be willing to play his/her part in achieving it. Without the genuine support of all concerned, the benefits of quality assurance will never materialize.

2.6.3 Possible Solutions for Resistance to Change

2.6.3.1 Motivation

The majority of staff, including some in managerial positions, need to be motivated to adapt to the cultural change. This is difficult task because construction company is made up of a group of people with different background, education and aspirations. Paying a bonus may work, but there will be negative effects when the monetary incentive is stopped. Penalizing the unconvinced is counterproductive and will make them more resistant to the change. Instead, the following motivators have been proven to be effective [2]:

- Commitment and leadership
- Staff involvement
- Training opportunities
- Recognition of accomplishment

Throughout the implementation stage of the QMS, lots of difficult problems crop up and a certain amount of dislike is unavoidable. Even those who have helped develop the quality system tend to lose faith in it. At this critical moment, it is up to senior management to show firm commitment and leadership. They must demonstrate by action their willingness to face the problems and to allocate resources for their speedy resolution. Section managers of the organization must be convinced that this is the way to go and be seen practicing accordingly. There is no better way to motivate others than setting an example oneself. Furthermore, the

responsibility for quality must filter down the line of management. Quality assurance will not be achieved unless middle management feels that they are also in the driver's seat [2].

In formalizing the procedures, consult the people who perform the various functions. Let them help in drafting the procedures during implementation, provide opportunities for comment and treat the feedback seriously. Most people are motivated by the satisfaction of making a meaningful contribution and get recognition. They will be motivated if they can see that rewards are linked to efforts. As an incentive for quality work, the company may consider the evidence of faithful support of the quality system as criterion for promotion and on the contrary, repeated neglect of the established procedures is a cause for disciplinary action [2].

2.6.3.2 Training

The potential of the QMS cannot be exploited until the staff fully understands how it functions. To promote awareness of the QMS, a well-planned and timely training scheme is essential. Quality training, as distinct from training for specific skills, is carried out in two stages; while the quality system is being developed and when the quality procedures are ready as described below [2]:

- **While the quality system is being developed:** the concepts of quality assurance are spoken among the staff at all levels. It is particularly important to ensure that every member of staff understands the company's quality policy and realizes the management's commitment to quality. The main purpose of this training is to shape the attitudes of all personnel towards the cultural change in the organization.
- **When the quality procedures are ready:** Workshops are organized for the relevant groups of staff to familiarize them with the procedures, including the correct way of filling in the standard forms. Mock-up exercises are organized both in the office and on site. The trade foremen may be proficient in carrying out supervision and inspection but they often have difficulty in completing the various forms involved.

Quality training in an organization is an ongoing process. It is also required after the system is in full operation. New staffs are indoctrinated soon after joining the company. Existing staff are also given a refresher course every now and then, especially after major changes have been made to the procedures.

2.7 Measuring the Effectiveness of QMS

Measuring the effectiveness of once company's QMS is an essential part of overall quality control program. Even if the company's QMS is not registered to one of the ISO set of standards, ISO9001 being an example, the company's customers will very likely audit the company system. For this reason, it is important that one has provisions to measure the organization system's effectiveness. This can be achieved by documenting all of the areas where one will measure quality against a baseline of existing data. If baseline is not available, it is better to establish at the outset of planning for this initiative [24].

Sub-clause 4.1(e) of ISO 9001: 2008 describes that the organization shall 'monitor, measure where applicable and analyze these processes'. Similarly sub-clause 8.1 of the standard also states that "*the organization shall 'plan and implement the monitoring, measurement, analysis and improvement processes needed':*

- *To demonstrate conformity to product requirements,*
- *To ensure conformity of the quality management system, and*
- *To continually improve the effectiveness of the quality management system.*

This shall include determination of applicable methods, including statistical techniques, and the extent of their use." [1]

In similarly way but more informative, a guide line for implementing QMS indicates: "*The clause of monitoring and measurement requires that the organization has to show that it has established a system which produces information of 1) customer satisfaction, 2) internal audits, 3) process performance and 4) product conformance, in order to demonstrate conformity of the product, to ensure conformity of the QMS and to continually improve the effectiveness of the QMS. The idea is to prove that there is systematic way to monitor processes and products (e.g. by inspection and test), analyse customer, product and process related information, and based on this information take relevant improvement actions. When processes are documented, it proves the existence of all relevant requirements* [30]."

It is essential that everyone in the organization know what is meant by customer satisfaction and dissatisfaction. The means to get feedback from the customers are e.g. visits to customers´

premises or vice versa, direct communication with customers, complaint handling, customer satisfaction questionnaires and news in the media [30].

Therefore, one must establish methods and indicators to monitor and measure the QMS processes to demonstrate process capability to achieve planned results and identify opportunities to improve the process. One can use his/her organizations cross-functional knowledge of customer requirements, product, technology, manufacturing processes, etc to determine process monitoring and measuring indicators and controls. Monitoring and measurement may be done manually or by automated means [26].

An effective ISO 9001 QMS incorporates monitoring and measurement of key quality performance indicators. This performance indicator enables management to have objective data upon which to base decisions. Internal auditing is an 'early warning system' and helps spot problems that could impact customer satisfaction or operating efficiency and give the chance to address and resolve the problems before they are detected by others, rather than after [27].

Kevin R. Grimes in his practical quality manual book indicated that providing quality products or services that meets customer's needs can be measured by [25]:

- Meeting specific requirements of the proposal
- Meeting schedule requirements
- Customer survey results

It is the company's responsibility to decide what and how to measure the activities and what analyses can be derived from the measurements. During the management review process, one should check the methodologies that one is using to obtain monitoring and measuring information and ensure that the methods used are still effective so that over time they could change or be improved. Monitoring and measurement can include customer satisfaction, internal audits, control of records, quality objectives, design reviews, monitoring and measuring devices or monitoring and measurement of processes and product. After collecting information through measurement one may do with collected information [25]:

- Establish priorities: if there are problems in a particular area, the monitoring and measurement data should highlight this as well as providing insights on how to correct the problem.
- There should be some periodic review of the information collected to ensure it is still valid. Can one collect more or need to collect less?
- One can do something with the information to improve the process
- Internal audits are used to verify that improvements and communications are effectively implemented.

Internal Quality Audits

Functioning of the QMS is monitored through a regular programme of internal quality audits coupled with periodic management reviews. An internal quality audit is a systematic and independent examination performed by the company's own staff to verify whether quality activities and related results comply with planned arrangements and whether these arrangements are suitable to achieve the quality objectives [2].

The audits tend to expose the main problems of the QMS so that they can be quickly resolved. The audits also evaluate the QMS in practice such as the QMS strengths and weaknesses as well as its acceptance by the staff. Objective evaluations of QMS activities by competent personnel should include the following activities or areas [2]:

a. Organizational structures
b. Administrative, operational and QMS procedures
c. Personnel, equipment and material resources
d. Work areas, operations and processes
e. Products being produced to establish degree of conformance to standards & specifications
f. Documentation, reports, record-keeping

"*Internal quality auditing by itself is a quality activity covered by documented procedure(s). It is subject to evaluation as other quality activities, i.e. the auditing process must be audited. The auditees may feel that it is a check by management on their performance. To ease their nervousness, management should assure the staff that the audit is carried out to evaluate the*

QMS but not the individuals. Furthermore, the audit is performed to establish facts rather than faults. After they get used to it, the staff will welcome the audit as a stepping stone to improvement. Sincerity and cooperation are central to an effective audit." [2]

An internal audit is a planned exercise and the functional unit or construction site being audited is given sufficient notice of the intended visit so that the auditees get themselves ready for interview and the quality records ready for inspection. An activity should be audited more often if one or a combination of the following is true [2]:

- The activity is a critical link in the administration or construction operation
- The activity is a constant source of nonconforming work or client complaint
- A major nonconformity was noted in the last audit
- A number of minor nonconformities were noted in the last audit
- The operators are not experienced in the activity or use of equipment

The person responsible for the audit should be objective and impartial. The only restriction is to audit its own work. The following are major points which describe the behaviour of an internal auditor during the auditing process [2]:

- Be goal oriented
- Define minimum standards of acceptance
- Count only facts and no assumptions
- If nonconformity is found do not criticise, look for the reasons, record all details, try to assess if the nonconformity is a single case.
- Understand yourself as a partner of the auditees
- Communicate honestly (explanations, open ended questions, good listening)

After conducting audit, an audit report with all nonconformities is generated and presented to the management. The management who are responsible for the organisation being audited should ensure that identified problems are solved without delay. The objective is to detect and eliminate the reasons for nonconformities and their causes [2].

2.8 Construction Project Management and Construction Quality Management Practices of Ethiopian Construction Companies

Once the project owner has proved construction project is feasible and accordingly make arrangements to finance the project, the next main objective of a project owner is to find a potential contractor with the lowest possible tender price and who can execute the project to the satisfaction of the quality standards stated in the drawings and technical specifications as well as complete the works within in the time frame stated in the bidding documents [19].

