Addis Ababa University

Addis Ababa Institute of Technology

School of Mechanical and Industrial Engineering

Developments of Quality Management System (QMS) for Steel Industries

(Quality Improvement: A Case Study of Walia Steel Industry)

A Thesis Submitted to the School of Graduate Studies of Addis Ababa Institute of Technology, Addis Ababa University in partial fulfillment for the Degree of Master of Science in Industrial Engineering

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Declaration

I hereby declare that the work which is being presented in this thesis entitled "Developing Quality Management System Framework for Walia Steel Industry" is original work of my own, has not been presented for a degree of any other university and all the resource of materials used for this thesis have been dully acknowledged.

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

____________________ _________________

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Abstract

Quality management system framework is a synchronized set of quality management system principles and quality tools and techniques which implemented by an organization to meet the standards demanded by customers and stakeholders. The research aims is developing a quality management system (QMS) framework for Walia Steel Industry by addressing the barriers and lack of integration of quality tools and techniques with the company process approach and management. Methodologically, the study employed a literature review and a case study-based questionnaire involving 38 respondents, including quality managers, top managements, department managers, and supervisors. The findings of the study identified eight critical success factors and seven barriers in the practice of quality management system at Walia Steel Industry. The study emphasizes that sustaining the practice of QMS requires integrating quality tools and techniques with the company's process approach and management. By doing so, it is believed that the quality of products and services provided by Walia Steel Industry can be improved. The research also suggests that the developed QMS framework can be applicable to other manufacturing industries that practice quality management systems. The uniqueness of this study lies in its focus on the integration of quality tools and techniques with the company's process approach and management, specifically within the context of Walia Steel Industry. In conclusion, the study proposes that integrating quality tools and techniques with the company's process approach and management is a potent QMS framework for sustaining the practice of quality management system. By adopting this framework, Walia Steel Industry and similar manufacturing industries can enhance their product and service quality.

Keywords: QMS developments, ISO 9001:2015, Barriers and Success factors of QMS, Steel industries, Walia Steel industry

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Acronyms and Abbreviations

QMS: Quality Management System

QTT: Quality Tools and Techniques

TQM: Total Quality Management

PDCA: plan-Do-Check-Act

QA: Quality Assurance

QC: Quality Control

SPC: Statistical Process Control

CI: Continuous improvement

SPSS: Statistical Package for Social Science

EFQM: European Foundation of Quality Managements

WSI: Walia Steel Industry

Six sigma (DMAIC): Define, Measure, Analyze, Improve and Control.

(BPM): Business Process Management

VSM: Values stream mapping

5-S Method: Sort, Set in order, Shine, Standardize, and Sustain

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background of the Study

Quality management system framework is a coordinated and structured set of quality management system principles, processes , procedure and values that implemented by an organization to meet the standards demanded by customers and stakeholders (Gremyr et al. 2021; Mourougan and Sethuraman 2017). QMS framework is a synchronized set of QMS principles with a quality tools and techniques, which implemented by an organization to improve the quality of process, products and service in order to fulfill the customer satisfaction (Berhe, Gebremichael, and Beyene 2023; Prashar 2022).

The importance of QMS framework is to insure quality management system process flow through planning, controlling, monitoring and continuous improvement (Bashan and Notea 2018; Garza-Reyes, Rocha-Lona, and Kumar 2015; Gremyr et al. 2021; Mourougan and Sethuraman 2017; Al Qubaisi et al. 2016). The companies which implementing integrated quality tools and techniques with company’s process approach and management get more importance to specific success and better performance of quality improvement (Bacoup and Michel 2018; Ismyrlis 2017; Wang 2023).

There are different models of quality management system which are widely used by many companies worldwide: Ethiopian Quality Excellency Model, Malcolm Baldrige National Quality Award (MBNQA) Model, European Foundation for Quality Management (EFQM) Model, Oakland TQM Model, Australian Quality Award, Deming Prize Model (Cook and Zhang 2019; Gupta and Vrat 2020; Safari et al. 2020).

However, the practices of these models in Ethiopia manufacturing industries, which have been certified ISO 9001 has significant and positive effect only on process management, suppliers’ quality management, and continuous improvements (Kebede Adem and Virdi 2021). In addition, the prior study encouraged that Ethiopia manufacturing industries should be utilize reliable and valid framework of quality management system in order to improve their quality of products and services (Kebede Adem and Virdi 2021; Mustapha, Ashfaq, and Qureshi 2019).

The purpose of this research is to developing QMS framework for Walia Steel Industry in order to sustain the practices of quality management system through integration of quality tools and techniques with the company's process approach and management.

1.2 Statements of the problem

Walia Steel Industry is one of a manufacturing company that have been certified ISO 9001:2015, but their quality improvement need integration of quality tools and technique with quality management system. Because still there are, a customer's complain due to a problem with quality of products and services. Among the problem in the case company, the defects of products are one the main problem of the organization. The annual defect rate of products in Walia Steel Industry is **1.07%,** which means **213,229.83kg** (Source: Quality Control and safety service department of Walia Steel Industry).

The case company loss (**34,116,773.17 birr)** due to the defects of products, this defect of products' and poor service provision is the main customers complain that has a negative impact on an organizational business more than the loss in term of money.

Over consumption of spare parts and high maintenance cost due to unplanned maintenance of machinery costs per annual **7,542,874** birr whereas the annual production performance is **19.73%,** which implies under capacity utilization (Source: Production and Techniques Departments of Walia Steel Industry).

There is also a poor inventory management mechanism in the case company especially semi-process material handling and controlling, finished product handling and controlling; In general, to sustain the practice of quality management system in Walia Steel Industry integration of quality tools and techniques with company's process approach and management is an essential issue.

1.3 Basic Research Questions

The research questions are developed as the following:

i. What are the critical barriers in practice of quality management system?
ii. What is the critical success factors required to sustain the practice of QMS?
iii. What is the appropriate QMS framework for Walia steel Industry?

1.4 Research Objective

1.4.1 General Objective of the research

The general objective of this research is developing quality management system that integrated with quality tools and techniques for Walia Steel Industry in order to sustain the practice of quality improvement.

1.4.2 Specific Objective

Specifically, objectives of this research were as follows:

i. To investigate the critical barriers in practice of quality management system
ii. To identify the critical success factors required in practice of quality management system
iii. To develop appropriate quality management system framework for Walia Steel Industry

1.5 Scope of the study

This study has intended to focus on developing appropriate QMS framework for Walia Steel Industry in order to sustain the practice of quality management system. The principles of quality management system are applied to assess the extent to which the quality management system practices in the case company. All departments of Walia Steel Industry are included in this research except finance department. Because, the finance department of Walia Steel Industry is not included in the implementation of quality management system

1.6 Significance of the study

The study emphasizes that sustaining the practice of QMS through integrating quality tools and techniques with the company's process approach and management. By doing so, it is believed that the quality of products and services provided by Walia Steel Industry can be improved. The research also suggests that the developed QMS framework can be applicable to other manufacturing industries that practice quality management systems. The uniqueness of this study lies in its focus on the integration of quality tools and techniques with the company's process approach and management, specifically within the context of Walia Steel Industry. Over all the study proposes that integrating quality tools and techniques with the company's process approach and management is a potent QMS framework for sustaining the practice of quality management system. By adopting this framework, Walia Steel Industry and similar manufacturing industries can enhance their quality of product and service. Also other scholars use as the reference for future study.

1.7 Research Limitation

While conducting this research there are a numbers of challenges with data collection due to the case company managements and supervisors are busy with operational activities of the organization, additional there is also some challenges to validate quality management system framework due to the expert of ISOQAR are busy with consulting and auditing of quality management system.

1.8 Organization of the study

This study organized/structured by including five chapters. Chapter one include background of the study, statement of the problem, research question, objective of the research, research scope, significance of the study, limitation of the study, definition of terms. The second chapter focused on review of related literature, this chapter includes theoretical and empirical literature related to models of quality management system; In addition, this chapter deals with QMS principles and quality tools and techniques. Chapter three deal with research methodology, this chapter include research design, target population and sample size, source of data, data collection procedure, method of data analysis, validity and reliability test, research ethics. Chapter four focused on discussion of the result and research finding. In the last chapter (chapter five), this chapter summarized the research finding, conclusion and recommendation including future research area.

CHAPTER TWO

2. REVIEW OF RELATED LITERATURE

2.0 Introduction

This chapter presents definition of the key terms, recent literature from journal articles of QMS models and factors affect practice of quality management system in the area of manufacturing sectors. The theoretical and practical findings of various studies related to quality management system used as secondary sources such as published journal, articles, and related literature to achieve the research objectives.

2.1 Theoretical Literature Review

2.2.1 Concept of quality

Quality is an important competitive advantage for companies and organizations in the global market whereas quality models and practices have evolved over time, from inspection to control, to quality assurance, to quality management system (Georgiev and Ohtaki 2016; Zonnenshain and Kenett 2020).

2.2.2 Quality Management System Models

A quality management system (QMS) framework provides a structured approach for organizations to establish, implement, maintain, and continuously improve their quality management practices. It serves as a guideline or blueprint for managing and ensuring consistent of quality across all aspects of an organization's operations (Hellingsworth, Hall, and Anderson 2020; Landerville 2015). Quality management system (QMS) framework is a coordinated and structured set of quality management system principles and quality tools and techniques that implemented by an organization to meet the standards demanded by customers and stakeholders (Gremyr et al. 2021; Mourougan and Sethuraman 2017). While quality management system is a set of policies, processes, procedures, and resources that are implemented by an organization aligning to their business strategy to ensure that products or services consistently meet customer requirements and regulatory standards (Garza-Reyes, Rocha-Lona, and Kumar 2015; Gremyr et al. 2021; Hellingsworth, Hall, and Anderson 2020; Landerville 2015).

2.2.3 Ethiopia Quality Excellence Model

The worldwide market is growing increasingly competitive. Model of quality management system is becoming more crucial in order to boost customer's satisfaction and, consequently, gain the market over the long haul however, the quality of their goods and services are a difficulty for emerging economies like Ethiopia. The practice of quality management system in Ethiopia's manufacturing industries and service sectors examined using the self-assessment approach for the Ethiopian Quality Award (Birhanu and Daniel 2014). The Ethiopia manufacturing industries encouraged to utilize reliable and valid framework of quality management system to sustain practice quality management system in order to improve their quality of products and services (Kebede Adem and Virdi 2021). The enablers factors are leadership, policy and strategy, resource management and process management whereas customers satisfaction, business performance, and impact on society were the primary factors that the Ethiopia quality award (EQA) model utilized to evaluate different sectors (Birhanu and Daniel 2014; Kebede Adem and Virdi 2021; Landerville 2015) as shown in the following figure.

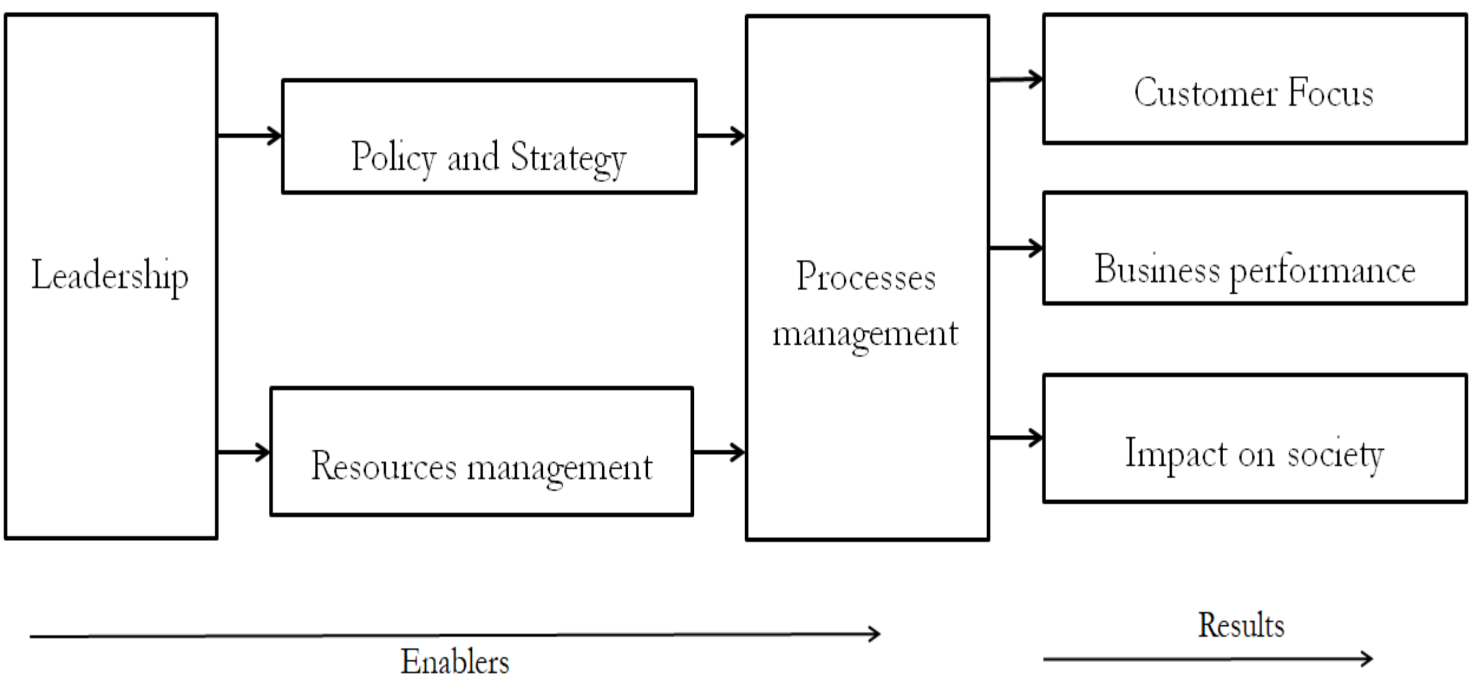

Figure 2:1 Ethiopia Quality Award (EQA) Assessment Model

2.2.4 European Quality Model

The European Foundation of Quality Managements (EFQM) Global model seeks to honour exceptional businesses throughout the world, whether they are for profit or nonprofit. These businesses exhibit an undeniable record of accomplishment of success in putting strategy into practice and continuously raising their performance standards. The EFQM model is a management framework that places a strong emphasis on quality. It aids organizations in determining where they stand on the "path to excellence" or what has to be done to improve (Safari et al. 2020; Şanliöz-Özgen 2016) as indicated in the following figure.

