



St. Mary's University (SMU)  
Institute of Quality and Productivity Management (IQPM)  
School of Graduate Studies

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*Analyzing the Effectiveness of the Design and Implementation of  
the Components of Quality Management in Selected Manufacturing  
Companies, Ethiopia*

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By:

Abel Zewde

Advisor:

Melaku Girma (Ph.D.)

May 2022

Addis Ababa, Ethiopia

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***A Thesis Submitted to St. Mary's University, School of Graduate Studies in  
Partial Fulfilment of the Requirement for the Degree of Masters of Science in  
Quality and Productivity Management***

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Approved by Board of Examiners

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## **DEDICATION**

This thesis work is dedicated to my beloved family and friends. I have special feelings of gratitude to my beloved parents. I also dedicate this thesis to all who have supported me throughout the process.

## **DECLARATION**

I hereby announce that the work which is being portrayed in this thesis entitled “*Analysing the Effectiveness of the Design and Implementation of the components of Quality management in Selected Manufacturing Companies, Ethiopia*” is original work of my own, and has not been presented for a degree of any other university and all the resource of materials used for the thesis have been accordingly acknowledged.

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**Abel Zewde**  
**MSc. Candidate**

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**Date**

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

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**Melaku Girma (Ph.D.)**  
**Advisor**

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**Date**

## **ACKNOWLEDGMENT**

First and above all, I thank the Almighty God to whom I owe my very existence for providing me with this opportunity and granting me the capability to accomplish this research.

I would like to thank my research thesis Advisor Melaku Girma (Ph.D.) St. Mary's University (SMU), Institute of Quality and Productivity Management (IQPM), School of Graduate Studies. He always has a sincere interest if I had an inquiry about my research or writing, he consistently allowed this paper to be my work and also guided me on the right path.

Finally, I must express my very profound gratitude to my parents, for providing me with unfailing support and continuous encouragement throughout my year of study and through the process of researching and writing this thesis. Thank you

## **ABSTRACT**

*In today's competitive economic climate, higher-quality items from outside Ethiopia have presented a threat to Ethiopian manufacturing enterprises. As a result, many businesses have responded to the concerns by implementing wide quality management aspects. The primary purpose of this research is to uncover the critical quality management components that are important for every organization's success. Also, look at the difficulties of establishing critical quality management components. In addition, explore the practicality of using these components in certain manufacturing businesses. A mixed research design (triangulation design) research approach was used to assess the efficacy of the design and implementation of quality management components in selected manufacturing organizations. Closed-ended survey questionnaires and interviews were used to collect data. The survey questions were made available online at [abelzewde.blogspot.com](http://abelzewde.blogspot.com). The survey questionnaire data were analyzed using SPSS Statistics 22, while the interview data were analyzed using Nvivo 11 Plus software. Each of the selected manufacturing organizations is confronting obstacles related to staff competency, management & employee dedication, lack of training, and other quality management challenges. Additionally, documentation, lack of communication, regulatory & statutory criteria, availability of raw materials, and Lack of awareness of quality management are the major factor for the ineffective implementation of quality management. The research finding demonstrated that the practicality of quality management components in selected manufacturing companies was found to be low throughout all tents, including quality planning, quality control, quality assurance, and quality improvement, according to an analysis of the quality management components self-assessment report evaluation.*

**Keywords:** *Components of quality management, manufacturing sector, design and implementation*

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## **LIST OF ACRONYMS**

Acronyms	Description
<b>EMS</b>	Environmental Management System
<b>FSSC-22000</b>	Food Safety System Certification 22000
<b>ISO</b>	International Organization for Standardization
<b>LMS</b>	Learning Management System
<b>MOE</b>	Ministry of Education
<b>QMS</b>	Quality Management System
<b>SQA</b>	Software Quality Assurance

## **CHAPTER ONE**

### **1. INTRODUCTION**

---

*This chapter presents the background of the research, statement of the problem, research question, research objective, the scope of the research, the significance of the research, operational definition, and proceeding section highlights.*

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#### **1.1. Background of the Study**

In today's competitive business environment, products of higher quality from outside Ethiopia have posed a threat to Ethiopian manufacturing firms. As a result, many companies have reacted to the issues by adopting broad aspects of quality. For this reason, firms are beginning to emphasize quality management in all elements and phases of their business, rather than just operations. Indeed, quality management is a critical component for establishing a competitive advantage.