Construction costs are becoming far too high and construction project management is more difficult than it should be when turnaround at the end of a project, the project comes with unnecessary disputes that arise due to insufficient quality or indifference to quality. Settlement by negotiation, arbitration, or even litigation imposes a serious drain on the financial resources of a company and limits profit potential. To tackle such kind of problems, construction managers need to improve their performance [20].

Like the industry in other developing countries, the construction industry in Ethiopia is suffering by many problems. Like [23]:

- An inadequate capital base
- Old and limited numbers of equipment and low levels of availability and utilization
- Low level of management, especially project management knowledge and practice
- Deficiencies in technical, financial management and entrepreneurial skills
- Limited experience and participation of the private sector in large construction project
- Inadequate and inappropriate project organization structures, which lead to problems of authority, responsibility, communication and coordination, etc.

There have been efforts to promote quality all over the country such as Ethiopian quality award organization (inaugurated its establishment on January 17, 2008), international development partners, private quality promoters and others [28].

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 [28].

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 (the current 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 [28].

There are also few private quality promoters in Ethiopia which are helping the industry to implement management system and in general which promote quality. Some of these are:

- Integrated Quality Solutions PLC
- AJB Institute of Quality Management (IQM)
- PDCA Engineering PLC.

Particularly in construction sector, the government of Ethiopia has made efforts to develop the capacity of construction companies and modernize Ethiopia's construction sector that can lead to increased international competitiveness through capacity building programs [21].

There are road sector development program (RSDP) for road construction projects and university capacity building program (UCBP) in building new universities.

The Government of Ethiopia has placed increased emphasis on improvement of the quality and extent of road infrastructure in the country. To address constraints in the road sector, related to restricted road network coverage and poor condition, the Government formulated the Road Sector Development Program in 1997 [22].

University Capacity Building Program (UCBP) has been initiated with the assistance of the German government to support the capacity of local contractors in which the government of Ethiopia has chosen the German experience to serve as a benchmark for capacity development in the construction sector.

GTZ IS established in Ethiopia, since September 2005, to build capacity of construction sector companies. Accordingly, general contractors, architecture and engineering firms, construction management consultancies as well as regional and local enterprises and cooperatives are trained. GTZIS provided managerial and entrepreneurial training and coached and prepared contractors for ISO 9001certification. Contractors under the program were given training in areas such as modern contract and project management, modern financial and construction equipment management systems, general management and leadership, marketing, project safety and efficiency using good practices from the German construction sector and quality management [23].

The university capacity building program (UCBP) were classified into phases in which three phase were accomplished from 2006 to 2009.

- Phase I: 05.2006 - 10.2007 University Capacity Building Program; Construction Company Component
- Phase II: 11.2007 - 07.2008 for Construction Management Consultants (CMCs)
- Phase III 10.2008 - 07.2009 for Construction Management Consultants (CMCs)

In the first 18 months of the first phase, participating companies have had the opportunity to training workshops on leadership development, human resource management, procurement, time, quality and cost efficiency in project management.

According to the GTZ IS report, ISO training for local construction sector enterprises started in September 2006. The managers and staff of 13 construction companies were trained on QMS requirements according to ISO 9001:2000 standards. A survey made by GTZ IS has shown that top managers created awareness of their strengths and weaknesses as well as the importance of reconsidering their attitude towards international requirements for future challenges. Top managers gained confidence in applying new tools and methods to run a more effective and efficient business. In addition, companies have started continuous improvement cycle that integrates change management into the daily business [21].

Many task force team members have been also trained as 'ISO 9001:2000 internal auditor' by QSAE [Quality and Standard Authority of Ethiopia in which after 2010/11 called ESA (Ethiopian Standards Agency)] and received an internationally recognized certificate. This

enables them both to conduct internal audits in their own company and to work as ISO 9001consultants [21].

Yimam Abadir (2011) in his study of 'maturity of project quality management of Ethiopian grade 1 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 [23].

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.

"*Generally, except for 'material' and 'equipment management knowledge areas' the construction Project management maturity level of contractors which are ISO certified or in a process to obtain the certification are found to be higher than those which are not ISO certified and not in a process to obtain the certification. This might be due to maturity model use, concept of quality management and the emphasis by ISO to follow structured and documented processes perhaps may have contributed to the improvement in maturity of the contractors in the category compared with those contractors which are non-ISO certified*." [23]

Similarly, the project management maturity of the contractors which took part in Capacity Building Program (CBP contractors) is found to be higher than those which did not participate in the capacity building program (non- CBP Contractors) [23].

At the end of his thesis work, Yimam Abadir recommended that encouraging contractors to obtain ISO certification would help them improve not only quality management but also their project management capability.

Chapter 3: Research Methods

3.1 Introduction

The research overall approach was desk study of archival documents and piece of literatures together with surveying and interview with ISO 9001 certified construction companies (respondents). Both qualitative and quantitative approaches are used in analyzing the primary data collected. This research is both descriptive and explanatory type.

The objective of this research is achieved through literature review, questionnaire design, data collection, analysis, examining the data through interview & interpretation as detailed below.

3.2 Literature Review

Under this part, a vast review of different piece of literatures was carried out to understand the benefits, concepts, how to implement QMS, challenges faced in implementing of QMS. In addition to this, developments in quality management and construction quality management practices of Ethiopia were reviewed. The literature review has helped to understand national and international practices concerning ISO 9001implementation and maintenance. This literature review has also helped to develop questionnaires for the research.

3.3 Questionnaire Design

The researcher has developed questionnaires based on the literature review to meet the objective of the research. (See Appendix A)

According to some pieces of literatures, there are three types of questionnaire namely 'closed', 'open-ended' and 'open response-option questions'. An open response-option is a form of question which is both open-ended and includes specific response-options as well. In this questionnaire, both the open-ended and open response-option questions' are used but most of the questions are based on the latter one. In the open response option question type, respondents were given response options to save their time and to depend less on memory in answering a question. At the end each question or group of questions, open response option was given as 'specify if there are others' to accommodate respondent's additional view.

3.4 Sample Size

The ISO 9001 certified construction companies are few in number. The researcher has got 10 certified companies and distributed questionnaire to all of them. The population size is small so the researcher tried to cover the whole population instead of representative sample.

3.5 Interview

In semi-structured interview, the researcher has a list of questions to be covered often referred to as an interview guide, but the interviewee has flexibility in how to reply.
Questions may not follow on exactly in the way outlined on the schedule. The interviewer may ask additional questions that are not included in the guide based on the reply of interviewee. But all of the guide questions are asked and a similar wording is used from interviewee to interviewee [31].

The researcher has used semi-structured interview to get better flexibility advantage. The researcher has conducted the interview with ISO 9001 certified construction companies (respondents) to justify the reliability of the data collected through questionnaire focusing on the responses that the researcher thought it needs clarification.

The researcher has also prepared guide questions (see appendix B) and carried out semi-structured interview to get additional information which was not covered in the questionnaire. Information which are not covered in the questionnaire such as the current status of ISO 9001 certification validity (expired or not), reasons for failure in getting some unachieved benefits of ISO 9001 certification etc. are collected during interview.

3.6 Data Collection, Analysis and Discussion

Data was collected mainly in the form of questionnaire and analyzed using relative importance index method. Based on the relative importance index, factors were ranked into priority. However, to retest the validity of the survey, interview was used based on the same questionnaire to let support respondents their responses by example.

Finally, the findings are discussed and then conclusions are drawn. Based on the findings, conclusion and recommendation are forwarded.

Chapter 4: Research Data Analysis and Discussion

4.1 Introduction

The ISO 9001 certified Ethiopian construction companies are few in number. The researcher tried to know total number of certified construction companies through direct calling by taking contractors address from contractors association and by asking different governmental and nongovernmental offices (for example, Grade 1 Contractors Association, Contractors Association, Ministry of Science & Technology, Statistics Agency etc.) in which these offices are expected to have information. The researcher was able to get only 10 certified contractors and greater than 6 contractors who are in the process of getting certified. Since the scope of this thesis is limited to only certified construction companies, the contractors who are in the process to get certified are not included.

The difficulty of getting list of certified contractors was because the certificate was given by different certifying bodies such as British company, German company and Ethiopian conformity assessment enterprise. One contractor out of the nine certified contractors has got certification from British certifying company (ISO QAR). From the 9 surveyed construction companies, this (certified by ISO QAR) is the only Company who is not participated in the university capacity building program (UCBP). The remaining 8 contractors all or most of them are certified by German company (ZERT) through GTZIS. At this time Ethiopian Conformity Assessment Enterprise is giving ISO 9001 certification to any interested and qualified Ethiopian companies. Accordingly, two contractors out of the eight certified contractors by ZERT are re-certified by Ethiopian Conformity Assessment Enterprise. It should be noted that the number of certified companies to date may be greater than 10 but as per the effort made, only 10 contractors were found.