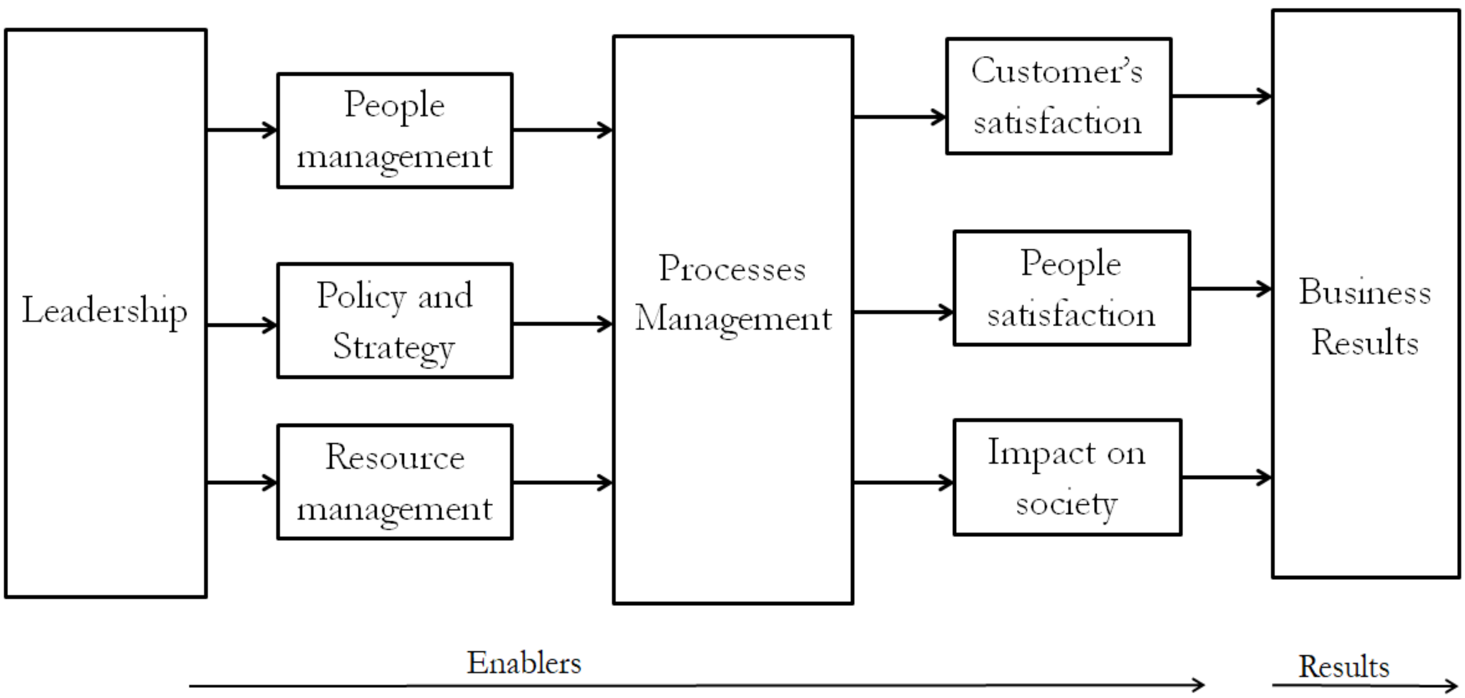

Figure 2:2 European Quality Award

2.2.5 Integrated Quality Framework

An integrated quality framework with quality tools and techniques are used to ensure consistent and effective quality management throughout an organization. Integrating these tools and techniques within a quality framework ensures a comprehensive approach to quality management by addressing various aspects of process improvement, risk mitigation, and customer satisfaction (Berhe, Gebremichael, and Beyene 2023; Prashar 2022) as shown in the following figure.

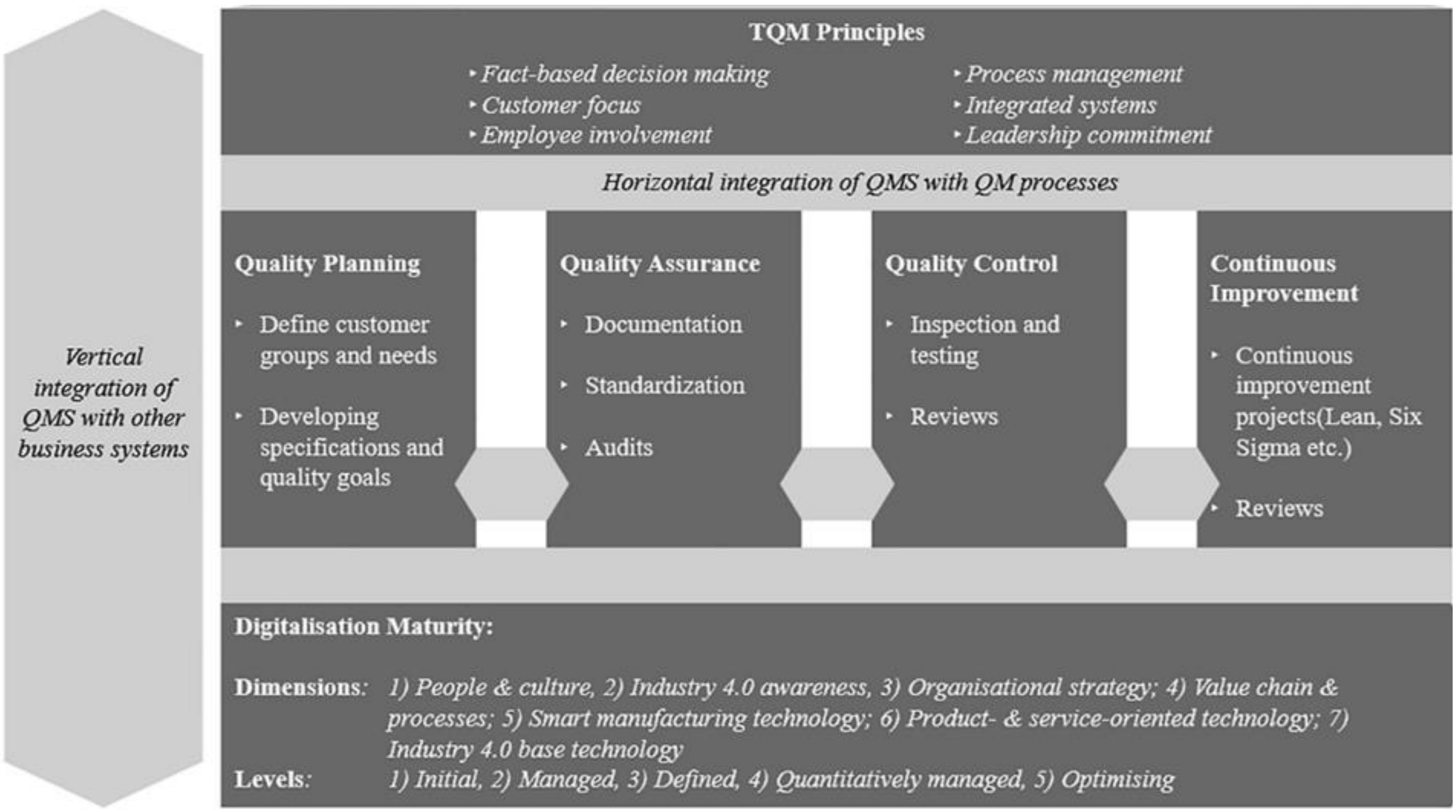

Figure 2:3 integrated quality framework

2.3 Empirical Literature Review

Critical success factors of quality management system: Different studies identified the success factors of quality management system, these success factors are: leadership, customer focus, employee involvement, process approach and management, systematic and strategic integration, resource management, communication, suppliers relationship, factual based decision and improvement (Almeida 2018; Hietschold, Reinhardt, and Gurtner 2014; Mehrabioun Mohammadi, Jalali, and Hasani 2022). The term "quality management principles" refers to a body of basic ideals, beliefs, and values that serve as the cornerstone of quality management. To help a company improve its performance, the quality management principles can serve as a foundation. They were created and revised by foreign specialists of ISO/TC 176, which is in charge of creating and upholding the ISO quality management standard (Georgiev and Ohtaki 2016; Gremyr et al. 2021; Hellingsworth, Hall, and Anderson 2020; Landerville 2015; Sanchez-Lizarraga et al. 2020)

2.3.1 Customer focus

Customers’ requirements are used as the basis for quality, whereas frequency close contact with customers, customers’ feedback on quality and delivery performance, customers complain handling, and relationship of employees with company customers are the main criterial of customer focus (ElMelegy, Alnajem, and Albuloushi 2022; Sanchez-Lizarraga et al. 2020). To satisfy customers and drive beyond their standards a quality management system is crucial tools. A business succeeds in the end when it earns and keeps the trust of its customers and other stakeholders. Every aspect of a customer interaction presents an opportunity to add value, and success relies on understanding both the needs of the present and those of the future. Increased customer value, improved customer satisfaction, improved customer loyalty, increased repeat business, improved company image, exhausted customer base, enlarged revenue, and enhanced market share are some advantages (Hellingsworth, Hall, and Anderson 2020; Mourougan and Sethuraman 2017; Provided, No, and Licensee 2013).

2.3.2 Leadership

The creation of conditions that encourage employee engagement in achieving the organization's quality objectives by leaders at all levels establishes unity of purpose and direction. The alignment of an organization's strategies, policies, processes, and resources to meet its goals made possible by the engagement of its workforce (Hellingsworth, Hall, and Anderson 2020; Mourougan and Sethuraman 2017; Provided, No, and Licensee 2013; Sanchez-Lizarraga et al. 2020). Leadership directs and assumes responsibility for quality programs, top management provides leadership for quality improvement initiatives, department in the organization participate in quality improvement programs, quality issues are reviewed in the organization meeting, employees are empowered and motivated to make their own decisions (ElMelegy, Alnajem, and Albuloushi 2022; Landerville 2015).

2.3.3 Engagement of employees

Engagement of employees include training given in the total quality concept in the organization, training is given in the basic statistical techniques in the organization, open communication environment and give feedback to employees on their performance, quality circles responsible for identifying and solving quality problems, employees are recognized for superior quality improvement (ElMelegy, Alnajem, and Albuloushi 2022; Landerville 2015). The standard of the organization's goods and services is everyone's duty. Sales, processes, and efficiency cannot improve without every employee giving their all. To be involved, however, workers must feel empowered to make their own choices, which depend on management fostering the ideal work environment. Employees must comprehend the objectives and vision that have communicated. To be dedicated to meeting deadlines, they must receive adequate training and the necessary tools to finish duties. To empower employees, there should be training, excellence team, measurement and recognition, Suggestion scheme (Hellingsworth, Hall, and Anderson 2020; Mourougan and Sethuraman 2017; Provided, No, and Licensee 2013; Sanchez-Lizarraga et al. 2020)

2.3.4 Process approach

An organization can organize its processes and the interactions between them using the process method. Utilizing the PDCA cycle, a company can make sure that processes managed and resourced effectively. The process approach involves the systematic definition and management of processes, and their interactions, to achieve the intended results in accordance with the quality policy and strategic direction of the organization (ElMelegy, Alnajem, and Albuloushi 2022; Landerville 2015). Management of the processes and the system as a whole can achieved using the PDCA cycle with an overall focus on risk-based thinking aimed at taking advantage of opportunities and preventing undesirable results. Plan-Do-Check-Act cycle: The PDCA cycle can apply to all processes and to the quality management system as a whole. Representation of the structure of this international standard in the PDCA cycle (Hellingsworth, Hall, and Anderson 2020; Mourougan and Sethuraman 2017; Provided, No, and Licensee 2013; Sanchez-Lizarraga et al. 2020)

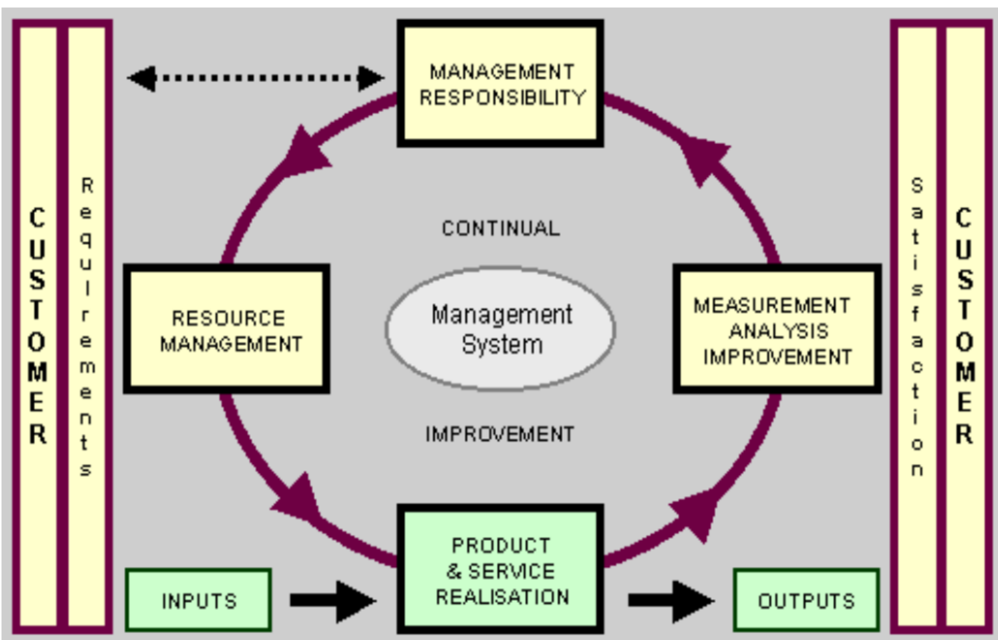

Figure 2:4 Process approach and Management

2.3.5 Strategic and system approach

Organizations should have an integrated system for total quality management, either a bespoke system or one based on a quality standard such as ISO 9001. This system should be understood and apply across all functions and departments. The effectiveness and efficiency of the organization are increased by identifying, comprehending, and managing a system of interconnected processes for a specific objective (Mourougan and Sethuraman 2017; Sanchez-Lizarraga et al. 2020). Applying the system approach to management involves several key steps, including defining the system, structuring it to achieve the goal in the most effective way, comprehending the relationships between processes, continuously improving the system through measurement and evaluation, and anticipating resource needs and setting resource constraints. (ElMelegy, Alnajem, and Albuloushi 2022; Hellingsworth, Hall, and Anderson 2020; Landerville 2015; Provided, No, and Licensee 2013)