Meanwhile, numerous research has been conducted hitherto to identify the components of successful quality management, from various perspectives, mainly contributions from quality leaders, formal evaluation models, and empirical research (Tari, 2005). Accordingly, this section primarily presents empirical research conducted on the components of quality management in the worldwide, African, and Ethiopian contexts.

Several empirical research has been conducted globally on the components of quality management see, for instance, Brkić et al., (2011); Claver et al., (2003); Jaafreh & Al-abedallat (2013); Tarí et al., (2007), likewise, Agarwal et al., (2013); Gutiérrez et al., (2012); Hoonakker et al., (2010); Martínez-Costa & Martínez-Lorente (2008); Patyal & Koilakuntla (2017); Phan et al., (2011); Zeng et al., (2014). However, they did not identify the crucial components of quality management and examine their effectiveness.

Briefly, in a regional context, these are some of the empirical research that has explored the components of quality management see, for example, Muyanda et al., (2019); Milanoi (2016); Wanza et al., (2017). Even if, there is numerous empirical research conducted on the components of quality management. Still, there is an absence of empirical research on ascertaining components of quality management.

Similarly, in the Ethiopian context, there is so much empirical research done on the crucial quality management components so far as. See, for instance, [Bayissa \(2016\)](#); [Berhe & Gidey \(2016\)](#); [Gedif \(2019\)](#). Generally, most of the research focuses mainly on discussing quality management practices and examining their impact on organizational performance in various sectors. Nevertheless, there is a lack of empirical research in this area particularly, in analyzing the critical quality management component.

Consequently, the purpose of the research is to fill both theoretical and practical gaps in this research area, mainly by analyzing, and recognizing the vital quality management components. Additionally, investigate the challenges of implementing crucial quality management components in selected manufacturing companies. Also, explore the practicality of utilizing these components in selected manufacturing companies.

## **1.2. Statement of the Problem**

Currently, quality management is the most spectacular constituent that needs serious consideration for firms to exceed their competitors. In any government and private manufacturing firm, the key to its survival and success depends on the capacity to provide quality products and meet or exceed customer expectations. It is a common phenomenon that many manufacturing companies encounter issues in delivering satisfactory products/services to its customer at the minimum cost that will increase the profits of the company.

Presently, it is reasonable by most of the partners that quality management issues are the stumbling piece for the investors in manufacturing companies. Besides, quality management issues were clear in all divisions. Yet, numerous research were conducted to reduce this problem. See, for case ([Addis, 2020](#); [Birhanu & Daniel, 2014](#); [Kitaw & Bete, 2003](#); [Mohammed et al., 2019](#); [Tsegaye, 2021](#); [Tsegaye, 2004](#)).

Hitherto, due to a lack of current empirical investigations, it is difficult to acquire adequate information to seek intervention areas for improvement and to help the QM implementation process. As a result, there is a need to collect up-to-date information on QM applications in the Ethiopian industrial scene. Therefore, the purpose of the research is to identify the crucial quality management components that are significant for the success of any organization. And also investigate the challenges of implementing crucial quality management components. Besides, investigate the viability of utilizing these components in selected manufacturing companies.

### **1.3. Research Questions**

This research attempted to provide answers to the following questions.

- What are the crucial quality management components?
- What are the challenges of implementing crucial quality management components in selected manufacturing companies in Ethiopia?
- How is the viability of utilizing crucial quality management components in selected manufacturing companies in Ethiopia?

### **1.4. Research Objectives**

#### **1.4.1. General Objectives**

The general objective of the research is to analyze the effectiveness of the design and implementation of the component of quality management in selected manufacturing companies in Ethiopia.

#### **1.4.2. Specific Objectives**

This research sought to fulfill the following specific objective.

- Identify the crucial quality management components.
- Identify the challenges of implementing crucial quality management components in selected manufacturing companies in Ethiopia.
- Investigate the practicability of applying these components in selected manufacturing companies in Ethiopia.

### **1.5. Significance of the Research**

By analyzing the effectiveness of the design and implementation of the components of quality management presented by this research, there will be an expansion of the current understanding of the manufacturing companies on the quality management components.

This research provides a clear presentation of this quality management component for manufacturing companies, giving them insights into which strategy is more appropriate and useful for them.