Consequently, the research questionnaire was initially delivered to 10 ISO 9001 certified contractors. However, regardless of the effort made, 1 contractor could not fill the questionnaire and return it. As a result, 9 of the 10 questionnaires were returned. Hence, only responses from the 9 contractor were used in analyzing this survey. The summarized

information about distribution and response rate of questionnaires are presented in the following Table.

Table 4.1: Distribution and response rate of questionnaires

Questionnaires issued	Returned	Returned rate in %	Rejected	Usable	Usable rate in %
10	9	90	0	9	100

Ensuring validity and reliability of the data obtained in survey is critical as most of the time compared with other data gathering method such as interview and case study approach; generally surveys are prone to bias and misunderstanding and thus overall the validity is doubtful. To retest the validity of the survey and accommodate additional ideas, interview was used based on the same questionnaire especially on some factors that the researcher believes that the factors are required to be supported by respondents with example. Accordingly, very little response bias was found on the questionnaires and corrected in this final presentation of questionnaire analysis.

The interview also helped to get some additional information which are not covered in the questionnaire, like the current status of ISO 9001 certification validity (expired or not) of a construction company, current challenges in maintaining QMS, reasons for failure in getting some unachieved benefits of ISO 9001 certification etc.

Actually, to control the impact of respondent bias, the researcher has delivered the Questionnaire in person to the construction companies' offices and explained the importance of accurate data for the research and also to the participants' and has collected in person. The researcher has also described his willingness to make explanations on unclear questions in the questionnaire, if raised by respondents.

4.2 Data Analysis and Discussion

The data analysis was done using descriptive statistics. In calculating the relative importance index, all factors were given equal weight but depend on the respondents rating. Accordingly, 1 point (weight) is given to the 'yes' response of construction company, 0.5 point is given to

the 'somewhat' responses and 0 point for 'no' response. According to this weight the relative importance index (RII) is calculated as per the following formula.

RII = total point score / (P_*N), ($0 \leq RII \leq 1$) Where;

Total point score = summation of all the ratings for a given factor (variable). E.g. if 5 respondents said 'yes', 3 said 'somewhat' and 1 said 'no' out of total 9 respondents, the total point score is calculated as: 5*1+3*0.5+1*0 = 5+1.5+0 = 7.5, RII = 7.5/(1*9) = 0.83
P = maximum rating (point) possible given to a factor. E.g. if the points given to (yes =1, somewhat = 0.5 and no = 0), then p = 1 which is the maximum point possible.
N = total number of respondents for that factor or variable.

The survey was organized in to 3 main parts in which 'part I' is general information of the certified construction companies, including challenges faced during implementation and driving forces to implement ISO 9001.

Part II is about the actual benefits obtained by participants after ISO 9001 certification. Under this part 30 factors were listed to identify to what extent each factor is achieved by each participating contractor. Respondents were also asked to mention if they have other achieved benefits after certification in the form of open ended question.

Part III is also all about how individual construction companies measure the benefits or outputs of QMS. Ten measurable factors were identified from different pieces of literatures to measure the effectiveness of the QMS. Under each of the 10 measurable factors, the researcher proposed some means of measuring each factor and asked to participants to mention whether the proposed means of measuring are practiced or not. Respondents were also asked to mention if they have other means of measuring beyond the listed once. The detailed analysis of the questionnaire is presented below.

4.2.1 General Information about Participant Contractors

The general information of the construction companies is summarized in the Table below:

Table 4.2: General information about participant construction companies

Identification Code of participant contractors	Category and grade	Certified in	Position of the respondent	Frequency of internal audit	Frequency of external audit	Frequency of management review meetings
C1	BC-1	2008	QMS representative	Every 3 months	Every year	Every 3 months
C2	GC-1	2011	QMS representative	Every 3 months	Every year	Every 3 months
C3	BC-1	2008	Managing director	Every year	Every 3 year	Every 3 months
C4	BC-1	2008	General Manager	Every 6 months	Every 2 years	Every 2 years
C5	GC-1	2008	Planning &contract Administration	Every year	–	Every 6 months
C6	BC-1	2008	Deputy manager	Every 6 months	Every year	Every year & whenever the need arises
C7	BC-1	2008	Office Engineer	Every 3 months	Every 3 year	Every year
C8	BC-1	2007	QMS representative	Every year	Every year	Every year
C9	GC-1	2008	Construction Department manager	none	none	none

From the above Table, one can see that in terms of category 66.7% of the ISO certified respondents are building contractors (BC-1) while the remaining 33.3% are general contractors (GC-1). The greater number of ISO certified building contractors (BC-1) than general contractors (GC-1) could be due to the reason that the contractors that have participated in the university capacity building program and trained on ISO 9001 were more of building contractors.

The earliest ISO certified construction company is in 2007 and the latest certified company is in 2011. However, most of the construction companies (77.8%) were certified in 2008. The frequency of internal audit and management review conducted is found to be more or less the same and ranges from every 3 months to every year except for one respondent which makes management review every 2 years. On the other hand respondents have said that they are externally audited at different frequency raging from every year to every 3 years.

The two construction companies externally audited after 3 years and the one which was not audited at all show that the degree of commitment to external audit is low. They are not interested to be externally audited every year because they do not see value in the QMS.

During interview, the researcher understood that the validity of ISO 9001certification of the surveyed construction companies currently is as described below:

- 3 out of 9 certified construction companies have maintained their certificate. Their external certification has not expired.
- 6 out of 9 certified construction companies have had one or two surveillance audit by their respective external auditor in previous years but now their certificate is expired. Their external certification is expired because they failed to request for renewal of certification. However, 3 out of the 6 construction companies, with expired certificate, are making effort and in process to get new certification. All of the expired certificates of ISO 9001 were expired in 2012.

4.2.2 Main Challenges Faced During the Implementation of the QMS

To understand the main challenges faced during implementation, participant construction companies were asked to mention what they faced during implementation of the QMS to their organization, as open ended question because the researcher thought that the challenges faced may be specific to each contractor. In analyzing this open ended question, same ideas shared by different respondents are gathered into one group and considered as frequency of same idea. Accordingly, the responses of the surveyed construction companies are summarized below in Table 4.3.

Table 4.3: Main challenges faced during implementation of the QMS

Item No	**Main challenges faced during implementation of QMS**	**Frequency of same idea by respondents**
1	Resistance of changes by staff i.e. unwillingness of the staff to implement QMS is the main challenge. Convincing the workers to follow the procedures to implement the system at project site level was difficult. This challenge has happened due to the reason that some employees were not willing to divert from their previous tradition. Especially Engineers are more change resistant than other professionals.	9
2	The QMS is not implemented as per the manual i.e. the company staff are not using formats and work instructions properly and not following determined process as per QMS requirement. Some staffs could not use and keep the formats and documents' identification number and sometimes also prefer to use formats which are redundant. Generally there is lack of consistency in level of awareness of ISO 9001 among the staff when starting implementation.	5
3	Construction projects are geographically scattered making it difficult to train people at various sites by sending trainers from the head office b/c it takes time and even some staffs are incapable of understanding of the QMS due to lack of capacity and commitment.	4
4	High turnover of trained staff	4
5	"Implementing & maintaining QMS requirements needs additional staff and additional staff time so paying for this additional staff increases company overhead cost"	2
6	Employees not giving attention for additional assignments concerning QMS implementation which are given in parallel to their usual work.	1
7	Rewriting the company rules and regulations as per ISO 9001 requirement was time taking.	1

The above Table shows that **'resistance to change by staff especially engineers i.e. unwillingness to implement and maintain the QMS' was the 1st main challenge,** faced by all (100%) of the certified construction companies. The engineers, especially the senior engineers, do not like the paper works which is required by clause 4.2 of the standard.

Engineers did not have a habit of documenting and record keeping rather they focus on the work itself. Some of the certified construction companies said that when the engineers are required to prepare and document work instructions, check lists etc. and keep record of work done, they don't feel comfortable rather some of them decide to leave the company and join other uncertified construction companies.

In relation to resistance to change, the literature review of this thesis section 2.5 and 2.6.2 describe the possible solutions to resistance of change. Section 2.5 describes that 'If employee's introduction to QMS is delayed, once negative rumors have developed, ISO 9001 implementation efforts will become more difficult.' In addition, the reason why the certified construction companies faced resistance to change shows that the extent of the possible solutions to the resistance mentioned in section 2.6.3 such as motivation (commitment and leadership, staff involvement and recognition of accomplishment) and training opportunities had not been applied to a required level by all the Ethiopian certified construction companies during implementation of ISO 9001. In addition to the above, the staff didn't have work experience based on QMS requirements because ISO 9001 certification is almost new to Ethiopia.