2.3.6 Continuous improvement

The company shall determine and pick out opportunities for improvement and put in force any essential moves to satisfy patron necessities and beautify customer pleasure. those shall consist of improving services and products to satisfy necessities as well as to cope with future needs and expectations; correcting, stopping or decreasing undesired effects; improving the overall performance and effectiveness of the high-quality control system. Examples of development can include correction, corrective movement, continual improvement, breakthrough trade, innovation and re-organization. Successful organizations have an ongoing consciousness on development. (Mourougan and Sethuraman 2017; Provided, No, and Licensee 2013; Sanchez-Lizarraga et al. 2020). Successful organizations have an ongoing consciousness on development. Reacting to modifications in the internal and external surroundings is important if the enterprise need to preserve to supply fee for the customers that is of paramount importance nowadays while conditions evolve so speedy (ElMelegy, Alnajem, and Albuloushi 2022; Hellingsworth, Hall, and Anderson 2020; Landerville 2015; Mourougan and Sethuraman 2017; Provided, No, and Licensee 2013; Sanchez-Lizarraga et al. 2020)

2.3.7 Factual approach to decision making

The Factual approach to decision-making principle states that effective decisions based on the analysis of data and information, rather than the uncertainty (ElMelegy, Alnajem, and Albuloushi 2022; Provided, No, and Licensee 2013; Sanchez-Lizarraga et al. 2020). Data collection and analysis, greater understanding of the market and its consumers, and only the facts that are currently available can used to evaluate business success. Decisions should base on analysis and evaluation of data to achieve desired (Hellingsworth, Hall, and Anderson 2020; Landerville 2015; Mourougan and Sethuraman 2017).

2.3.8 Mutually beneficially supplier relationship

Value creation requires a connection of mutual benefit between a company and its vendors. This entails identifying and choosing key suppliers, developing supplier relationships that balance short-term gains with long-term considerations, fostering clear and open communications, co-developing and improving products and procedures, developing a clear understanding of customers' needs, and praising supplier advancements and successes. Businesses and organizations today do not operate in isolation (Landerville 2015; Sanchez-Lizarraga et al. 2020). The key to long-term success is identifying the crucial connections with stakeholders, such as vendors, and developing a strategy to handle them (ElMelegy, Alnajem, and Albuloushi 2022; Hellingsworth, Hall, and Anderson 2020)

2.4 Barriers of quality management system

Prior studies identified many barriers factors that hinder the practice of quality management system. This barriers includes lack of employee training, lack of competent management, organizational resistance to change, insufficient infrastructure, resource limitations, in-adequate knowledge base, lack of government support, lack of financial resources, deficient supplier management, lack of management review, lack of mentor-ship, lack of commitment, imbalanced knowledge-experience, unclear authorization, and lack of freedom of action.(Beraki 2022; Mehrabioun Mohammadi, Jalali, and Hasani 2022; Yamada et al. 2013)

2.5 Quality Tools and Techniques

Quality tools and techniques integrate with QMS principles to support decision-making and process optimization. These quality tools and techniques includes: Six Sigma, SERVQUAL model, Kano model, Cause-and-Effect Diagram, Quality policy deployment (QPD), Seven QC: Checklists, Cause and Effect Diagrams, Pareto Diagrams, Stratification, Scatter Diagrams, Histograms, and Control Charts, Failure mode and effect analysis (FMEA), Total productive maintenance, PDCA (Deming Cycle), 8D Method, 5-S Method, Six sigma (DMAIC), Business Process Management (BPM), VSM (values stream mapping) and DOE (design of experiments) (Antony and Sony 2020; Castello, De Castro, and Marimon 2020; Desai and Prajapati 2017; Gaikwad and Sunnapwar 2021; Hammad et al. 2017; Patel and Desai 2018; Pathiratne, Khatibi, and Md Johar 2018)

Quality tools and techniques grouped into three levels:

First level of quality tools and techniques used for consulting and acting proactively the existing process are include internal and external audits, management review, teamwork, customer satisfaction surveys, suggestion system (mailbox suggestions), Employee satisfaction surveys, standard operation procedure, document and data record (Castello, De Castro, and Marimon 2020; Martins et al. 2021). **Second level of quality tools and techniques** are used for analyzing and controlling such as Flowchart diagrams, Cost of poor quality, Individual data collection template, Pareto Chart, Brainstorming, 5 Whys and 2 How's, Cause–effect diagrams , Histograms, Poka Yoke tools, FMEA (failure mode and effect analysis) , SPC (Statistical process control), Benchmarking, QFD (quality function deployment), Kano Model, SERVQUAL model (Castello, De Castro, and Marimon 2020; Martins et al. 2021). **Third level of quality tools and techniques** used for improving and problem solving such as Six sigma (DMAIC), Business Process Management (BPM–BPR), VSM (values stream mapping), DOE (design of experiments) 8 D Method, 5-S (Method) (Castello, De Castro, and Marimon 2020; Martins et al. 2021).

2.6 Consolidated result from the literature review and the literature gap

The following framework of QMS developed from combined result of literature review and the literature gap to sustain the practices of quality management system in order to improve the quality of product and services.

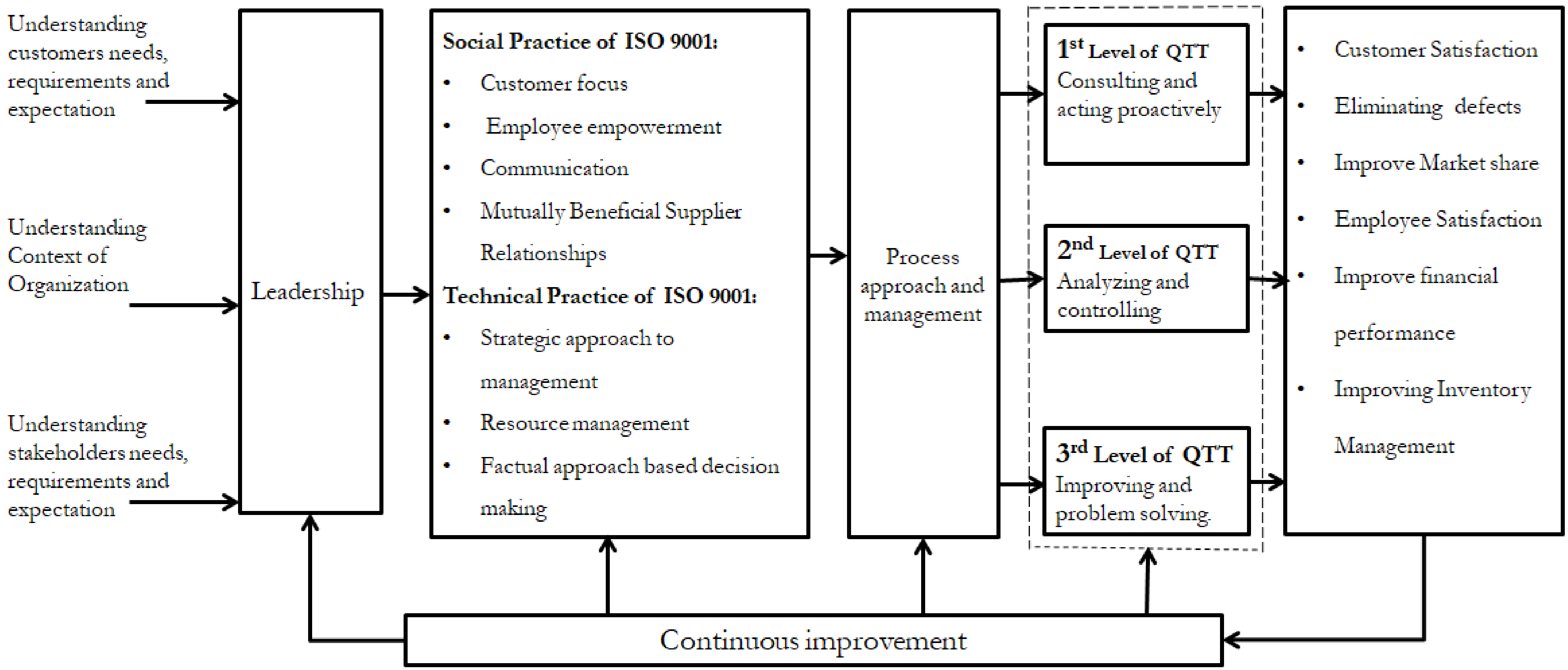

Figure 2:5 Quality Management System Frameworks

The literature review and practical gaps are identified and stated as the following.

Ethiopia Quality Excellency Assessment Model stated that a leadership assimilates resource management; policy and strategy to bring a company's process approach and management as result of customer's satisfaction, business performance, and influence society (Birhanu and Daniel 2014; Kebede Adem and Virdi 2021).

However, sustainability of QMS practice requires integration of quality tools and techniques with a company's process approach and management (Castello, De Castro, and Marimon 2020; Gaikwad and Sunnapwar 2021; Hammad et al. 2017). On the other hand, the existing of quality management system framework in Walia Steel Industry are not dedicated on sustainability of QMS practice through integration of quality tools and techniques with a company's process approach and management (source: Walia Quality Manual).

The review of literature concluded that the appropriate integration of quality tools and techniques with a company's process approach and management is a powerful QMS framework to sustain the practice of quality improvement.

CHAPTER THREE

3 RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

The numerous methods employed to carry out the research are presented in this section. To guarantee the achievement of the study's predetermined objectives, a specific, linked research design is identified. The study areas are explained, along with the research design and methodology, target population, sampling technique, and processes. Data collecting procedure and source of data are covered. Statistical techniques are used in the analysis of both quantitative and qualitative data. When gathering various sorts of information on the topics being investigated, ethics are also taken into account.

3.2 Description of the study area

The set of this study enclosed to the factors that sustain quality management system practice in Ethiopian manufacturing in the case of Walia Steel industry at Alemgena city. To improve quality product and service a case company implemented QMS but there are challenges to achieve the benefit of quality management due to different barriers and factors. Among these challenges, quality management system elements are not integrated with quality tools and techniques.

3.3 Research design

This research is designed mainly to address the research questions that focused on the factors affect implementation of quality management. This study uses a miscellaneous – methods style that consists of quantitative and qualitative data. Quantitative data was used to analyze frequency, percentage, and correlation. The identification process was performed primarily through a comprehensive review of literature on factors affect implementation of quality management in manufacturing industries in Ethiopia a case of Wali Steel Industry. The literature review identified various factors (barriers and success factors of QMS) that influence the implementation of quality management.

The following research design shows how to develop QMS framework and collect primary and secondary data to validate the final framework.

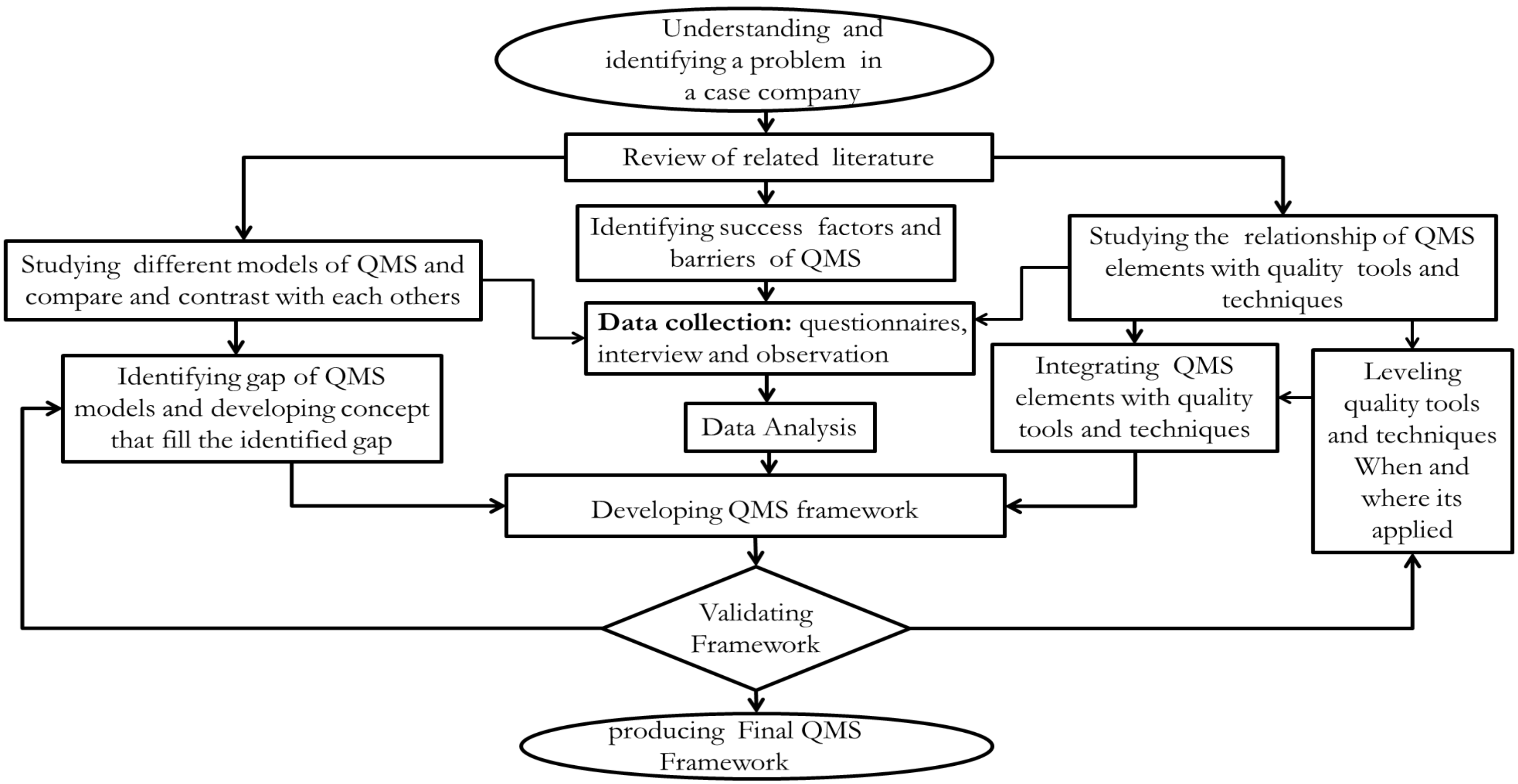

Figure 3:1 Research-Design

3.4 Target population and sample size

Directly or indirectly all workforces in the organization are involved in the practice of quality management system process to improve quality of products and service. The target population is the numbers of employees in Walia Steel Industry. In order to managing the study, among 250 organization employees optimum 38 respondents were taking from the large population (organization employee). The sample size were selected from various participants of each department mainly from production department , technique department, quality control department, human resource department, marketing and sales department, material management department and all top managements and internal auditors of the organization.