Specifically, this research will benefit manufacturing companies in deciding which quality components they should employ. The manufacturing companies may also consider the result of this research to review their quality management practices.



Furthermore, a detailed presentation on the design and implementation of the components of quality management involved in this research may serve as a tool for further studies to innovate the current strategies being employed in the manufacturing companies.

## **1.6. Scope of the Research**

With the objective in mind, the research focused on analyzing the effectiveness of the design and implementation of the component of quality management in selected manufacturing companies in Ethiopia. That being said, the research was conducted from October 2021 to June 2022.

## **1.7. Operational Definition of Basic Terms**

**Effectiveness:** refers to the ability to create a particular result or output.

**Design:** refers to the provision of both assistance and procedures for an organization's quality-related operations to run smoothly (El-Bakry et al., 2010).

**Implementation:** refers to the comprehensive formulation and adoption of all rules and principles that harmonize all corporate procedures and activities (Petkovska & Gjorgjeska, 2003).

**Quality Management:** “refers to all activities of the overall management function that determine the quality policy, objectives, and responsibilities, and implement them by means such as quality planning, quality control, quality assurance, and quality improvement within the quality system” (El-Bakry et al., p-90, 2010).

**Components of Quality Management:** refers to the four crucial quality management components such as quality planning, quality control, quality assurance, and quality improvement (Rose, 2005).

## **1.8. Organization of the Research**

This research is organized in chronological order so that the proofreader can easily capture the flow of the research. Having said that, this research contains five chapters, references, and appendix.

Chapter One\_Introduction: This section provides a porta to the proofreader about the background of the research, statement of the problem, research question, research objective, and the scope of the research, the significance of the research, and operational definition, and the proceeding section highlights.

Chapter Two\_Literature review: Presents a related literature review of the concept, theory, definition, models, and findings on components of quality management.

Chapter Three\_Research Methodology: Describes the methodologies employed in the research, i.e., the overall research plan which incorporates what task should be through & the chronological order of the task, a method to execute the task, what major data is required, what data collecting technique is taken, determine the research sample size, selecting a data source, what data analysis approach/tools/technique/method executed, and also demonstrate how the credibility of the research has been maintained.

Chapter Four\_Result and Discussion: Presents the results/findings of the research investigation and demonstrates how different manufacturing firms design and implement crucial quality management components, and interpret the analysis result.

Chapter Five\_Conclusion, Recommendation: shows a conclusion drawn from the research, and forward a method of how the company can overcome issues related to quality management components.

## CHAPTER TWO

### 2. LITERATURE REVIEW

#### 2.1. Introduction

*This chapter presents a theoretical review, conceptual framework, empirical studies on components of quality management, and a synthesis of the literature review.*

#### 2.2. Theoretical Review

This section aims to present a review of numerous related literature on the theory or theories and discuss how the theory (ies) has been used by other researchers.

##### 2.2.1. Concepts of Quality and Quality Management

Regardless of the challenges in defining the concept of quality exactly, however, several scholars have defined the concept of quality from different perspectives (Saghier & Nathan, 2013). Meanwhile, Harvey & Green (1993) summarize the concept of quality into two different comparative concepts such as quality means different things to different people, and the second relative to a process or outcomes, subsequently, they reflected quality as an exception, value for money, transformative, and fitness for purpose.

Also, based on their importance, the concept of quality can be categorized into five generic classes in terms of, transcendent, product, process or supply, customer, and values approach (Ghobadian et al., 1994). The concept of quality leads to meeting the gap between what customers expect and what they perceive (Shen et al., 2000). Indeed, the concept of quality is quite difficult for customers to understand, consequently, customers describe quality based on their actual perception (Dale, 2003). See, for example, the meaning of quality from figure 2.1.