Not implementing the QMS as per the manual is rated as the 2nd main challenge faced by 55% of the respondents. This is due to lack of consistency in level of awareness of ISO 9001 among the staff when starting implementation. As per the respondents' saying, the lack of consistency stems from two aspects. The one aspect is the geographically scattered nature of construction projects that makes training staffs time taking to provide at all project sites under the company. The other aspect is the new culture created by implementing QMS such as documentation is not practiced by construction site people. Staff didn't have enough practice on documentation, carrying out the work as per its documentation and recording the works done. This created difference, among staffs, in level of internalizing the need of implementing QMS as per the quality manual.

The literature review part of this thesis, section 2.6.3.2, describes that the potential of the QMS cannot be exploited until the staff fully understands how it functions. To promote awareness of the QMS, quality training is carried out in two stages; while the QMS is being

developed and when the quality procedures are ready. In addition, quality training in an organization is an ongoing process so it is also required after the system is in full operation.

The 3rd main challenges of implementing ISO 9001 in construction companies with 4 (44%) response frequency are:

- Construction projects are geographically scattered making it difficult to train people at various sites by sending trainers from the head office because it takes time and even some staffs are incapable of understanding of the QMS requirements due to lack of capacity and commitment. Some respondents argue that had construction works were not geographically scattered, it would have been easy to sufficiently train the staff on QMS requirements. Therefore, the nature of construction projects discourages training all the staffs going to all project sites.
- 'High turnover of trained staffs': Some trained staffs that feel it is easier to work with uncertified construction companies, leave the certified company. In addition, due to the construction business opportunity and high demand of Engineers in the country, some QMS trained staffs leave for their own job or join other company for higher salary.

The 4th main challenge with response agreement rate of (22%) is:

"Implementing and maintaining QMS requirements needs additional staff and additional staff time so paying for this additional staff increases company overhead cost". Two out of nine certified construction companies argue that if they were not implementing QMS, they had not been required to hire additional staffs still making profit by running business as usual.

In contrary to this increase in overhead cost as said by two construction companies, the literature review part of this thesis section 2.4.2 describes that even if implementing and maintaining ISO 9001 costs, the savings which can be obtained latter on after implementation are much greater than the costs. Analysis of seven building projects of various sizes in Australia has shown that through the implementation of a proactive quality system that costs for prevention 1% of the project value, the expenditure as a result of repair etc. which is the failure cost drops from 10% to 2%, representing a saving of 7%.

4.2.3 Why Ethiopian Construction Companies were interested in Implementing ISO 9001 QMS in Their Organization?

Table 4.4: Main driving forces to implement ISO 9001 QMS in Ethiopian construction companies

Item No	Description of the driving forces to implement ISO 9001	Relative importance index (RII) = (total point/(P*N)) yes=1 pt somewhat=0.5 no=0 pt	Rank
1	For marketing purposes & to enhance the reputation of their company	0.94	1st
2	To ensure higher productivity	0.94	1st
3	Because GTZ IS trained ISO 9001 for construction companies	0.94	1st
4	To increase employee motivation & participation	0.83	2nd
5	Dissatisfaction with the previous mode of operation & its results	0.72	3rd
6	To compete with international construction companies where ISO certification is required to participate in a construction project	0.72	3rd
7	To be more competitive	0.67	4th
8	Expecting that ISO 9001 QMS certification will be a requirement for tender internationally and locally in Ethiopia.	0.67	4th
9	Customer requirements	0.61	5th
10	The university capacity building program (UCBP) and GTZ IS pushed to get ISO 9001 certification	0.61	5th
11	To fulfill legal requirements	0	All said No

Respondents were asked to specify if they have other driving forces which are not mentioned by the researcher. Accordingly, only 'code contractor 2 (C2)' and 'code contractor 3 (C3)' have responded the following:

Participant contractor with identification code 2 (C2) has said:

- To provide quality products and service. (This idea can be considered equivalent to customer satisfaction)
- To minimize effect of turnover of employees by establishing system & institutionalize the company. During implementation of QMS, a system is developed as per the standard requirements. Responsibilities and authorities are clearly defined. Job descriptions are also prepared. So when employees terminate their employment other new employees will continue with the system so the company will not be affected.
- To create check and balance. To control performance of quality related operations and take corrective action through application PDCA cycle.

Participant contractor with identification code 3 (C3) has said:

- Somewhat helps to know the actual position of the company at any time by comparing against the objectives in the QMS and other documentations which enables to take appropriate actions needed.

As can be seen from the above Table 4.4, the main driving forces to implement ISO 9001 QMS in construction companies are the following:

- **Ranked 1st with relative importance of 0.94:**
  - **For marketing purposes and to enhance the reputation of the company:** This is the factor that almost all certified construction companies have targeted when implementing QMS to their company. It was for making promotion saying that the companies' quality management is standardized, to get better market and reputation.
  - **To ensure higher productivity:** Similar to the marketing and reputation, almost all of the certified construction companies were forced to implement QMS to increase their productivity through increased efficiency. However, as it can be understood from section 4.2.4 below, the participants were asked whether they have achieved the benefit of 'increased productivity' after certification, the response of some of the respondents showed that they have not achieved the benefit satisfactorily. The achieved benefit index which for achievement of increased productivity is 0.56 which

is relatively low. Almost half of the participants have not been able to achieve the expected benefit.

- **Because GTZ IS trained ISO 9001 for construction companies:** The respondents said that the training provided by GTZ IS has motivated them to implement QMS.

❖ **Ranked 2nd with relative importance of 0.83:**

- **To increase employee motivation and participation:** As most respondents agreed, the other driving force in implementing QMS was to increase employee motivation and participation. It was the belief of certified companies that if the QMS is implemented to their company, the duties and responsibilities of employees will be clearly described making the employees motivated. In line with this expectation, as it can be seen from section 4.2.4 below, after certification almost all of the construction companies have said they able to achieve the benefit of 'clearly defined duties and responsibilities of employees'. However, 'motivation and involvement of all employees' is not achieved as intended.

❖ **Ranked 3rd with relative importance of 0.72:**

- **Dissatisfaction with the previous mode of operation and its results:** Most of the respondents agreed that they were dissatisfied with their previous mode of operation and its results. E.g. before certification controlling was not easy, there was lack of coordination, unstructured (not consistent) decision making process etc.
- The other intention was '**to compete with international construction companies where ISO certification is required to participate** in a construction projects'.

On the other hand, the least driving forces as ranked by the respondents both 5th with relative importance of 0.61 are:

- '**The university capacity building program (UCBP) and GTZ IS pushed construction companies to get ISO 9001 certification':** The participants stated that the UCBP and GTZ IS were promising that uncertified construction companies will not be allowed to participate especially in construction projects owned by ministry of education. So this has partly contributed for participants to get certified.
- **'Customer requirements':** the respondents mentioned that it was mainly the UCBP and ministry of education, as part of the capacity building program, were demanding

certification or being on process to get certification as a requirement to participate in new university construction projects under the ministry of education. But other customers were not explicitly demanding ISO 9001 certification as a requirement.

No construction company is certified 'to fulfill legal requirements' but to fulfill tender requirement when some floated tenders consider ISO 9001 certification as additional requirement. During interview, respondents explained that no legal requirement is in place that restricts to get certified for construction companies. However, sometimes ISO 9001 certification is required to fulfill tender requirement. The respondents also added that ISO 9001 is adopted in line with legal requirements so it can be used as a means of fulfilling legal requirements. ISO 9001 certification is demanded as a requirement for tender when some international tender is floated. However, in almost all national tenders, being ISO certified is not yet considered as a requirement or as additional value by customers.

4.2.4 The Actual Benefits Obtained by ISO 9001 Certified Construction Companies

Table 4.5: The actual benefits obtained by ISO 9001 certified construction companies

Item No	**Description of benefits obtained by construction company after ISO 9001 QMS certification**	**Relative importance index = (total point/(P*N)), yes =1 pt, somewhat =0.5, no = 0 pt**	**Rank**
1	Responsibilities and authorities are adequately defined	0.94	1st
2	Improved management confidence	0.89	2nd
3	Improved awareness of company objectives by top management	0.89	2nd
4	Improved communication	0.83	3rd
5	Improved identification of root causes of problems	0.83	3rd
6	Improved utilization of resources	0.83	3rd
7	Giving more focus to customers' requirements	0.83	3rd
8	Improved awareness of company objectives by middle management	0.78	4th
9	Better management control and reporting	0.78	4th
10	Better record handling	0.78	4th
11	Better document handling	0.78	4th
12	Are able to satisfy their customers better than before certification	0.72	5th
13	Able to continuously monitor and improve their objectives or performance	0.72	5th
14	Achieved Increased credibility or reputation	0.72	5th
15	Commitment for continued improvement	0.72	5th

Table 4.5 (Continued): The actual benefits obtained by ISO 9001 certified construction companies

Item No	**Description of benefits obtained by construction company after ISO 9001 QMS certification**	**Relative importance index = (total point/(P*N)) yes =1 pt, somewhat =0.5, no = 0 pt**	**Rank**
16	Increased profits and company growth	0.67	6th
17	Fewer defects in quality of construction	0.67	6th
18	Decreased rework	0.67	6th
19	Decreased material waste	0.67	6th
20	Greater employee awareness about quality	0.67	6th
21	Increased motivation and involvement of all employees	0.67	6th
22	Improved awareness of company objectives by lower level management	0.61	7th
23	Reduced error rates	0.61	7th
24	Better management of risk	0.61	7th
25	Better accountability and contractual control	0.61	7th
26	Increased sense of ownership	0.61	7th
27	Increased productivity	0.56	8th
28	Errors rectified at the earliest stage and not repeated	0.56	8th
29	Tender winning increased	0.44	9th
30	Improved awareness of company objectives by laborers	0.28	10th

Even though, respondents were asked to specify if there are others additional benefits obtained by their organization than the above listed, no one mentioned.