3.5 Sampling techniques

A purposive sampling technique is applied to select respondents for questionnaire and interview. This purposive sampling method is chosen due to it allow the researcher to concentrated on a restricted number of information which consists of different department experts to get the required information and carry out the study in order to get best understanding.

The respondents are selected based on their quality of educational background, experience, information and area of work they have on the practice of quality management system in their organization of Walia Steel Industry at Alemgena city. From production department 9 experts are selected, quality control department 3 experts are participants, from HR and marketing departments 5 and 6 experts are participants respectively, from technique department and material management 5 and 7 experts are involved, all top managements 13 are completely involved to response the questionnaires'.

3.6 Source of data

To achieve satisfactory and significant data, which used to response the research question and objective both qualitative and quantitative data were applied, primary, and secondary sources. The primary sources of data were employees and professionals at each departments of the organizational level of Walia Steel industry who selected for this study. The secondary data subjugated to conduct the study through document review and analysis of various sources that used as source of information such as relevant journals, articles books; organization's past and current written documents on the relevant issues were used. Moreover, available organizational documents such as structure, accessible quality documents including, internal and external audit, management review, each department annual report were reviewed.

3.7 Data collection tools

The most crucial methods of data collecting are questionnaires, interviews, and direct observations. In order to obtain the majority of the data for this study, semi-structured interviews and both closed- and open-ended questionnaires were used. Additionally, literature reviews, journals, and magazines were used to gather secondary material that is pertinent to the study. To allow the respondent to express how much they agree or disagree with a certain statement in the questionnaire, a Likert Scale, which is a five-point scale was employed. The questionnaire was created and being modified in accordance with the goals of this study.

3.8 Procedures of data collection

The procedure of data collection follow, data collection tools that mentioned in the above. Depending on the established samples that discussed earlier, a questionaries' are produced and distributed to the selected each department of Walia Steel Industry. Before distribution of questionaries' the researcher appoint and visit with General Managers and explain the research issue and clear that the data is only and strictly used for research purposes. In addition, a cooperation letter issued from the university was provided to the case company. The exact location of the selected employee would be communicated face to face and based on this the deployed data collectors would be directly went to the employees of the selected participants and made them fill the questionnaires. Besides, their top and middle management would also make to interview by face to face. Then the collected data analysis and interpret would be done.

3.9 Data analysis Method

Data analysis were applied after collecting all required data both quantitative and qualitative data. The data collected from the respondents used to addressing the factors affect the practice of quality management system. These items were analyzed using SPSS version 2026 and the results were presented using tables and figures.

Data analysis also include interview, observation and review of document related to internal and external audit report, management review, corrective and preventive action and others document related to operational procedures and quality manual. The interview was conducted with quality managers and top managements, general manager, production managers and others departments managers are involved in interview with respect to challenges exist in their organization in the practice of quality management system.

The result of interview and observation conclude that there are lack of quality tools and technique integration with the company process approach and management to sustain the practice of quality management system and improve the quality of products and service.

3.10 Validity and reliability

3.10.1 Validity

The researcher checked the validity of the questionnaires developed for this study by commenting advisors and others professional experts on questionnaires'. The final vrsion was distributed after incorporating all the clarifications and feedbacks achieved from these professionals.

The validation of a Quality Management System framework that integrated with quality tools and techniques is typically involves assessing its effectiveness, compliance with relevant standards, and suitability for achieving organizational goals, consistency, comprehensiveness, flexibility, ease to implement and sustainability are all-important aspects (Berhe, Gebremichael, and Beyene 2023; Inglis 2008; Prashar 2022)

The case company general managers are involved in interview after data collection and analysis. The case company general manager, Production managers, and other experts involved in validation of QMS framework. In addition, from ISOQAR consulting and auditing company and others experts are involved in validation of this QMS framework. In general, both experts from a case company (Walia Steel Industry) and ISOQAR consulting and auditing company are believed that an integration of quality tools and techniques with the company's process approach and management is the main issue to sustain the practice of QMS.

Finally they argued that the group of quality tools and techniques (quality tools and techniques for consulting and acting proactive the existing process, quality tools and techniques for analyzing and controlling process, and quality tools and techniques for improving and problem solving) are used for further process, products, and service improvements.

3.10.2 Reliability

The questionnaire was organized to ask similar question in different sections. IBM SPSS vesrsion software was used for analyzing the data. Before feeding the collected data into SPSS, a visual checking of all the responses was made. The first visual check was to assess the eligibility of the respondents for the research, and the second was to examine the accuracy in responses. The internal consistency of responses to all items was checked using the Cronbach's coefficient alpha. The Cronbach's alpha measures the internal consistency of a group of items by measuring the homogeneity of the group of items. The Cronbach's alpha value for the test questionnaire was calculated for each factor, which indicates that there is a high internal consistency among the data.

Cronbach's alpha value adopted from (George & Mallery, 2003)

Cronbach's alpha	Internal consistency
$\alpha \geq 0.9$	Excellent
$0.9 > \alpha \geq 0.8$	Good
$0.8 > \alpha \geq 0.7$	Acceptable
$0.7 > \alpha \geq 0.6$	Questionable
$0.6 > \alpha \geq 0.5$	Poor
$0.5 > \alpha$	Unacceptable

Figure 3:2 Cronbach's alpha value

3.10.2.1 Reliability for success factors of QMS

The reliability tests for internal consistency of key success factors/principle of QMS were described her as the following:

Since the value of Cronbach's alpha are greater than 0.8 the reliability test for internal consistency considered as good internal consistency for each success factors (principle of QMS) leadership, process approach and management, customer focus, strategic & systematic approach management , employee involvements and empowerment, communication, continuous improvement, factual approach to decision making, resource management, and mutually beneficial supplier relationships,

3.10.2.2 Reliability of QMS barriers

The reliability test for internal consistency of QMS barriers were described her as the following:

The value of cronbach's alpha are greater than 0.7 which means the reliability test for internal consistency considered as acceptable internal consistency for resistance to change, lack of teamwork, lack of experts of QMS, bureaucratic management, poor and ineffective training. Whereas the value of cronbach's alpha are greater than 0.8, which means the reliability test for internal consistency considered as good internal consistency for poor understanding and insufficient knowledge of QMS, lack of delegation of authority and responsibility.

3.10.2.3 Reliability of QMS benefit

The reliability test for internal consistency of QMS benefit were described her as the following:

the value of cronbach's alpha are greater than 0.7 which means the reliability test for internal consistency considered as acceptable internal consistency for improving employee satisfaction, improving financial and performance of organization, decreasing the company's impact on the environment. Whereas the value of cronbach's alpha are greater than 0.8, which means the reliability test for internal consistency considered as good internal consistency for eliminating waste and defects, improving customer satisfaction.

3.10.3 Research ethics

The research ethics starting with cooperation letter which written from Addis Ababa Institute of Technology to show the legitimacy of the study. The study was voluntary and participants were asked for their willingness before receiving the questionnaire. They were assured that their responses would only be used for the purpose of the study. The data collection was conducted after consent from the general managers of company. This data was not used for other purpose rather than to achieve the research questions and objectives. An attempt was made to explain the objectives and significance of the study to the respondents, and their privacy, identity and confidentiality was maintained by assigning code numbers instead of their names.

CHAPTER FOUR

4 DATA PRESENTATION, ANALAYSIS AND DISCUSSION

4.1 Introduction

This chapter represented and discussed the results of the data gathered and analyzed. In addition, the result of interview and observation in the case company are interpreted and discussed in this section.

4.2 General Information of the Respondents

The general information of the respondents are described here as the following.

The total numbers of respondents are 38 whereas 71.05% male and 28.95% female, their educational background master degree, bachelor degree, and diploma are 7.89%, 73.68% and 18.42% respectively for more information refer Appendix A. Positions in their company are top management, middle management, junior management and quality managers.

4.3 Critical success factors of QMS.

The practice QMS elements in the case company are discussed as the following and for detail information refer Appendix B.

Leadership - The practice of leadership that exist in Walia Steel Industry is lack of top management commitment to continuous improvement of creativity and innovation which responded by participants though assessment of five Likert scale are; strongly disagree 21.27%, disagree 22.27%, neutral 32.46%, agree 15.57% and strongly agree 8.11%.

Process approach and management: the practice of process approach and management that exist in the case company strongly disagree 21.71%, disagree 21.49%, neutral 34.43%, agree 15.13% and strongly agree 7.24%.

Customers focus the practice of customer focus that exist in the case company; strongly disagree 22.20%, disagree 22.93%, neutral 21.80%, agree 35.71 % and strongly agree 12.03%.

Strategic & Systematic Approach Management: the practice of strategic & systematic approach management that exist in the case company; strongly disagree 18.86%, disagree 25%, neutral 32.02%, agree 15.35 % and strongly agree 8.77%.

Employee Involvements and Empowerment: the practice of employee involvements and empowerment that exist in the case company; strongly disagree 19.74%, disagree 21.38%, neutral 30.59%, agree 17.11 % and strongly agree 11.18%.

Communication: the practice of communication in the case company that was responded by respondents are strongly disagree 5.64%, disagree 7.14%, neutral 38.35%, agree 25.19 % and strongly agree 23.68%.

Continuous Improvement: the practice of continuous improvement in the case company that was responded by respondents are strongly disagree 22.37%, disagree 20.61%, neutral 29.82%, agree 19.74 % and strongly agree 7.46%.

Factual Approach to Decision Making: the practice of factual approach to decision making in the case company that was responded by respondents are strongly disagree 23.39%, disagree 22.51%, neutral 33.33%, agree 12.87 % and strongly agree 7.89%.

Resource Management: the practice of resource management in the case company that was responded by respondents are strongly disagree 21.05%, disagree 23.16%, neutral 30.53%, agree 19.21 % and strongly agree 6.05%.

Mutually Beneficial Supplier Relationships: the practice of mutually beneficial supplier relationships that exist in the case company; strongly disagree 22.56%, disagree 21.05%, neutral 34.59%, agree 12.78 % and strongly agree 9.02%.

4.4 Critical barriers of QMS

The data analysis with respect to QMS barriers in the case company are explained as the following and for Appendix C detail information.

Poor Understanding and Insufficient Knowledge of QMS: the challenges of poor understanding and insufficient knowledge of QMS that exist in Walia Steel Industry, which responded by participants though assessment of five Likert scale, are; strongly disagree 11.05%, disagree 12.11%, neutral 30.53%, agree 23.16% and strongly agree 23.16%.

Resistance to Change: the challenges of resistance to change of QMS that exist in the case company were responded by participants are strongly disagree 6.58%, disagree 15.79% neutral 28.29%, agree 26.32% and strongly agree 23.03%.

Lack of Delegation of Authority and Responsibility: the challenges of lack of delegation of authority and responsibility that exist in the case company strongly disagree 6.58%, disagree 15.79%, neutral 28.29%, agree 26.32% and strongly agree 23.03%.

Lack of Teamwork: the problem of lack of teamwork exist in the case company was responded by participants strongly disagree 8.55%, disagree 13.82%, neutral 31.58%, agree 20.39% and strongly agree 25.66% of the respondents.

Lack of QMS Experts: the challenges of lack of QMS experts that exist in the case company strongly disagree 10.53%, disagree 17.11%, neutral 26.97%, agree 24.34% and strongly agree 21.05%.

Bureaucratic Management: the challenges of bureaucratic management that exist in the case company were; strongly disagree 8.55%, disagree 18.42%, neutral 28.29%, agree 18.42% and strongly agree 26.32%.

Poor and Ineffective Training: the challenges of poor and ineffective training that exist in the case company were; strongly disagree 8.42%, disagree 14.74%, neutral 30.53%, agree 21.05% and strongly agree 25.26%.

4.5 Benefit of QMS

Even if the practice of quality management system in the case company is at low level, the current result of QMS benefits at Walia Steel Industry are described as the following. For detail information refer Appendix D.

Improving Customer Satisfaction: the practice of improving customer satisfaction that exist in Walia Steel Industry which responded by participants though assessment of five Likert scale are; strongly disagree 19.74%, disagree 20.18%, neutral 26.32%, agree 24.56 % and strongly agree 9.21%.

Improving Employee Satisfaction: the practice of improving employee satisfaction in the case company of the respondents are strongly disagree 20.53%, disagree 19.47%, neutral 29.47%, agree 21.05 % and strongly agree 9.47%.