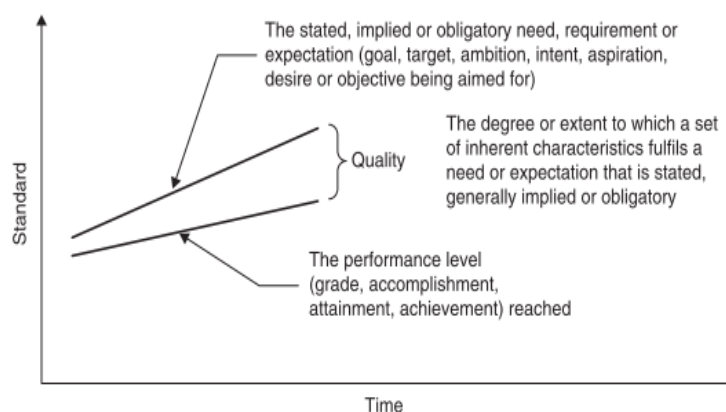


Figure 2. 1 The meaning of quality. Source: (Hoyle, 2007)

In brief, this means when we discuss anything using the concept of quality, it simply implies that we are referring to the extent or degree to which the stated requirement is met. The concept of quality management has evolved over the last decade, from a nascent set of concepts to a comprehensive framework for controlling all aspects of quality in any organization.

Quality management includes guiding and managing aspects such as staff training, supplier quality management, and product or service design; also, from a system–structural perspective, quality management may be described as a simple three-stage process mode (Benson et al., 1991). See, for instance, figure 2.2.

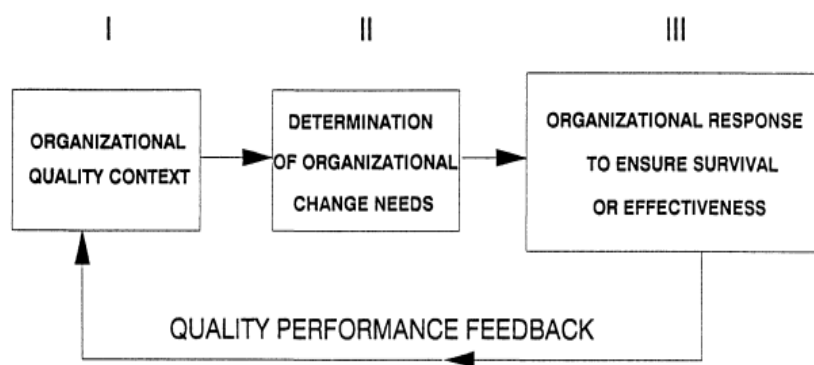


Figure 2. 2 System–structural view of quality management. Source: (Benson et al., 1991)

Quality management is defined as an integrated strategy for achieving and maintaining high-quality output by focusing on the maintenance and continual improvement of processes and defect avoidance at all levels and in all activities of an organization to meet or exceed customer expectations (Flynn et al., 1994). Quality management is described as a management philosophy or strategy comprised of a collection of mutually reinforcing principles, each of which is backed by a set of practices and methodologies (Sousa & Voss, p.92, 2002).

Modern statistical quality control, quality improvement, and reliability operate within the concept of quality management (Bisgaard, 2007, 2008). Finally, the ISO 9000 describes quality management as a coordinated action that directs and controls an organization’s quality (Hoyle, 2007). Quality planning, quality control, quality improvement, and quality assurance are examples of these activities. Next, the researcher will identify the critical quality management component in the next section.

### 2.2.2. Components of Quality Management

It was required to identify each critical quality management component in detail for this research. Numerous scholars stated the pillars of quality management consist of quality planning, quality assurance, quality control, and quality improvement. See, for example, [table 2.1](#).

Table 2. 1 Component of quality management

Components of Quality Management	Variables	References
	Quality planning	Bisgaard (2007), (2008); Hoyle, 2007; Tummala & Tang (1996); Mitra (2016); Visschedijk et al., (2005); Westgard & Westgard (2016)
	Quality control	
	Quality assurance	
	Quality improvement	

Therefore in this section, the critical quality management components are identified. Accordingly, the variables will be used to create the conceptual framework and survey questionnaires, as well as to look into the possibility of using these components in specific manufacturing companies.