As can be seen from the above Table 4.5, the actual benefits obtained by ISO 9001 certified Construction Companies are the following:

❖ **Ranked 1st with relative importance index of 0.94:**

- Responsibilities and authorities are adequately defined: When the companies get certified they should define the responsibilities and authorities clearly as per ISO 9001requirement (sub-clause 5.5.1 as in 2008 version) among other things. The respondents have also confirmed the upper most achieved benefit of ISO 9001 certification is 'adequately defined responsibilities and authorities'.

❖ **Ranked 2nd with relative importance index of 0.89:**

- Improved management confidence.

  During the interview, respondents were asked to support with example how improved management confidence is achieved. Their responses are:

  ✓ Duties and responsibilities are clearly described

  ✓ Necessary process and procedures are documented so employees will be clearer on how to do their work.

  ✓ In case of nonconformity, the QMS is traceable due to its documents and records

  ✓ Therefore, if management plays their part, the above mentioned issues and other requirements of the QMS are established, the management will be confident and trust on the system that employees will work towards achieving quality of products and customer satisfaction.

- Improved awareness of company objectives by top management: Because the standard demands top management to ensure that quality objectives are established, in doing so most of the top management of the certified construction companies became aware.

❖ **Ranked 3rd with relative importance of 0.83:**

- Improved communication
- Improved identification of root causes of problems
- Improved utilization of resources
- Giving more focus to customers' requirements

Most respondents explained that the ISO 9001 certification has helped them to document the necessary process, duties and responsibilities and other necessary

procedures to achieve improved communication because individuals know the line of communication within the organization structure and with other organizations than before certification. Similarly, the respondents said that the documentation and record keeping requirement of the standard has also helped them for improved identification of root causes of problems. The QMS also helped to give more focus to customer requirements. Most of the respondents said that because the target of QMS is to satisfy customers, accordingly, the QMS enabled to give more focus to requirements of their customers. Resources utilization has been also improved because of better understanding of the operation process and plan documentation.

Another important point that should be mentioned here is that the relative importance index of 'improved awareness of company objectives by middle management' and 'improved awareness of company objectives by lower level management' is 0.78 (ranked 4th) and 0.61 (ranked 7th) respectively, as it can be seen from Table 4.5 above. This indicates that to some extent there is lack of awareness of company quality objectives by middle management in some of the certified construction companies. To a greater extent, the awareness of lower level management can be judged as low when it is compared with what it had to be. Awareness is the starting point for action. The evidence for this argument is:

- The ISO 9001; 2008 states that top management shall establish the quality policy and ensure that quality objectives are established. Top managements shall also insure that the quality policies and quality objectives are communicated and understood within the organization. (Clause 5.1 and 5.2)
- Similarly, the literature review part of this thesis also emphasizes that quality objectives should have to be determined and understood by all employees and even the resistance to change should have to be broken by motivating and training employees. During internal quality audit, the auditors should check if quality objectives are understood by employees.

On the other hand, the benefits that were not achieved with RII less than 0.50 are:

- **Tender winning increased (ranked 9th with RII = 0.44):**
  Most of the respondents said that their tender winning has not increased because in almost all national tenders, being ISO certified is not yet considered as a requirement for tender or as additional value. They are not given any credit by being certified than uncertified construction companies. However, 2 out of 9 of the certified construction companies said that they have got some advantages especially in internationally floated tenders in which most of the international tenders consider ISO 9001 certification as a requirement for tender. This has enabled the certified contractors to win in internationally floated tenders.
- **Improved awareness of company objectives by laborers (ranked 10th with RII = 0.28):** Most of the research participants believe that laborers awareness on company quality objectives is not necessary because their employment is temporary and even they may not have the capacity of understanding the quality objectives. However, under sub-clause 6.2 human resources part of the ISO 9001: 2008 describes that "conformity to product requirements can be affected directly or indirectly by personnel performing any task within the QMS".

In order to identify the benefits of QMS implementation in greater depth, the researcher asked respondents to put in quantifiable amount for some of the benefits mentioned in Table 4.5 above. The only construction companies that responded yes and specified achieved benefits in percentage of performance improvement after certification are separately presented below.

Table 4.6: Four selected quantifiable benefits of ISO certification

Code of contractors (Respondents)	Increased productivity after certification	Increased profits & company growth	Decreased rework	Decreased material waste
C1	Not determined	15%	Believes rework has been decreased but report not yet issued	Believes material waste has been decreased but report not yet issued
C3	20 -30%	40-50%	50%	30%
C8	Not determined	44% but QMS is not the only factor for increased profit	Report is not yet issued but the company believes rework has been decreased by greater than 20%	Report is not yet issued but the company believes material waste has been decreased by greater than 35%

The responses of participants who have specified the achieved benefits in quantifiable amount are presented in the Table above. However, all the remaining respondents responded for the above four quantifiable achievable benefit factors namely 'increased productivity after certification', 'increased profits & company growth', 'decreased rework' and 'decreased material waste' as somewhat achieved benefits of ISO 9001 certification. No one has responded as no, not achieved. This shows that respondents believe there were improvements but most of them could not quantify them.

As it can be seen from Table 4.5 above, the relative importance index (RII) for 'increased productivity after certification', is 0.56 while RII for 'increased profits and company growth', 'decreased rework' and 'decreased material waste' is 0.67 each. This relatively lower RII shows that the efficiency of the certified construction companies has not reached to the required level or their data collection and analysis especially on the above mentioned four quantifiable benefits is not systematically developed. It is only one construction company that could put fully in quantifiable percentage on the above four factors. The other two construction companies put in subjective figure. The remaining respondents have responded 'somewhat' because they could not able to put in exact figure. This shows that most of the certified construction companies do not know exactly what improvements after certification are achieved quantitatively.

The one construction company that could specify the benefits in a figure has supported the benefits it has got with example. The examples are:

- **Example of waste reduction:** Code Contractor 3 (C3) put some examples on the quantifiable benefits. Before ISO 9001 certification, rebar was cut as per drawings then if there are any remaining pieces employees had no motivation to find suitable use for them resulting in the production of waste. But after certification, any remaining rebar cut from a 12 m standard length is recorded and stored. Then next time, before cutting from a new standard length bar, a check is made at the store for availability of suitable pieces for a given use. This practice has saved considerable waste of rebar.

- **Example of waste and rework reduction:** The same contractor (C3) stated that before certification, doors and windows were produced as per the drawings and installed. As a result, this company was facing problems of discrepancy between the size of the door and window openings of the building and the size of the doors and windows. But after ISO 9001 certification, this company has brought a consistent method of work. Either the doors and windows are produced after the as built opening is measured or produced as per drawings but the workers at site leave extra space that is later plastered to close remaining open spaces after doors and windows are installed. By doing so the construction company has reduced waste & avoided rework that may result from discrepancy between size of the openings and the actual size of doors & windows. In addition, the company has also improved the installation quality of the doors and windows.

In addition to the benefits mentioned in table 4.5 above, respondents forwarded during interview the following exemplary benefits of ISO 9001 implementation:

- Certification helped for 3 of the certified construction companies to be one of the short listed construction companies for tender
- Instructions and procedures are clearly prepared and helped the company workers to become clear with their work without confusion.
- 2 out of 9 certified construction companies have got international recognition. E.g. one company has able to get construction project out of Ethiopia, in Somaliland. Another

one has got a project in African union found in Addis Ababa due to its ISO 9001 certification in which certification was considered as tender requirement.

- Performance is monitored
- Improved quality management
- Communication among departments is enhanced
- Activities of the company become traceable due to the process determined that shows beginning and ending of any activity, clear procedures and records

Generally, on one hand certified construction companies have got the above mentioned benefits which go in line with the findings of Yimam Abadir that he mentioned for most of project management knowledge areas, the Project management maturity level of contractors which are ISO certified or in a process to obtain the certification are found to be higher than those which are not certified. On the other hand, the certified construction companies failed to achieve some benefits of QMS to required extent for reasons mentioned in section 4.2.6.