Eliminating waste and defects: the practice of eliminating waste and defects in the case company of the respondents are strongly disagree 21.05%, disagree 23.25%, neutral 27.19%, agree 19.30 % and strongly agree 9.21%.

Improving Financial and Performance of Organization: The practice, improving financial, and performance of organization in the case company strongly disagree 22.37%, disagree 24.56%, neutral 26.75%, agree 17.54 % and strongly agree 8.77% of the respondent.

4.6 Applying of QMS framework

There are different stages in applying this QMS framework as discussed in the following. This stage includes Quality requirement, Quality planning, Quality assurance, Quality measurement, Quality improvement and sustainability.

4.6.1 Quality Requirements

This phase includes understanding of customer's needs, requirements and expectation; understanding stakeholder's needs, requirements and expectation; understanding context of the organization.

Understanding customer's needs requirements and expectation: determining the requirements specified by the customer, including the requirements for delivery activities through past history, experience and/or customer needs; determining the requirements not stated by the customer but necessary for specified use or known and intended use through past history, experience and/or customer needs; understanding current and future customer needs and expectations; translating the identified needs and expectations into requirements; identifying marketing opportunities, weaknesses, future growth, and advantages

Understanding the organization and its context: the external and internal issues of the organization are determined, opportunities available are identified and the potential risks that could be encountered have been evaluated in view of severity and probability of threats.

Understanding Stakeholders and interest parties' needs, requirements and expectation: the needs and expectations of interested parties that directly or indirectly affect the organization's ability to consistently provide its products /services that meet customer and applicable statutory and regulatory requirements.

4.6.2 Quality Planning

The top management of the case company should be committed to ensure that the established and sustainability of QMS practice to meet customers and other stakeholders or interested parties as well as relevant regulatory /statutory requirements. Leadership ensured the integration of quality management system requirements and principles customer focus, employee empowerment, communication, mutually beneficial supplier relationships, strategic approach to management, resource management, factual approach based decision making into the organization's business processes. In order to determine whether planned objectives have been achieved, the top management shall define methods of measurement with the context and strategic direction of the of the business through quality policy, quality objective, action plan to active quality objective, standard operation procedure, internal audit procedure, customer satisfaction procedure,

4.6.3 Quality Assurance

Quality management system is established, documented, implemented, and effectiveness of process approach and management take place. The processes needed for the quality management system and their application throughout the organization are identified and the sequence and interaction of these processes are determined. Criterion and methods needed are determined to ensure that both the operation and control of these processes are effective. The availability of resources and information necessary to support the operation and monitoring of these processes are ensured. Quality tools and techniques support the operation of this process through internal and external audit, management review, and customer's survey.

4.6.4 Quality Measurements

Performance measurements demonstrate the ability of the processes to achieve planned results and practice of quality management system. Corrective actions are taken as appropriate, when planned results are not achieved, to ensure conformity of the products. Measurement may include any of the following, but not limited: Improvement of market share and customer satisfaction, Reducing and eliminating of defects, Improvements of employee satisfaction, Improvements of financial performance, Improvements of inventory management, Yield of production (comparing raw material versus finished product), Effectiveness and efficiency of personnel (through performance appraisal and other means), Technology, usage and knowledge, Conscious efforts of waste and cost reduction, Monitoring and measurement methods as scheduled with records documented and monitored

4.6.5 Quality improvement

In the practice of QMS, an Organization shall determine and select opportunities for improvement and implement any necessary actions to meet customer requirements and enhance customer satisfaction. These shall include: Improving products and services to meet requirements as well as to address future needs and expectations; Correcting, preventing or reducing undesired effects; Improving the performance and effectiveness of the quality management system, Examples of improvement can include correction, corrective action, continual improvement, expansion and breakthrough change, and re-organization.

To achieve this objective, controls for identifying, documenting, separating, reviewing, notifying functions concerned and disposing of nonconforming product, with particular emphasis on preventing any accidental delivery to a customer, are defined in a documented procedure. Nonconforming product may be identified at any inspection stage of the process and, when identified, is held, recorded, re-inspected and disposed of in an approved manner. The disposal method may be one of the following: Reprocess the product to conform to specifications, Return to Supplier (RTS) and Reject and dispose.

Any reworked and/or repaired product or materials are re-inspected and re-tested in accordance with the quality plan and/or other documented procedures before reintroduction into the production process. A clear and concise description of the nonconforming product or material characteristics, with a record of its acceptance, acceptance details, and final disposal, is required.

When nonconforming product is detected after delivery or use has started, an organization takes action appropriate to the effects, or potential effects, of the non-conformity.

Corrective and Preventive Action: The purpose of corrective action is to identify and eliminate the quality failures that cause, or contribute to, actual and potential nonconformance in the production process. The detection and investigation of quality failures, and potential failures, is a dynamic responsibility of all managers and supervisors. The introduction of nonconforming product and materials into the process environment, or the production of nonconforming product, may represent a systemic failure of quality management objectives or may simply indicate a temporary, and easily corrected loss of process control.

The specific procedures developed for corrective action: Promptly and effectively, review and respond to customer complaints and other reports of product nonconformity; Determine causes of nonconformities; Evaluate the need for action to ensure the identification of causative factors do not reoccur in any product, material, process and/or quality documentation that contribute, directly or indirectly, to any nonconformity; Determine and implement corrective action needed; Review and monitor any corrective action taken to assess its effectiveness.

An organization strives continually improve for effectiveness of the quality management system through quality policy, quality objectives, audit results, corrective and preventive actions and management review. Every employee within the company is empowered to submit suggestions, ideas and bring forth any other information that help quality improvement.

4.7 Sustainability of QMS practice

To sustain the practice of QMS, Integrating quality tools and techniques with a company's process approach and management is critical for ensuring efficient and effective operations. By aligning these elements, an organization can achieve improved quality, productivity, and customer satisfaction. Here are some key steps to integrate quality tools and techniques with the process approach and management:

Process Mapping: Start by mapping out the company's processes and identifying key areas where quality tools and techniques can be applied. This involves visually representing the steps, inputs, outputs, and interactions within each process.

Identify Quality Tools and Techniques: Review the available quality tools and techniques that can be applied to the identified processes. Examples include Six Sigma, Lean Manufacturing, Statistical Process Control (SPC), Failure Mode and Effects Analysis (FMEA), and Root Cause Analysis (RCA).

Training and Awareness: Provide appropriate training and awareness programs to employees regarding the selected quality tools and techniques. This ensures that everyone understands their purpose, benefits, and how to apply them effectively.

Incorporate Quality Tools into the Process: Integrate the selected quality tools and techniques into the company's processes. This may involve modifying existing processes or creating new ones to accommodate the application of these tools. Ensure that the tools are seamlessly incorporated and align with the process flow.

Establish Metrics and Key Performance Indicators (KPIs): Define relevant metrics and KPIs to measure the effectiveness of the integrated quality tools and techniques. This provides a quantifiable way to assess the impact and success of the initiatives.

Management Support and Leadership: Ensure that top management supports and promotes the integration of quality tools and techniques. Leadership involvement is crucial for driving the necessary changes, allocating resources, and creating a supportive environment.

Documentation and Communication: Document the integrated quality tools and techniques, including standard operating procedures, guidelines, and best practices. Communicate these documents effectively across the organization to ensure consistent implementation and understanding.

Employee Engagement: Involve employees in the integration process by encouraging their participation, feedback, and suggestions. Engaged employees are more likely to embrace the changes and contribute to the success of the integrated quality initiatives.

By following these steps, a company can successfully integrate quality tools and techniques with its process approach and management. This integration enables the organization to drive continuous improvement, enhance quality, and achieve overall business excellence.

Regular Audits and Reviews: Conduct regular audits and reviews to assess the effectiveness and efficiency of the integrated quality tools and techniques. Use the findings to identify areas of improvement and take corrective actions as needed.

Continuous Improvement: Foster a culture of continuous improvement by regularly reviewing the integrated quality tools and techniques. Encourage feedback from employees and stakeholders, and use it to identify areas for further enhancement and refinement.

4.7.1 QMS practice at low level

An organization that their process approach and management supported by first level of quality tools and techniques are considered as low quality practice as shown in the following model. Whereas the first level of quality tools and techniques include internal and external audits, management review, teamwork, customer satisfaction surveys, suggestion system (mailbox suggestions), Employee satisfaction surveys, standard operation procedure, and document and data record.

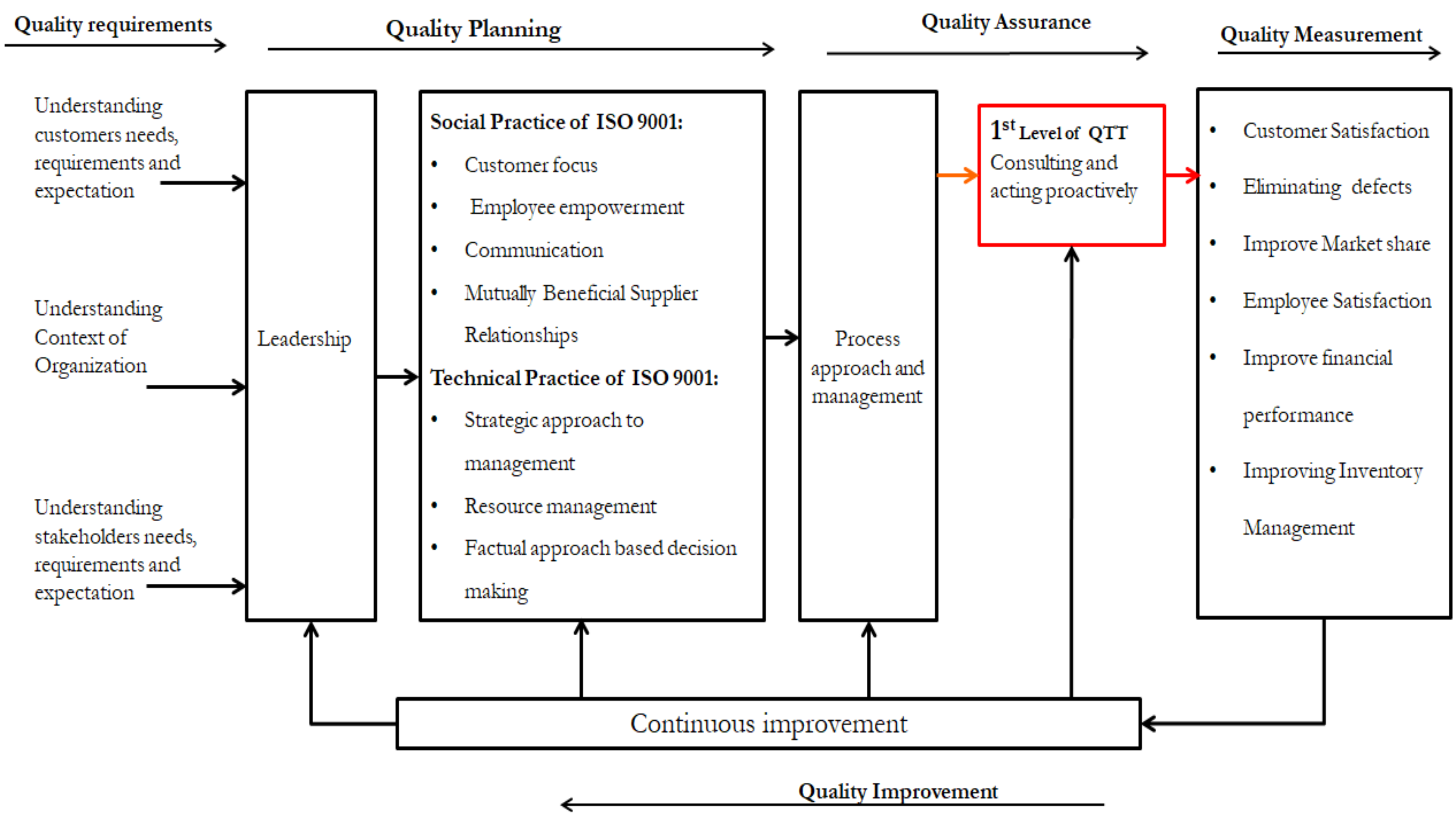

Figure 4:1 QMS framework practice at low-level

4.7.2 QMS practice at medium level

An organization that their processes approach and management supported by both first level and second level of quality tools and techniques are considered as medium quality practice. Whereas the second level of quality tools and techniques are includes. Cause–effect diagrams, FMEA (failure mode and effect analysis), SPC (Statistical process control), Benchmarking, QFD (quality function deployment), perato principle, Kano Model and SERVQUAL model