### 2.3. Conceptual Framework

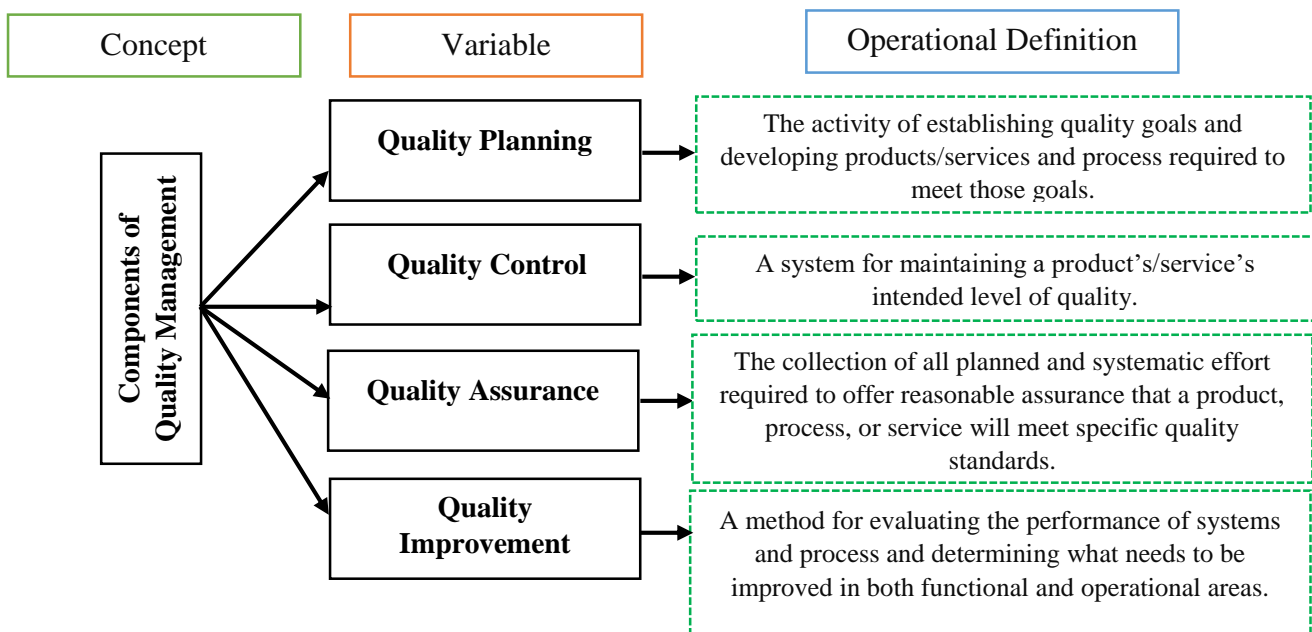


Figure 2. 3 Conceptual Framework. Source: (Author survey,2022)

## 2.4. Empirical Studies

In the previous section theories, regarding quality and quality management have been explained in detail. Further, a critical quality management component was identified. With this in mind, the conceptual framework is created using these identified variables. Therefore in this section, empirical studies will be reviewed in each quality management component in detail.

### 2.4.1. Quality Planning

Several researchers have conducted empirical research over the last decade to explore the impacts of quality planning on different sectors. See, for example, the table below.

Table 2. 2 Empirical studies on quality planning

Author	Research Purpose	Methods	Units of Analysis	Findings
(Lam, 1997)	Investigate the quality planning process & its perceived usefulness.	Factor & Cluster analysis	84 quality managers	Different firms could be grouped according to their strategic planning orientation & the level of planning sophistication was found to moderate significantly the strategic performance baseline.
(Senaratne & Thushangi, 2012)	Explore whether the Sri Lankan construction contractor practices quality planning effectively and the extent to which they are ready to implement strategic quality planning.	Descriptive & Inferential Statistics Analysis	3 large scale constructing firms	ISO 9000 is the most quality management system practiced by Sir Lankan construction contractors.

### 2.4.2. Quality Control

Similarly, numerous scholars have undertaken empirical studies to investigate the effects of quality control in various industries. See, for case, the table below.

Table 2. 3 Empirical studies on quality control

<b>Author</b>	<b>Research Purpose</b>	<b>Methods</b>	<b>Units of Analysis</b>	<b>Findings</b>
(Olayiwola et al., 2019)	Investigate the effect of quality control management and customer retention focusing on the dimensions of employee participation, supplier quality management, higher management commitment, and leadership enhancement in quality.	Pearson Product Moment Correlation & Multiple regression Analysis	150 respondent	+ve significant relationship between high management commitment ( $r = .659$ ), supplier quality management ( $r = .607$ ), employee involvement ( $r = .619$ ), leadership enhancement ( $r = .508$ ) and customer retention.
(Oloo, 2017)	Investigate based on two theories, Deming's theory of total quality management and the reliability theory by Rausand and Hoyland.	Descriptive Statistics & Regression Analysis	5 mobile telecommunication firms	72% of the variation in organizational performance can be accounted for by the variation in the quality control practices discussed, with the remaining 28 % being accounted for by other factors not in the model or by chance variation.
(Alzoubi, 2021)	Investigate the hotel industry in the light of process quality and quality control.	Descriptive statistics, correlation, ANOVA & regression analysis	119 hotel firms	Process quality & quality control has a significant impact on attaining competitiveness in the hotel industry.