4.2.5 Measuring the Outputs of ISO 9001 Certification

How do Ethiopian construction companies measure the benefits and effectiveness of implementing ISO 9001QMS?

Table 4.7: Measuring the outputs of ISO 9001 certification

Item No	Descriptions of main Expected benefits of ISO 9001 certification	Means of measuring the benefits	Relative importance index (total point/(P*N)) yes=1 pt no=0 pt	Rank
1	Customer satisfaction	Direct communication with customers	1.00	1st
		Willingness of customer to allow contractors to participate in other tenders or awarding other projects	0.89	2nd
		Via number of complaints	0.56	3rd
		Survey via Questionnaire	0.22	4th
		Via suggestion box	0.11	5th
		Lost business analysis	0.11	5th
2	Consistency in the quality of construction products (deliverables) in construction projects	Keeping track of non-compliance with specifications and drawings	1.00	1st
		Keeping track of the number of defective or out of spec products used	0.56	2nd
		By counting the number of defective installations that require rework	0.44	2rd
3	Continual improvement of the organization's overall performance	Tracking customer complaints	1.00	1st
		Keeping track of repetitive errors	1.00	1st
		Keeping track of the level of rework	0.89	2nd
4	Better company reputation	If there are no or reduced warranty claims	1.00	1st
		Repeated business from the same clients	0.89	2nd
		Number of bids won	0.78	3rd

Table 4.7 (continued): Measuring the outputs of ISO 9001 certification

Item No	Descriptions of Expected benefits of ISO 9001 certification	Means of measuring the benefits	Relative importance index	Rank
5	Increased profit (How do you measure the increased profit whether it is due to QMS implementation or through other opportunities)	By increase in productivity, decrease in rework, waste reduction etc	0.89	1st
		By simply comparing the profit before certification and after without considering other factors	0.44	2nd
6	Reduced rework	By valuing on monetary bases the amount of rework before certification and after	0.56	-
7	Traceability of the source of quality problems	By being able to identify the cause of poor workmanship	1.00	1st
		By being able to trace the particular batch of material or component used	0.89	2nd
8	Continual improvement of the effectiveness of the quality management system and its processes	Actions taken as a result of management review meetings	1.00	1st
		Reviewing the effectiveness of preventive actions taken	1.00	1st
		Reviewing the effectiveness of corrective actions taken	1.00	1st
		Via internal audit results that may identify areas for improvement	0.89	2nd
		Via external audit results	0.67	3rd
9	Increased employees sensitivity to quality	Keeping track of the number of suggestions for improvement that comes from employees.	0.89	-
10	Improved awareness of company objectives	Keeping track of the level of planned objectives met	1.00	1st
		Internal audit	0.89	2nd
		External audit result	0.56	3rd

For customer satisfaction, respondent code contractor 2 (C2) forwarded other means of measuring 'customer satisfaction' and said new customers come on **recommendation of**

previous customers which matches with the philosophy 'if satisfied, tell others; if not, tell us' presented in section 2.3 literature review part of this thesis.

As it can be seen from Table 4.7 above, the means of measuring output or benefits of ISO 9001 certification are described below:

- **Customer satisfaction:**
  - The common means of measuring customer satisfaction by all participant construction companies is found to be 'direct communication with customers' with RII=1.
  - 'Willingness of customer to allow contractors to participate in other tenders or awarding other projects' is also the next usual means of measuring customer satisfaction with relative importance index of 0.89.
  - On the other hand two contractors (RII = 0.22) have the habit of measuring their customers satisfaction via 'Questionnaire' and this survey has shown greater than 80% of their customers are satisfied with their work or service provided.
  - 'Via suggestion box' and 'lost business analysis' are found to be the least or almost not practiced means of measuring customer satisfaction with RII of 0.11 each.
- **Consistency in the quality of construction products (deliverables) in construction projects**:
  - Keeping track of non-compliance with specifications and drawings' is practiced means of measuring consistency in the quality of construction products with RII = 1. However, during interview, some participants have said they execute all the works so as the work or product fit the specs and drawings to get the go-ahead permission when supervisors inspect the operation or product. If the supervisor rejects the operation or product, in most of the cases it is because of non-compliance with specs and drawings.
  - 'Keeping track of the number of defective or out of spec products used' is the second practiced means of measuring consistency of the construction products almost by half of the participants with RII=0.56.
  - 'By counting the number of defective installations that require rework' is not that much practiced means of measuring consistency of product in which its RII is 0.44. Had the certified construction companies have a record of rework; they could have used their records to measure how consistent products are produced and whether

continual improvement is achieved. But as it can be seen in the above and in section 4.2.4, certified construction companies have weakness in record keeping specifically concerning rework, increase in productivity, decrease in waste, etc.

- **Continual improvement of the organization's overall performance:**
  - 'Tracking customer complaints' and 'Keeping track of repetitive errors' are both practiced means of measuring continual improvement of overall performance with RII=1.
  - 'Keeping track of the level of rework' is the next practiced means of continual improvement with RII = 0.89. During interview the researcher understood that 'Keeping track of the level of rework' is not based on quantified figurative and compiled data of track of rework but based on subjective judgment. It should be noted that the RII of 'keeping track of the level of rework' to measure continual improvement is 0.89. This RII is high and it reflects almost all respondents keep track of level of rework but this seemingly high RII is due to the only 'yes' or 'no' option scale. There is no intermediate option scale like 'somewhat' so respondents preferred to answer 'yes' than 'no' due to the attempt they made to keep track of level of rework.

    This can be compared with responses regarding rework in other sections. When the respondents asked to quantify the reduction of rework in percent after certification in section 4.2.4, except one contractor, no one could give response in exact figure. But most of them agree they have got benefit of reduction in rework after certification with RII = 0.67 as can be seen in Table 4.5 above. However, when respondents were asked if they measure consistency of quality of products by 'counting the number of defective installations that requires rework', majority said 'No'. Once again when respondents were asked if they value the reduced rework after certification on monetary bases, only 5 out of 9 respondents said 'yes' even if they could not exactly state a figure. This response on rework reduction may seem contradictory. But the responses are not contradicting but show the respondents believe that they have got advantage of reduction in rework after ISO 9001 certification but they have difficulties in properly recording and quantifying rework.

- **Better company reputation:**
  - All respondents measure their company reputation mainly by looking into their customers warranty claims. Respondents said 'If there are no or reduced warranty claims', ISO certified construction companies can know that their company reputation is at good position.
  - 'Repeated business from the same clients' and 'Number of bids won' are the next to warranty claim means of measuring company reputation with RII = 0.89 and 0.78 respectively. The aforementioned response shows that majority of the certified construction companies use not only one of but three of the means of measuring company reputation together to measure their company reputation.
- **Increased profit (How the construction companies measure their increased profit whether it is due to QMS implementation or through other opportunities):**
  - 'By increase in productivity, decrease in rework, waste reduction' is the common means of measuring increased profit after certification with RII = 0.89. However, it has been discussed in the previous sections that the companies have weakness of determining this factors in a figure.
  - However, 'By simply comparing the profit before certification and after without considering other factors' is not practiced means of measuring increased profit by most of participant contractors with RII = 0.44.
- **Reduced rework:**
  - Almost half of the participant contractors (with RII=0.56) measure reduced rework by 'valuing on monetary bases the amount of rework before certification and after'. However, except one Construction Company, others could not give specific example figuratively when they were asked during interview.
  - Out of the ten listed measurable factors, 'reduced rework' is found to be the least measured factor. In the questionnaire participants were asked if they have other means of measuring reduction in rework but no one could give other means.
- **Traceability of the source of quality problems:**
  - 'By being able to trace the particular batch of material or component used' and by 'being able to identify the cause of poor workmanship' are commonly used means of

measuring traceability of the source of quality problems with RII = 1.0 and 0.89 respectively.

- **Continual improvement of the effectiveness of the QMS and its processes:**
  - 'Actions taken as a result of management review meetings', 'Reviewing the effectiveness of preventive actions taken', 'Reviewing the effectiveness of corrective actions taken' are the most practiced means of measuring 'continual improvement of the effectiveness of the QMS and its processes' by all respondents with RII=1 for three of the factors. This shows the three aforementioned means are jointly or independently practiced means of measuring continual improvement of the effectiveness of the QMS and its processes.
  - Measuring 'Via internal audit results that may identify areas for improvement' and 'via external audit results', are relatively moderately practiced with RII = 0.89 and 0.67 respectively.
- **Increased employees sensitivity to quality:**
  - Respondents agreed that 'keeping track of the number of suggestions for improvement that comes from employees' is the means of measuring 'increased employees sensitivity to quality' with RII=0.89. During interview, the participant construction companies have said the following are indications of the suggestions for improvement.
    - ✓ During meeting employees are promoted to make participation and forward some suggestions.
    - ✓ During internal quality audit, employees give suggestions for improvement
    - ✓ Sometimes employees show their participation by resisting for sake of producing quality products when pushed to continue execution of work at rush from head office or project manager
    - ✓ Employees put their suggestion into suggestion box secretly when working at the company and exit suggestions collected from leaving employees.