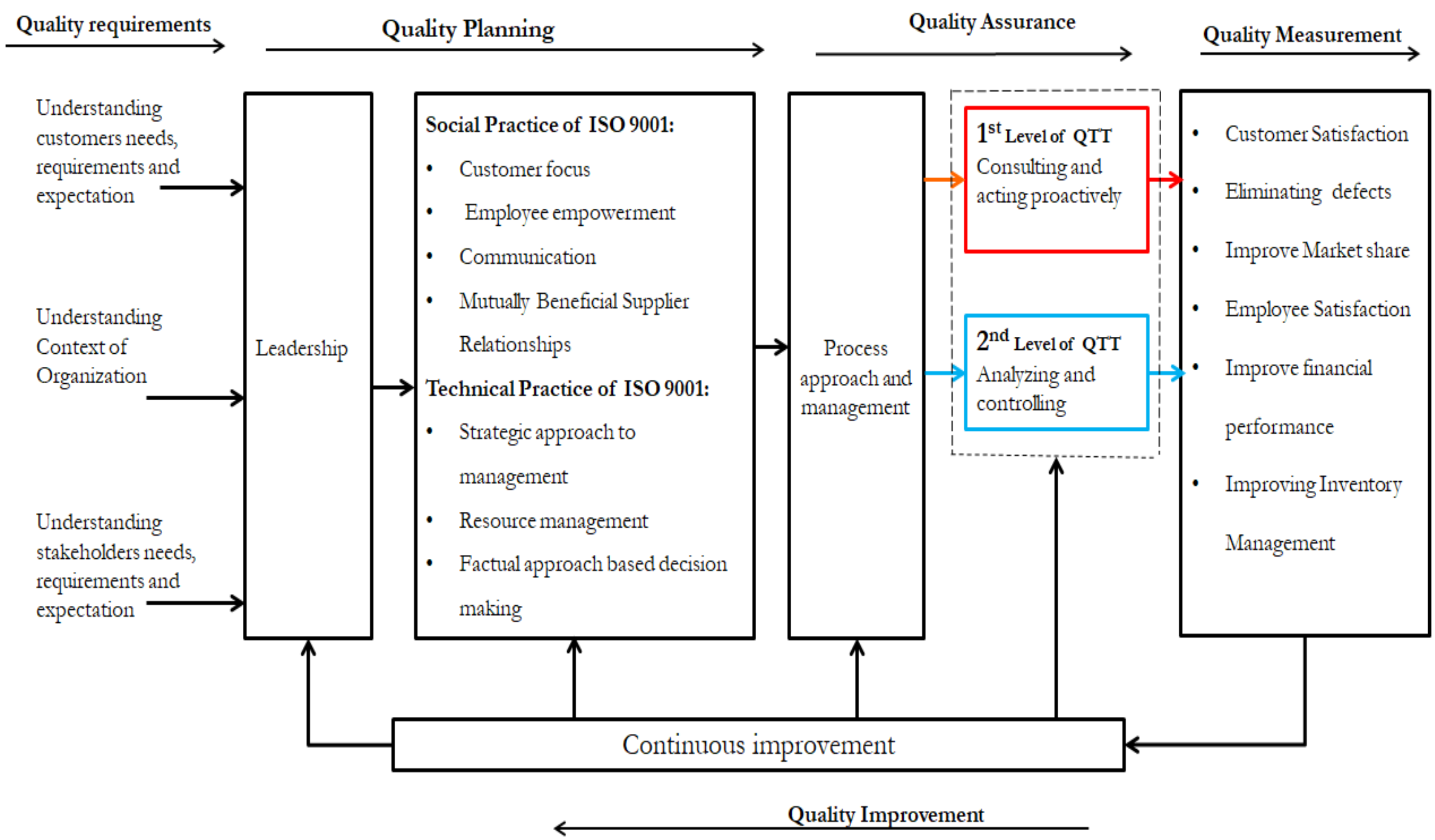

Figure 4:2 QMS framework practice at medium-level

4.7.3 QMS practice at high level

QMS practice is at high level for an organization that their process approach and management supported by first, second and third level of quality tools and techniques. Whereas the third level of quality tools and techniques are including six sigma (DMAIC), Business Process Management (BPM–BPR), VSM (values stream mapping), DOE (design of experiments) and kaizen and 5-s method

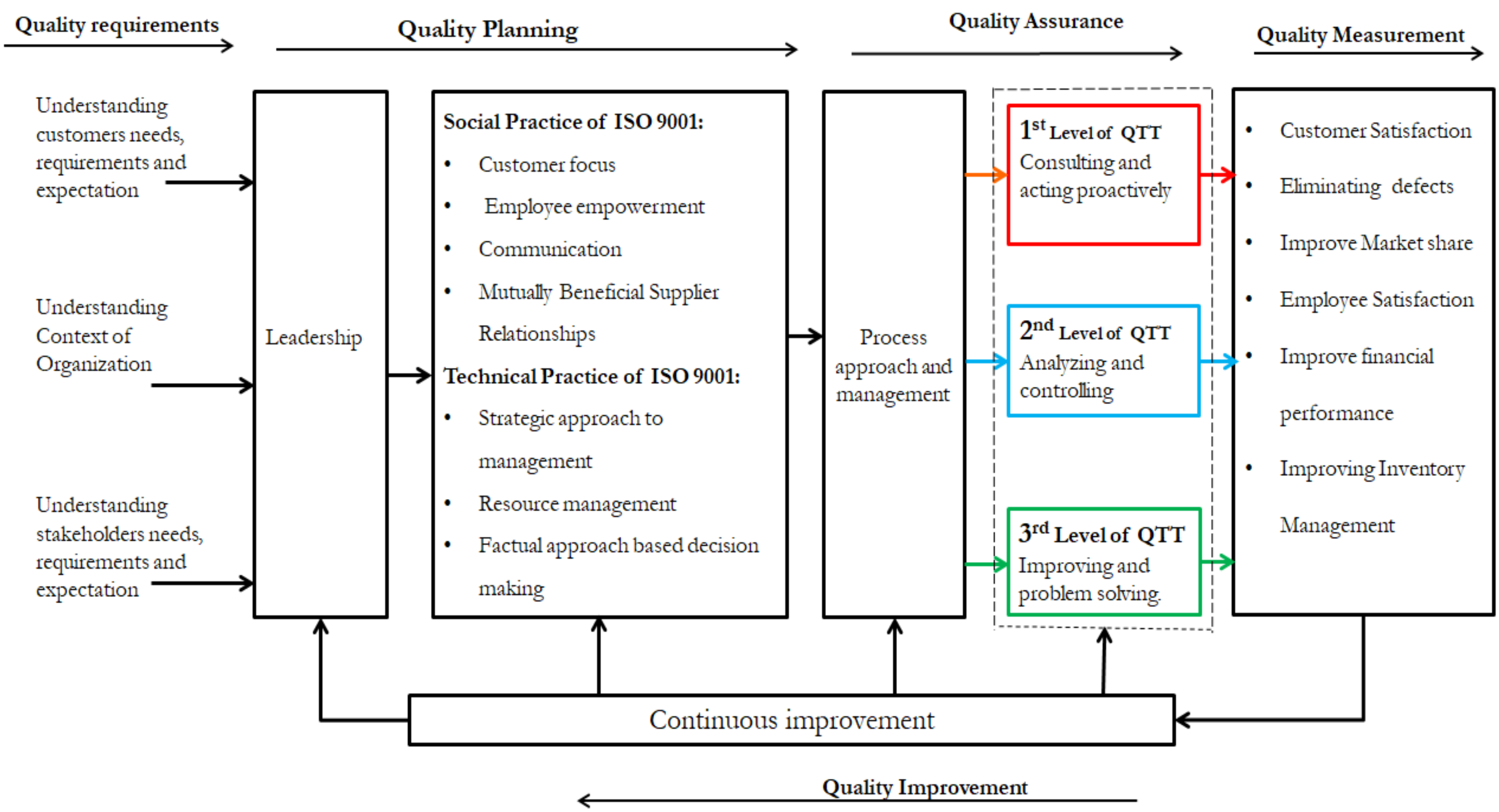

Figure 4:3 QMS framework practice at high-level

The following figure show that improvement and suatainability of quality performance through integration of quality tools and techniques with the company's process approach and management.

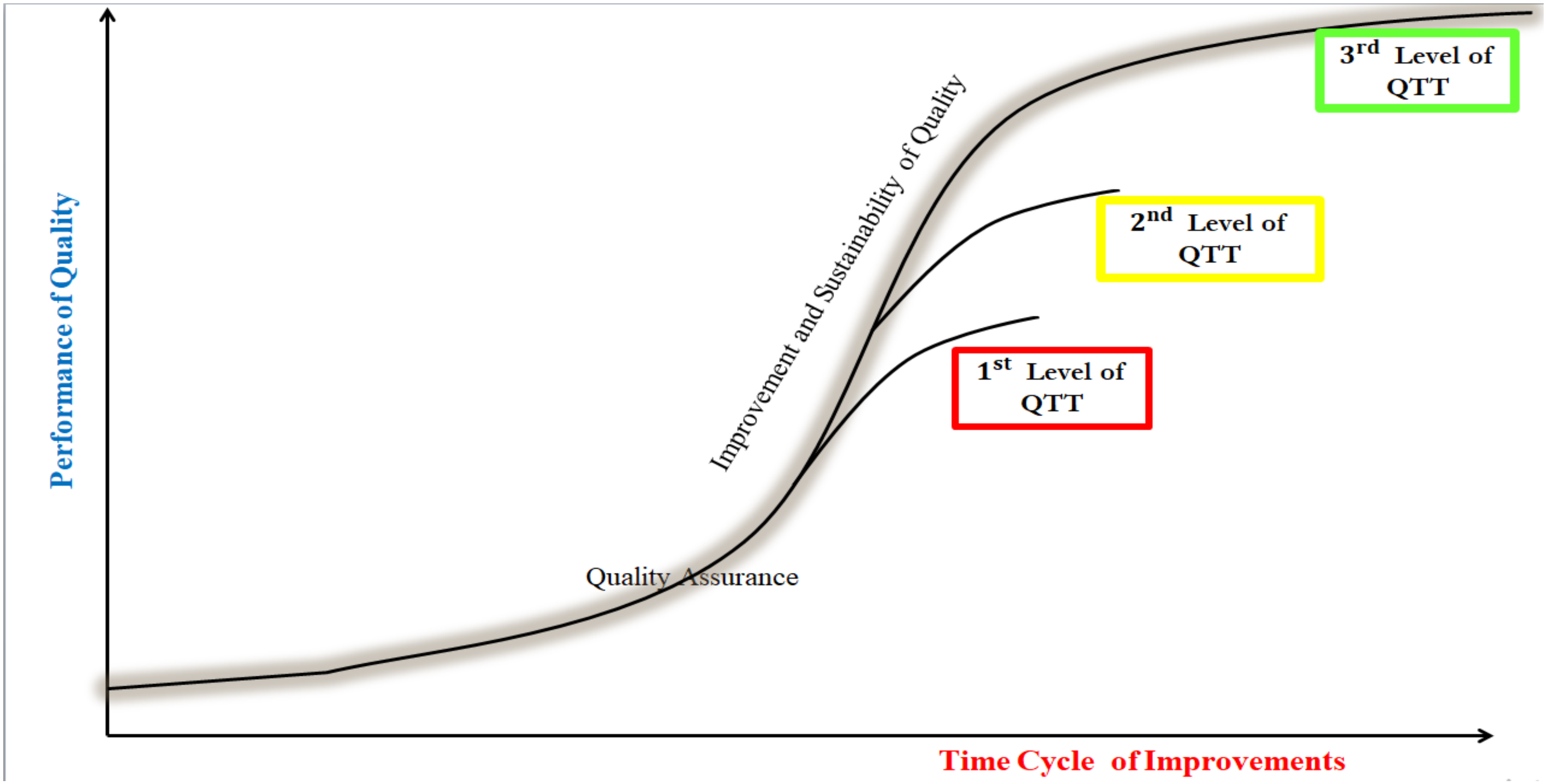

Figure 4:4 Improvement and sustainability of Quality QTT:- Quality Tools and Techniques

4.8 Final QMS framework

In development of QMS framework; initially the leaders initiated by needs, requirements and expectation of customers' and stakeholders. Whereas customers focus, employee empowerment, communication, mutually beneficial supplier relationships, factual approach based decision-making, strategic approach to management, and resource management are planned to achieve the company's process approach and management while integration of company process approach and management with quality tools and techniques considered as quality assurance.

The result of quality measurement performance includes customer satisfaction, eliminating and reduce defects, improve market share, employee satisfaction, and improve financial performance and inventory management. Depending on this quality performance, further continuous improvement taken place through integration of second level of quality tools and techniques with a company's process approach and management.

Finally to sustain the practice of QMS; the company's process and management supported by third level of quality tools and techniques which used for improving and problem solving for further process, products, and service improvements.

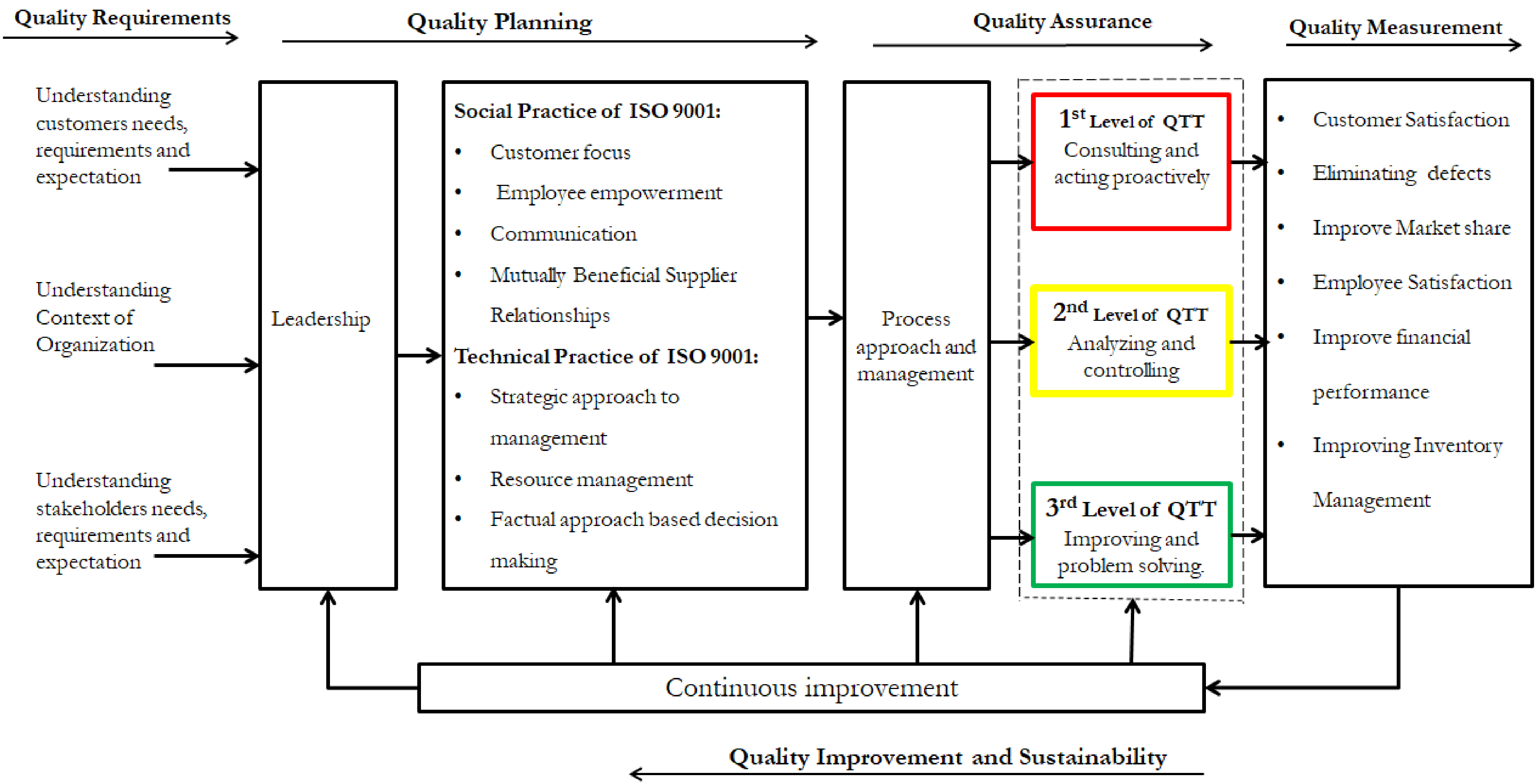

Figure 4:5 Final QMS framework

The contributions of this framework against other frameworks in the literature and practical gap are clarified as the following:

The integration of company's process approach and management with quality tools and techniques is significant in achieving and sustaining high levels of quality in products and services. Here are some key contributions:

Sustainability of Quality: by integrating quality tools and techniques into quality management systems, an organization can ensure viability of quality in the long-term and enhance their competitiveness, reduce risks, and provide quality of product and service to consistently meet or exceed customer and stakeholder’s requirement and expectations

Improved Efficiency: Implementing of integrated quality tools and techniques with company’s process approach helps an organization responsibility, and interfaces within the organization, efficient utilization of resources, reduces waste, and eliminates redundant activities, identify and eliminate process bottlenecks, reduce cycle times, and improve overall efficiency.

Customer Satisfaction: A strong process approach combined with effective quality tools and techniques leads to improved customer satisfaction. Quality tools and techniques like customer surveys, quality function deployment (QFD), and failure mode and effects analysis (FMEA) help identify customer requirements, prioritize improvement efforts, and mitigate potential risks to customer satisfaction.

Risk Management: integrated quality tools and techniques with company’s process approach play a crucial role in managing risks associated with quality of process, product and service. Overall, the combination of company process approach and effective use of quality tools and techniques enables organizations to achieve higher levels of quality, enhance customer satisfaction, drive continuous improvement, and manage risks effectively. By integrating these approaches into their management systems, companies can establish a strong foundation for sustained success in today's competitive business environment.

CHAPTER FIVE

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusion

The study attempted to develop QMS framework and examine the critical success factors and barriers in QMS practice through quantitative and qualitative data gathered and analyzed. The findings of the research concluded that the sustainability of QMS practice is achieved through integration of quality tools and technique with company's process approach and management.

The critical success factors in QMS practice are identified as Leadership (top management commitment), customer focus, employee involvement, process approach and management, systematic and strategic integration, resource management, communication, supplier's relationship, factual based decision and improvement.

Also the barriers of QMS that affect the practice of quality management system are identified at Walia Steel Industry are include poor understanding and insufficient knowledge of quality management, resistance to change, lack of delegation of authority and responsibility, lack of teamwork, lack of experts of quality management, bureaucratic management, poor and ineffective training.

The integrated Quality Management Systems (QMS) framework with quality tools and techniques is a powerful approach that can significantly enhance a case company ability to achieve and maintain high levels of quality in its products or services. By combining the systematic framework of a QMS with the specific methodologies offered by various quality tools and techniques, Walia Steel Industry can optimize their quality management efforts and drive continuous improvement.

Overall, the research suggests that by implementing this framework, which integrated quality tools and techniques with quality management system; Walia Steel Industry can improve, enhances and sustain the quality of its processes, products, and services.

5.2 Recommendation

Based on the findings of study, it is recommended that Walia Steel Industry should be considering the following areas of improvement to sustain their practice of quality improvement.

Among the types of quality tools and techniques, the second level of quality tools and techniques (analyzing and controlling) should be practice at Walia Steel Industry in order to eliminate or reduce product defect, lower costs of production, increase productivity of production, enhance profitability, increase competitiveness, improve quality of products, improve material handling and controlling.

The customer expectations and perceptions of Walia Steel Industry should measure along quality service dimensions by using SERVQUAL model with regarding to reliability, tangibility, empathy, responsiveness and assurance.

An appropriate quality tools and technique like, total productivity maintenance recommended to identifying the cause root problem of machinery and equipment failures in order to minimize the consumption of spare parts cost and insure the service life of machinery to optimize the productivity and profitability of Walia Steel Industry.

Finally, the mechanism of material handling and controlling especial quality of strip coil handling requires a powerful practice that can bring significant enhancements like kaizen that can focus on making incremental improvements to streamline operations, optimize efficiency, and enhance overall quality.

By following the time cycle of quality improvement, organizations can systematically improve their quality performance and achieve higher levels of customer satisfaction, operational efficiency, and overall business success. Here the time cycle it taken to become at high quality performance through integrating first, second and third level of quality tools and techniques with company process approach and management requires further study.

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Appendix A: General information of respondents

General Information	Valid	Frequency	Percentage
Gender	Male	27	71.05
	Female	11	28.95
Total		38	100
Educational Background	Master degree	3	7.89
	Bachelor degree	28	73.68
	Diploma	7	18.42
Total		38	100.00
Position in the company	Top management	13	34.21
	Middle management	15	39.47
	Junior management	7	18.42
	Quality control	3	7.89
	Other (specify please)	-	-
Total		38	100.00
Experience in the company	(1 – 5) years	18	47.37
	(6 - 10) years	14	36.84
	(11 - 15) years	6	15.79
	(16 - 20) years	--	
Total		38	100

Appendix B: Cronbach's Alpha of Critical Success Factors

S/No	Summary of Key success factors /principles of QMS	Reliability Statistics	N of Items
		Cronbach's Alpha	
1	Leadership	0.898	12
2	Process approach and management	0.895	12
3	Customer focus	0.836	7
4	Strategic & systematic approach management	0.836	6
5	Employee involvements and empowerment	0.875	8
6	Communication	0.851	7
7	Continuous improvement	0.826	6
8	Factual approach to decision making	0.88	9
9	Resource management	0.898	10
10	Mutually Beneficial Supplier Relationships	0.871	7

Appendix C: Cronbach's Alpha of QMS barriers

S/No	Summary of QMS Barriers of QMS	Reliability Statistics	N of Items
		Cronbach's Alpha	
1	Poor understanding and insufficient knowledge of QMS	0.838	5
2	Resistance to Change	0.789	4
3	Lack of Delegation of Authority and Responsibility	0.80	4
4	Lack of Teamwork	0.764	4
5	Lack of experts of QMS	0.797	3
6	Bureaucratic management	0.784	4
7	Poor and ineffective training	0.794	5

Appendix D: Cronbach’s Alpha of QMS benefit

S/No	Summary of QMS Benefit	Reliability Statistics	N of Items
		Cronbach's Alpha	
1	Improving Customer Satisfaction	0.811	6
2	Improving Employee Satisfaction	0.742	5
3	Eliminating waste and defects	0.851	6
4	Improving financial and performance of organization	0.782	6
5	Decreasing the Company’s Impact on the environment	0.779	3

Appendix E: Summary of critical success factors of QMS

Success factors/ principles of QMS	Valid	Frequency	Percent	Valid Percent	Cumulative Percent
1. Leadership	Strongly disagree	97	21.27	21.27	21.27
	Disagree	103	22.59	22.59	43.86
	Neutral	148	32.46	32.46	76.32
	Agree	71	15.57	15.57	91.89
	Strongly agree	37	8.11	8.11	100
	Total	456	100	100	
2. Process approach and management	Strongly disagree	99	21.71	21.71	21.71
	Disagree	98	21.49	21.49	43.2
	Neutral	157	34.43	34.43	77.63
	Agree	69	15.13	15.13	92.76
	Strongly agree	33	7.24	7.24	100
	Total	456	100	100	
3. Customer focus	Strongly disagree	61	22.93	22.93	22.93
	Disagree	58	21.8	21.8	44.74
	Neutral	95	35.71	35.71	80.45
	Agree	32	12.03	12.03	92.48
	Strongly agree	20	7.52	7.52	100
	Total	266	100	100	
4. Strategic & systematic approach management	Strongly disagree	43	18.86	18.86	18.86
	Disagree	57	25	25	43.86
	Neutral	73	32.02	32.02	75.88
	Agree	35	15.35	15.35	91.23
	Strongly agree	20	8.77	8.77	100
	Total	228	100	100	
5. Employee involvements and empowerment	Strongly disagree	60	19.74	19.74	19.74
	Disagree	65	21.38	21.38	41.12
	Neutral	93	30.59	30.59	71.71
	Agree	52	17.11	17.11	88.82
	Strongly agree	34	11.18	11.18	100
	Total	304	100	100	
6. Communication	Strongly disagree	15	5.64	5.64	5.64
	Disagree	19	7.14	7.14	12.78
	Neutral	102	38.35	38.35	51.13
	Agree	67	25.19	25.19	76.32
	Strongly agree	63	23.68	23.68	100
	Total	266	100	100	
7. Continuous improvement	Strongly disagree	51	22.37	22.37	22.37
	Disagree	47	20.61	20.61	42.98
	Neutral	68	29.82	29.82	72.81
	Agree	45	19.74	19.74	92.54
	Strongly agree	17	7.46	7.46	100
	Total	228	100	100	
8. Factual approach to decision making	Strongly disagree	80	23.39	23.39	23.39
	Disagree	77	22.51	22.51	45.91
	Neutral	114	33.33	33.33	79.24
	Agree	44	12.87	12.87	92.11
	Strongly agree	27	7.89	7.89	100
	Total	342	100	100	
9. Resource management	Strongly disagree	80	21.05	21.05	21.05
	Disagree	88	23.16	23.16	44.21
	Neutral	116	30.53	30.53	74.74
	Agree	73	19.21	19.21	93.95
	Strongly agree	23	6.05	6.05	100
	Total	380	100	100	
10. Mutually Beneficial Supplier Relationships	Strongly disagree	60	22.56	22.56	22.56
	Disagree	56	21.05	21.05	43.61
	Neutral	92	34.59	34.59	78.2
	Agree	34	12.78	12.78	90.98
	Strongly agree	24	9.02	9.02	100
	Total	266	100	100	

Appendix F: Summary of QMS barriers

QMS Barriers	Valid	Frequency	Percent	Valid Percent	Cumulative Percent
1. Poor understanding and insufficient knowledge of QMS	Strongly disagree	21	11.05	11.05	11.05
	Disagree	23	12.11	12.11	23.16
	Neutral	58	30.53	30.53	53.68
	Agree	44	23.16	23.16	76.84
	Strongly agree	44	23.16	23.16	100
	Total	190	100	100	
2. Resistance to Change	Strongly disagree	10	6.58	6.58	6.58
	Disagree	24	15.79	15.79	22.37
	Neutral	43	28.29	28.29	50.66
	Agree	40	26.32	26.32	76.97
	Strongly agree	35	23.03	23.03	100
	Total	152	100	100	
3. Lack of Delegation of Authority and Responsibility	Strongly disagree	13	8.55	8.55	8.55
	Disagree	24	15.79	15.79	24.34
	Neutral	42	27.63	27.63	51.97
	Agree	33	21.71	21.71	73.68
	Strongly agree	40	26.32	26.32	100
	Total	152	100	100	
4. Lack of Teamwork	Strongly disagree	13	8.55	8.55	8.55
	Disagree	21	13.82	13.82	22.37
	Neutral	48	31.58	31.58	53.95
	Agree	31	20.39	20.39	74.34
	Strongly agree	39	25.66	25.66	100
	Total	152	100	100	
5. Lack of experts of QMS	Strongly disagree	16	10.53	10.53	10.53
	Disagree	26	17.11	17.11	27.63
	Neutral	41	26.97	26.97	54.61
	Agree	37	24.34	24.34	78.95
	Strongly agree	32	21.05	21.05	100
	Total	152	100	100	
6. Bureaucratic management	Strongly disagree	13	8.55	8.55	8.55
	Disagree	28	18.42	18.42	26.97
	Neutral	43	28.29	28.29	55.26
	Agree	28	18.42	18.42	73.68
	Strongly agree	40	26.32	26.32	100
	Total	152	100	100	
7. Poor and ineffective training	Strongly disagree	16	8.42	8.42	8.42
	Disagree	28	14.74	14.74	23.16
	Neutral	58	30.53	30.53	53.68
	Agree	40	21.05	21.05	74.74
	Strongly agree	48	25.26	25.26	100
	Total	190	100	100	
Summary of QMS Barriers					
S/No	Valid	Frequency	Percent	Valid Percent	Cumulative Percent
1	Strongly disagree	102	8.95	8.95	8.95
2	Disagree	174	15.26	15.26	24.21
3	Neutral	333	29.21	29.21	53.42
4	Agree	253	22.19	22.19	75.61
5	Strongly agree	278	24.39	24.39	100
Total		1,140.00	100	100	

Appendix G: Summary of QMS benefit

Benefits of QMS	Valid	Frequency	Percent	Valid Perc	Cumulative Percent
1. Improving Customer Satisfaction	Strongly disagree	45	19.74	19.74	19.74
	Disagree	46	20.18	20.18	39.91
	Neutral	60	26.32	26.32	66.23
	Agree	56	24.56	24.56	90.79
	Strongly agree	21	9.21	9.21	100
	Total	228	100	100	
2. Improving Employee Satisfaction	Strongly disagree	39	20.53	20.53	20.53
	Disagree	37	19.47	19.47	40
	Neutral	56	29.47	29.47	69.47
	Agree	40	21.05	21.05	90.53
	Strongly agree	18	9.47	9.47	100
	Total	190	100	100	
3. Eliminating waste and defects	Strongly disagree	48	21.05	21.05	21.05
	Disagree	53	23.25	23.25	44.3
	Neutral	62	27.19	27.19	71.49
	Agree	44	19.3	19.3	90.79
	Strongly agree	21	9.21	9.21	100
	Total	228	100	100	
4. Improving financial and performance of organization	Strongly disagree	51	22.37	22.37	22.37
	Disagree	56	24.56	24.56	46.93
	Neutral	61	26.75	26.75	73.68
	Agree	40	17.54	17.54	91.23
	Strongly agree	20	8.77	8.77	100
	Total	228	100	100	
5. Decreasing the Company's Impact on the environment	Strongly disagree	11	9.65	9.65	9.65
	Disagree	7	6.14	6.14	15.79
	Neutral	37	32.46	32.46	48.25
	Agree	28	24.56	24.56	72.81
	Strongly agree	31	27.19	27.19	100
	Total	114	100	100	

Summary of QMS benefit

S.No	Valid	Frequency	Percent	Valid Perc	Cumulative Percent
1	Strongly d	194	19.6	19.6	19.6
2	Disagree	199	20.1	20.1	39.8
3	Neutral	276	27.9	27.9	67.7
4	Agree	208	21.1	21.1	88.8
5	Strongly a	111	11.2	11.2	100
Total		988	100	100	

Addis Ababa University

Addis Ababa Institute of Technology (AAiT)

School of Mechanical and Industrial Engineering (SMIE)

Subject: Questionnaires:

Dear Sir/Madam

I am Mr. Zewde Tegenu, a M.Sc. student is conducting a research entitled "Developments of Quality Management System (QMS) for Steel Industries (Quality Improvement: A Case Study of Walia Steel Industry) in partial fulfillment of a M.Sc. degree in Industrial Engineering in the School of Mechanical and Industrial Engineering, Addis Ababa Institute of Technology, Addis Ababa University. The purpose of this questionnaire is to gather the factors affecting implementation of quality management system at Walia Steel Industry. Therefore, to come up with important results, your support in providing reliable information regarding existing phenomena will be involved and the result of this research will help in framework model development to improve the implementation of quality management system. The collected data will be only be used for academic purpose, and it will not be disclosed to third party nor presented at any level.