  However, no one certified Construction Company could give the exact number of suggestion that come from employees per year, on improvements for quality.

4.2.6 Main Reasons for Failures of Certified Construction Companies' in Achieving Benefits of ISO 9001Better than Their Current Achievements

During interview with respondents and informal discussion with some professionals in the construction industry, the researcher understood that the respondents strongly believe that the ISO 9001 QMS requirements are very important and it can be the best strategy to solve not only the quality management problems of Ethiopian construction companies but also to solve other management area (function) problems. Of course, the respondents believe implementing and maintaining ISO 9001 is very important quality management tool and helpful for general management, but the question is that do the certified companies practically achieve all expected benefits of effective QMS? Or partly failed?

During interview, the researcher tried to collect information on the belief of the certified construction companies that to what extent their implemented QMS met their expected (intended) benefits. Option rates were given as >90%, 75-89%, 65-74%, 50-64%, <50%. The response is summarized in Table 4.8 below.

Table 4.8: Respondents' opinion on overall extent of achieved benefits of QMS compared to their expectation or plan

Code of contractors (Respondents)	**Opinion of respondents' on the extent of achieved benefit of QMS in % compared to plan**	**Current status of ISO 9001 Certificate given by external certifying body**
C1	Made possible effort to utilize the benefits and believes it has highly benefited them but was not willing to provide a figure	Maintained and not expired
C2, C3, C7 & C8	75-89%	C2 & C8: maintained and not yet expired. C3 & C7: QMS certification was maintained until expiration but currently expired
C4, C5 & C6	50-64%	QMS certification was maintained until expiration but currently expired
C9	Except some requirements, the QMS was not maintained & considerable benefits are not obtained	Was not maintained after certification & currently expired

The above response shows that the achieved benefit of QMS by almost half of the certified construction companies is low because their achievement is less than 65%. The one construction company (C9) has not interest in maintaining the QMS after certification in its company. The 75-89% achievement is relatively good but two questions can be raised. One why not the achievement of all could not be greater than 90%? The other question is why most respondents failed to give response in a figure on increased productivity, reduced waste, rework etc.? The answer for these two questions is the reason for failures as presented below.

Respondents forwarded some of the reasons of failure in getting full benefits of ISO 9001. The reasons are:

- Company staffs are busy in routine works so partly failed to maintain QMS.
- Design incompleteness which is prepared by consultant. When the construction company faces incomplete design and requests for design completeness, it takes considerable time. The team sprit among client, supervisor or consultant and contractor is low.
- High turnover (4 construction companies have said turnover is still a challenge). The reason that contributed, according to the respondent belief, to high turnover is the growth of the country that some professionals engage in their own business as a result of opportunities created by the government or opportunities created by the market. E.g. so many engineer professionals have got a chance to work in team in rural road projects by leaving their previous employment.
- QMS is not implemented in all stakeholders. E.g. supplier evaluation and selection (clause 7.4.1 of ISO 9001) may not work because the suppliers may disappear or do not focus on the principle of mutual beneficial relationship. Suppliers are not ISO 9001 certified while the construction company does. Similarly, there is market problem e.g. there is a forged brand i.e. forged materials are available at the brand name of well-known manufacturing company. The certified construction company makes a purchase from the market, believing that a quality material should be purchased based on the brand described in specification but sometimes the purchased materials performance is found to be below expectation (specification). If the construction company uses in tender the quote of some well-known and trusted

importers, their supplying price is very high so this company cannot compete with others companies that may take a lower price quotation from forged brand material importers. Even if the Ethiopian conformity assessment enterprise is making a material inspection, the problem of forged brand on imported materials especially construction finishing materials is not yet fully solved. So at such kind of situation in which most stakeholders are not ISO 9001 certified, satisfying customers is difficult as per the sayings of some respondents.

- Owner and/or general manager are not that much willing on the QMS maintaining because they don't see immediate benefits like certification is not a tender requirement in almost all floated tenders or other external immediate pressure. Concerning this view, the literature review part, section 2.6.1 similarly states that 'considering implementation of ISO 9001QMS for certification only and unaware of its internal benefits of making firms effective and efficient even when there is no need for certification has contributed for companies not to be certified with ISO 9001'. This belief of respondents shows that the certified companies even after certification have awareness gap on the internal benefits of the standard.
- Employee's resistance to change: Some employees still are not willing to implement and maintain QMS as per its documentation at project sites. The reason that respondents forward is that the employees had no such kind of experience before.
- Managers do not encourage employees to participate. Instead some managers need to be autocratic on their subordinates.
- Management fear of transparency: Respondents mentioned that management people feel loss of control over their subordinates if the management process is transparent. The management style practiced by the management people in construction is more of autocratic type which gives much control to the manager. If QMS is implemented and maintained, the management process becomes transparent causing the fear of management.
- Even if top management are committed, they may lack capacity to bring change
- The construction companies have data collection, analysis and reporting gaps at project site level. Accordingly, correct and detailed data is not reported to head office.

Therefore, data on productivity, defects, rework, waste etc are not accurately collected and reported. No base line for data collection and analysis.

- Most of the certified construction companies were certified through the opportunity and facilitation of GTZIS under UCBP. The support of the government is appreciable but the facilitation may have contributed for companies to overseen the internal benefits of the standard and low utilization of QMS because the companies were not initiated by themselves by analyzing the internal and external benefits of the system. In addition, almost all of the construction companies had a great expectation and even they say there was promise by concerned governmental bodies that ISO 9001 certification will be a requirement for future for tender participation in national tenders. But this did not happen to date. As a result, the construction companies discouraged to maintain the QMS.

Chapter Five: Conclusion and Recommendation

5.1 Conclusion

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

1. Almost all of the certified construction companies have not got tangible benefits of ISO 9001 certification. No achieved quantifiable benefit that shows continual improvement except for one company.

2. **Main reason for failure in getting better benefits of ISO 9001:**
    - Certified construction companies have not given emphasis to continual improvement of their company's performance.
    - The companies did not get the competitive advantage they thought they would get
    - Lack of providing sufficient training for their staff
    - Lack of appropriate motivation
    - No preference is given to the certified companies
    - The government support lacked continuity

3. Although, certified companies attempt to measure the benefits of having QMS in terms of **customer satisfaction** and **continual improvement**, their measurement lacks objectivity because they don't quantify in a figure.

4. The top main challenges that certified companies faced during implementation of QMS are:
    - Resistance to change
    - Inconsistency in implementing QMS
    - Turnover

5.2 Research Recommendations

The following recommendations for action are forwarded for concerned bodies (stakeholders).

5.2.1 Certified Construction Companies should:

a. Give more emphasis to internal benefits of having QMS such as efficiency & effectiveness in company operations.
b. Top management should always be committed to maintain the QMS and continuously show that the QMS is a strategic weapon to win business.
c. Motivate and provide enough training to avoid resistance to change by employees and increase awareness during & after implementation of QMS.
d. Aware their staff and laborers on the company's quality objectives. Like other employees, the companies should aware their laborers (skilled and unskilled) on quality objectives of their company which is specific to the job of the laborers' when joined the company and then after. It is the skilled and unskilled laborers that practically do the product so they should be part of the effort of producing quality products at reduced cost.
e. Establish measurable objectives related to reworks reduction, waste reduction, increase in productivity, etc. and properly device processes required to record the achievements. The companies should also keep records to measure the company's efficiency and achieve continual improvement.
f. Management should not fear transparency rather they should effectively use QMS to create transparency and use potentials of their employees to increase effectiveness and efficiency of their company.

5.2.2 Concerned Governmental Bodies:

- The Ethiopian standards agency which is currently giving training on ISO 9001 should increase its admitting capacity to train larger number of professionals.
- Governmental bodies should do more on awareness creation.
- The government bodies should also encourage construction companies to get ISO 9001 certification and maintain it. For example, considering ISO 9001 certification as

a plus for tender requirement, arranging continual workshops on quality management to create awareness and build the capacity of companies.

5.2.3 Public and Private Clients

Major public clients like Ethiopian roads authority (ERA), Addis Ababa housing program etc should be certified themselves and take a lead in promoting construction companies to implement and maintain ISO 9001. These public clients should consider ISO 9001 as one of the technical requirements for tender. Similarly, private clients should also give priority to certified construction companies especially in large and complex projects.