Thank you for your cooperation!

Zewde Tegenu

Contact Address:

Email: zewdetegenu@gmail.com

Phone: +251 921076518

Part 1: Characteristics of the respondents

1. Gender: ☐ Male ☐ Female

2. Age: ☐ 18-29 ☐ 30-45 ☐ 46-60 ☐ Above 60

2. Marital Status: ☐ Single ☐ married ☐ others

3. Based on the following categories what is your position in the company?

☐ Top management ☐ Middle management

☐ Junior management ☐ Quality management

☐ Other (specify please)

4. What is your qualification?

☐ Secondary or high school ☐ Vocational school/institute

☐ Diploma ☐ Bachelor degree

☐ Master degree ☐ PhD degree

☐ Other (specify please)

3. How many years of experience in this company do you have?

☐ (1 – 5) years ☐ (6 - 10) years

☐ (11 - 15) years ☐ (16 - 20) year

☐ More than (20) years

Part 2: The key factors of QMS

State your opinion in terms of the following statements that related to quality management system key factors in your company.

Strongly disagree =1, Disagree = 2, Neutral = 3, Agree = 4, and strongly agree =5

Please tick (√) matches with in you are the appropriate boxes answer that.

Code	Key factors /principles of QMS	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1.0 Leadership						
1.1	Your company's top management has been fully committed to continuous improvement of creativity and innovation					
1.2	Your company's top management has been fully committed to continuous improvement of policies and strategies development					
1.3	Your company's top management has been fully committed to priorities and effective utilization of resource					
1.4	Your company's top management has been fully committed to review of achievements & recommendations in filling gaps					
1.5	Your company's top management has been fully committed to continually demonstrates of quality					
1.6	Your company's top management has been fully committed to uses performance indicators and ensure adequate performance measurement					
1.7	Your company's top management has been fully committed to people involvement in improvement activities					
1.8	Your company's top management has been fully					

	committed to continuous improvement of ethical values and beliefs					
1.9	Your company's top management has been fully committed to motivate employees with recognition and reward					
1.10	Your company's top management has been fully committed to recognize of major customers					
1.11	Your company's top management has been fully committed to encouraging customer's feed back					
1.12	Your company's top management has been fully committed to training and development of employees					
2.0 Process approach and management						
2.1	Your company's has been fully used appropriate measurement to control and improve the production process and deliver.					
2.2	Your company's has been fully used and followed clear working procedures and instructions					
2.3	Your company's has been fully identified & designed customer requirements					
2.4	Your company's has been fully planned and controlled operational activities					
2.5	The company has been fully generated ideas with customers and market research to scale new products					
2.6	Your company's has been fully used effective and efficient mechanisms for material handling and controlling					
2.7	Your company's has been fully used adequate storage to prevent damage or deterioration					
2.8	Your company's has been fully identified and					

	segregated nonconforming items					
2.9	Your company's has been fully followed value analysis to reduce overall product costs					
2.10	Your company's process has been fully traced and controlled at any stage of manufacturing process					
2.11	Your company's has been fully conducted market research on regular basis and estimates demand for its product /service					
2.12	Your company's purchasing process has been fully displayed supplies required by all units					
3.0 Customer focus						
3.1	Your company's has been fully determined current and future customer requirements and expectations					
3. 2	Your company's has been fully measured and analyzed customer complaints					
3.3	Your company's has been fully conscious of market trends					
3.4	Your company's employees has been fully a good relationship with customers					
3.5	Your company's has been fully collected information and reviewing the perception of their stakeholders					
3.6	Your company's products has been fully preferred with quality of products and service					
3.7	Your company's products has been fully conformance to national standards					
4.0 Strategic & systematic approach						
4.1	Your company's quality management system has been fully reflected in the organizational values, vision and mission					

4.2	Your company's middle and junior managers has been fully cleared knowledge about policy and strategy related to quality management					
4.3	Your company's policy and strategy has been fully reviewed on a regular basis					
4.4	Your company's quality culture has been fully implemented in the organization					
4.5	Your company's stakeholders (employee, customer, other) has been fully involved in policies & strategies formulation					
4.6	Your company's departments function has been fully integrated with each other's and supported with operational procedure					
5.0 People empowerment						
5.1	Your company's employees has been fully authority in their positions to make necessary actions when required					
5.2	Your company's employee has been fully motivated to suggest and create ideas for work improvement					
5.3	Your company's middle and junior managers has been fully involved in decision making					
5.4	Your company's managers, supervisors and employees has been fully trained with related to quality products and service					
5.5	Your company's resources has been fully available to cover employees training needs and development					
5.6	Your company's training outputs has been fully evaluated based on a regular basis					
5.7	Your company's has been fully provided benefit package for its employees					
5.8	Your company's has been fully improved safety					

	environment and given heath care services in work place.					
5.9	Your company's has been fully provided appropriate personal protective equipment at all level					
6.0 Communication						
6.1	Your company's has been fully effective in terms of exchanging and submitting information between different managerial levels in the organization					
6.2	Your company's has been fully got the required information from the varied internal and external sources in due time					
6.3	Your company's has been fully used the effective of IT system and linked the implementation of the quality management system to the information management systems					
6.4	Your company's information has been fully flow easily from company to customers and vice versa in the due date					
6.5	Your company's information has been fully flow easily from the top management to employees and vice versa					
7.0 Continuous improvement						
7.1	Your company's employees have been fully believed that quality improvement is their individual responsibility					
7.2	Your company's has been fully emphasized proactive improvement rather than maintenance					
7.3	Your company's has been fully emphasized continuous improvement of processes for all tasks at all levels					
7.4	Your company's has been fully worked to opportunities for improvement during its internal and external audit					

7.5	Your company's has been fully identified the alternatives option to take corrective and preventive action					
8.0 Factual approach to decision making						
8.1	Your company's data analysis method has been fully enough to make decisions.					
8.2	Your company's process has been reviewed and improved depending on customer's feedback and complain.					
8.3	Your company's process has been fully reviewed and improved in accordance to audit and non-conformance report					
8.4	Your company's has been fully done data analysis with support of qualitative evidence and practical experience.					
9.0 Resource management						
9.1	Your company's knowledge has been fully managed and controlled in the organization					
9.2	Your company's has been fully used a latest mechanism to handle, control and manage materials (raw material, scrap, defect and finished products)					
9.3	Your company's has been fully done risk assessment on a regular basis					
9.4	Your company's machine capacity has been fully utilized in production					
9.5	Your company's facilities (infrastructure, layout, machineries and equipment's) has been fully maintained as per its schedule					
9.6	Your company's budget has been fully utilized effectively and efficiently as per budget planned					

9.7	Your company's information has been fully supported by information management system					
9.8	Your company's employee has been fully provided with training and professional development					
9.9	Your company's human resource has been fully planned and organized					
9.10	Your company's employee performance evaluation has been fully done on a regular basis					
10.0 Mutually Beneficial Supplier Relationships						
10.1	Your company's has been fully updated suppliers list on a regular basis					
10.2	Your company's has been fully followed suppliers criteria and evaluation procedure to evaluate suppliers					
10.3	Your company's has been fully selected suppliers depending on the quality of material					
10.4	Your company's has been fully nominated potential suppliers to build a long term relationships					
10.5	Your company's has been fully classified suppliers in accordance with the type of product they supply					
10.6	Your company's suppliers has been fully delivered the material on time with acceptable of price					

Part 3: Barriers of QMS

Exploring barriers to implementing QMS in the company

Please tick (√) matches with in you are the appropriate box answers that.

Code	Barriers of QMS	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1.0 Poor understanding and insufficient knowledge of QMS						
1.1	Your company's has been more emphasis on the certification acquisition rather than on the process improvement					
1.2	Your company's has been lack of aligned QMS requirements with customer requirements					
1.3	Your company's employees has been unclear with QMS objective and benefit					
1.4	Your company's employees has been complicated in learning and implementing QMS					
2.0 Resistance to Change						
2.1	Your company's employees has been preferred to follow exist instructions rather than take initiatives and create a proposal in their jobs					
2.2	Your company's working culture has been challenged to change the existing attitude of employee					
2.3	Your company's staff has been resisted to involved in training and development programs					
3.0 Lack of Delegation of Authority and Responsibility						
3.1	Your company's has been not placed the right people to the right position of task					
3.2	Your company's job responsibilities has been not delegated with authority					
3.3	Your company's managers at middle and junior levels has been not shared authority for their workers					

4.0 Lack of Teamwork						
4.1	Your company's has been lack of integration, cross-functional cooperation and coordination between departments					
4.2	Your company's team-spirit has been not regarded as an important factor for improving and encouraging the employees to work in a team					
4.3	Your company's has been lack of effective teams building skills					
5.0 Lack of experts of QMS						
5.1	Your company's has been lack of knowledge in implementation of QMS					
5.2	Your company's employee has been no good awareness of QMS implementation					
5.3	Your company's has been placed a people in the wrong position					
6.0 Bureaucratic management						
6.1	Your company's has been conflict of interest in management style					
6.2	Your company's does not encourage and motive the staff to be innovative and creativities					
6.3	Your company's has been focused on the results rather than the processes					
7.0 Poor and ineffective training						
7.1	Your company's has been lack of training for all employees regarding to principles of quality					
7.2	Your company's has been a shortage of qualified trainers in the organization					
7.3	Your company's staff turnover has been increased					

7.4	Your company’s productivity has been reduced					
7.5	Your company’s has been inadequate training monitoring programs					

Part 4: The benefits of QMS implementation

The potential benefits of implementing QMS in the company

Please tick (√) matches with in you’re the appropriate box answer that.

Code	Benefits of QMS	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1.0 Improving Customer Satisfaction						
1.1	Your company’s has been fully enhanced the relationship between the organization and its customers					
1.2	Your company’s has been fully reduce customer complain in the organization					
1.3	Your company’s has been fully Meet customers' needs and requirements					
1.4	Your company’s has been fully forecasted the expectation of customers					
1.5	Your company’s customers delivery time has been fully responded in the given period of time					
2.0 Improving Employee Satisfaction						
2.1	Your company’s employees has been fully updated their skills and knowledge					
2.2	Your company’s employees complain has been fully decreased on average					
2.3	Your company’s Workers environment has been fully improved					
2.4	Your company’s employees turnover has					

	been fully decreased					
2.5	Your company's employee motivation has been fully supported with incentive package, reward and recognition					
3.0 Eliminating waste and defects						
3.1	Your company's process management and measurement has been fully enhanced through continuous improvement					
3.2	Your company's has been fully reduced the average number of defects and errors in the operational activities					
3.3	Your company's material handling mechanism has been fully improved in the organization					
3.4	Your company's quality of products has been fully improved through continuous improvement					
3.5	Your company's product inspection sample has been fully decreased in production process					
3.6	Your company's non-value adding activities has been fully reduced					
4.0 Improving financial and performance of organization						
4.1	Your company's profitability has been fully increased					
4.2	Your company's productivity has been fully improved					
4.3	Your company's market share has been fully					

	increased in local and global market					
4.4	Your company's image and brand has been fully improved at an international recognized					
4.5	Your company's management confidence has been fully improved					
4.6	Your company's has been fully trusted with regards to quality of products and service by its customers					
5.0 Decreasing the Company's Impact on the environment						
5.1	Your company's has been fully contributed and established a good relations within community where the organization carry out its activities					
5.2	Your company's has been fully complied and conformed to all requirements, including legal and statutory					
5.3	Your company's has been fully enhanced the contribution of the organization in social and environmental responsibility					

Interview

1. What kinds of quality tools and technique applied in your company in order to improve quality of products and services?
2. How you express activities in your organization from the view of products and services quality, delivery time, customers complain and management review
3. What are the major challenges faced by your organization in practicing quality management system
4. What is your overall suggestion to facilitate and sustain QMS practice in your organizational activities?

The general criteria used to validate QMS framework are mention as the following:

- Suitability for achieving organizational goals,
- Compliance with relevant standards,
- Flexibility and ease to implement
- Sustainability of quality improvement
- Effectiveness
- Comprehensiveness