5.3 Recommendations for Further Research

This research work is a starting one and it should be followed by a number of researches to investigate scopes which are not considered in this research. Thus this researcher recommends the following for further research and investigation:

1. A case study on benefits of ISO 9001 certification taking two or greater certified Ethiopian Construction Companies. This is to investigate the impact of ISO 9001 in more detail on selected certified construction companies to understand mainly their process efficiency and effectiveness both at project site and head office.
2. Awareness assessment of stakeholders' on importance of ISO 9001 certification in Ethiopian construction industry. Awareness of other stakeholders on importance of certified construction companies' and among one another.

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Appendix A: Questionnaire Distributed to ISO Certified Construction Companies

Questionnaire on '**Assessment of the Impact of ISO 9001 Certification on Ethiopian Construction Companies'**

Dear Respondents,

I am presently engaged in both descriptive and explanatory research to find out the Impact of ISO 9001 Certification on Ethiopian Construction Companies. In order to assess the impact, I designed a questionnaire and distributing it to you seeking your response.

The objective of this research is:

- To determine if Ethiopian ISO 9001 certified construction companies have benefited from obtaining the certification and investigate the main reasons if they have not
- In in line with the above objective, the study will answer the following two questions:
    - How the certified companies measure the benefits of implementing ISO 9001?
    - What are the main challenges faced in implementing ISO 9001 standard?

Confidentiality:

I confidently assure you that the information you provide me will remain confidential. The information you provide me will be used only for academic purpose.

Please take a moment to complete the questionnaire and return it to me within 5 days of receiving the questionnaire. If you have any questions/queries please do not hesitate to contact me on 0912 199561 or email: teklecotm@yahoo.com.

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

Sincerely yours,

Teklebrhan Kidanu, Graduate Student at Addis Ababa institute of Technology (AAiT)
School of Civil and Environmental Engineering
MSC in Construction Technology and Management Program
Advisor: Dr. Eng. Ephraim Senbetta

Part 1: General, Challenges during Implementation and Driving forces for Implementing ISO 9001

1.1 Please thick on your organization's category (GC/RC/BC) & grade (1,2,3,4,5,6)

1.2 When was your company ISO 9001 certified? In _____ / _____ G.C

1.3 Pleases mention your position in your company:

_____

1.4 Please specify the frequency that your organization makes internal audit of QMS. Every _____

1.5 Please specify the frequency that your organization's QMS is externally audited. Every _____

1.6 Please specify the frequency that your organization makes management review concerning QMS effectiveness. Every _____

1.7 What were the main challenges your company faced, in implementing ISO 9001 Quality Management System (QMS) to your organization?

1.7.1 _____

1.7.2 _____

1.7.3 _____

1.7.4 _____

1.7.5 _____

1.8 Why were you interested in implementing ISO 9001 QMS in your organization?

In the table below, please choose and mark 'yes' if you agree with the statement, 'No' if you disagree and 'somewhat' if you are neutral about it.

S. No	Description of driving forces to implement ISO 9001 QMS	Yes	Somewhat	No
1.8.1	Dissatisfaction with the previous mode of operation and its results			
1.8.2	Customer requirements			
1.8.3	For marketing purposes and to enhance the reputation of your company			
1.8.4	There is strong competition and your company needs to be more competitive			
1.8.5	To compete with international construction companies where ISO certification is required to participate in a construction project			
1.8.6	To increase employee motivation and participation			
1.8.7	To ensure higher productivity			
1.8.8	To fulfill legal requirements			
1.8.9	Expecting that ISO 9001 QMS certification will be a requirement for tender internationally and locally in Ethiopia.			
1.8.10	Because GTZ IS trained you ISO 9001			
1.8.11	The university capacity building program (UCBP) and GTZ IS pushed you to get ISO 9001 certification			

1.8.12 Please specify if you have other reasons:

_____

_____

_____

Part 2: The actual Benefits Obtained by ISO 9001 Certified Construction Company

What are the actual benefits you acquired in your company after certification of ISO 9001?

For each of the statements below please choose and mark the response that reflects the situation in your company. If you did not benefit from ISO 9001 certification, please mention the reasons for why your company may not have benefited in those areas where you marked 'No'.

S. No	Description of benefits obtained by your company after ISO 9001 QMS certification	Yes achieved	Somewhat achieved	No (Not achieved)	Please mention the reasons why you did not benefit if your response is 'No'
2.1	Improved management confidence				
2.2	Improved awareness of company objectives by:				
	○ Top management				
	○ Middle management				
	○ Lower level management				
	○ Laborers				
2.3	Improved communication				
2.4	Responsibilities and authorities are adequately defined				
2.5	Improved identification of root causes of problems				
2.6	Improved utilization of resources				
2.7	Errors rectified at the earliest stage and not repeated				
2.8	Reduced error rates				
2.9	Increased productivity	If yes by how much % increased? ____%			
2.10	Increased profits and company growth	If yes by how much % increased? ____%			

2.11	Are able to satisfy your customers better than before certification				
2.12	Giving more focus to customers' requirements				
2.13	Better management control and reporting				
2.14	Able to continuously monitor and improve your objectives or performance				
2.15	Fewer defects in quality of construction				
2.16	Decreased rework	If yes by how much % decreased? ____%			
2.17	Decreased material waste	If yes by how much % decreased? ____%			
2.18	Greater employee awareness about quality				
2.19	Increased motivation and involvement of all employees				
2.20	You achieved Increased credibility or reputation				
2.21	Your tender winning increased	If yes by how much % increased? ____%			
2.22	Better management of risk				
2.23	Better accountability and contractual control				
2.24	Commitment for continued improvement				
2.25	Better record handling				
2.26	Better document handling				
2.27	Increased sense of ownership				

Please specify if there are others benefits obtained by your organization:

_____

_____

Part 3: Measuring the Outputs of ISO 9001 Certification

3. How do you measure the benefits and effectiveness of implementing ISO 9001QMS?

Please mark the Yes column front of all that apply and the No column in front of those that do not apply. 'Please also specify if there are other means of measuring' on the last column space provided.

S. No	Descriptions of Expected benefits of ISO 9001 certification	Means of measuring the benefits	Yes	No	Please specify if there are other means of measuring
3.1	Customer satisfaction	• Via suggestion box			
		• Willingness of your customer to allow you to participate in other tenders or awarding you other projects			
		• lost business analysis			
		• Via number of complaints			
		• survey via Questionnaire			
		• direct communication with customers			
3.2	Consistency in the quality of construction products (deliverables) in construction projects	• Keeping track of the number of defective or out of spec products used			
		• By counting the number of defective installations that require rework			
		• Keeping track of non-compliance with specifications and drawings			
3.3	Continual improvement of the organization's overall performance	• Tracking customer complaints			
		• Keeping track of repetitive errors			
		• Keeping track of the level of rework			
3.4	Better company reputation	• If there are no or reduced warranty claims			
		• Repeated business from the same clients			
		• Number of bids won			
3.5	Increased profit (How do you measure the increased profit	• By simply comparing the profit before certification and after without considering other factors			

	whether it is due to QMS implementation or through other opportunities)	• By increase in productivity, decrease in rework, waste reduction etc			
3.6	Reduced rework	• By valuing on monetary bases the amount of rework before certification and after			
3.7	Traceability of the source of quality problems	• By being able to trace the particular batch of material or component used			
		• By being able to identify the cause of poor workmanship			
3.8	Continual improvement of the effectiveness of the quality management system and its processes	• Via internal audit results that may identify areas for improvement			
		• Reviewing the effectiveness of preventive actions taken			
		• Reviewing the effectiveness of corrective actions taken			
		• Actions taken as a result of management review meetings			
		• Via external audit results			
3.9	Increased employees sensitivity to quality	• Keeping track of the number of suggestions for improvement that come from employees.			
3.10	Improved awareness of company objectives	• Internal audit			
		• Keeping track of the level of planned objectives met			
		• External audit result			

The end

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

Appendix-B: Guide for Interview

Ensuring validity and reliability of the data obtained in survey is critical as most of the time compared with other data gathering methods such as interview and case study approaches; generally surveys are prone to bias and misunderstanding and thus overall validity is doubtful. Therefore, checking by interviewing based on the same questionnaire to let support respondent's responses by example will be mandatory.

In addition, in this particular research the interview also helped to get additional information which was not covered in questionnaire. The base ideas used to get additional information are as below.

1. Is the ISO 9001certificate of the certified construction company still maintained and audited by external auditor or expired?
2. Driving force to implement QMS:
   Is there any legal requirement that forced you to implement QMS? If yes please give an example:_____
3. Challenges during QMS implementation:
   - Do you have well trained your own internal auditors?
   - Do the challenges you faced during implementation of QMS solved after implementation or remained to be still challenges?
4. Actual benefits acquired:
   Can you please mention examples of what you achieved by having the QMS?
5. To what extent do you believe that your implemented QMS met your expected benefits?
   a) > 90% b) 75-89% c) 65-74% d) 50-64% e) < 50%