### 2.4.3. Quality Assurance

This section presents empirical studies on quality assurance from various sources. See, for instance, [table 2.4](#).

Table 2. 4 Empirical studies on quality assurance

<b>Author</b>	<b>Research Purpose</b>	<b>Methods</b>	<b>Units of Analysis</b>	<b>Findings</b>
<a href="#">(Belina, 2021)</a>	Investigate the extent of quality assurance implementation from the inspection approach & its contribution to quality enhancement & accountability.	Thematic analysis	2 firms	The inspection strategy design at MOE did not practically implement as it was designed & it has a shortage of linkage to the operational practice.
<a href="#">(Sultana et al., 2020)</a>	Empirically investigate the SQA process followed in software companies in Bangladesh.	Quantitative & Qualitative analysis	9 software companies	More than half of the companies fall short in adhering to SQA practices within their SDLC. The rest either fully or partially comply with it.
<a href="#">(Faller, 2018)</a>	Analyze the impact of quality assurance on management practices & staff performance in the technical college of the Sultanah of Oman.	Descriptive-correlation analysis	233 faculty member	The relationship between all the quality assurance implementation and staff performance, implementation & management practices was significant.
<a href="#">(Sowunmi et al., 2016)</a>	Investigate the software quality assurance practices of practitioners in Nigeria	Descriptive statistics	All software firms in Nigeria	It was observed that quality assurance practices are quite neglected and this can be the cause of low patronage.



#### 2.4.4. Quality Improvement

This section presents empirical quality improvement research from a variety of sources.

See, for case, [table 2.5](#).

Table 2. 5 Empirical studies on quality improvement

<b>Author</b>	<b>Research Purpose</b>	<b>Methods</b>	<b>Units of Analysis</b>	<b>Findings</b>
<a href="#">(Maani et al., 1994)</a>	Empirical verification of the operational & strategic value of quality improvement aims to narrow the gap between theory & practice.	Structural Equation Modeling (SEM)	184 plant	Improving quality positively enhances operational performance & productivity.
<a href="#">(Miller et al., 2006)</a>	Investigate quality improvement practices of for-profit & non-for-profit hospitals.	Factor analysis	110 hospitals	Thus, underscoring the utility of quality improvement efforts despite the difference in operating characteristics, strategies & operating constraints is helpful.
<a href="#">(Kokemüller, 2011)</a>	Empirically analyzing the factor influencing the success of data quality improvement.	Structural Equation Modeling (SEM)	179 respondents	Organizational implementation success is positively associated with perceived data quality, whereas no significant contribution of data quality project, to perceived data quality, could be observed.
<a href="#">(Mulay &amp; Khanna, 2020)</a>	Investigate the impact of quality (terms of customer expectations) related to selected administrative processes in professional higher education institutions.	Partial Least Square-Structural Equation Modeling	725 respondents	The admissions process was found to have the most impact on quality, and exam & placement processes also had a significant impact on quality.

## **2.5. Synthesis of the literature review**

Briefly, after exploring deeply into the “related literature review” for theory, concepts of quality, and quality management, it is possible to achieve comprehension. Also, related empirical research has been discussed in-depth on crucial quality management components.

However, there is no evidence of empirical research in the Ethiopian context. Therefore, the research is required to fill or link the knowledge gap existing by empirically marking out the impact of the critical quality management components in the manufacturing sector.

Therefore this research is undertaken to fill both theoretical and practical gaps that existed in this research area, mainly in analyzing and recognizing the vital quality management components. Additionally, explore the practicality of utilizing these components in selected manufacturing companies.

## **CHAPTER THREE**

### **3. RESEARCH METHODOLOGY**

---

*This chapter describes the methodologies employed in the research, i.e., the overall research plan which incorporates what task should be through & the chronological order of the task, a method to execute the task, what major data is required, what data collecting technique is taken, determine the research sample size, selecting a data source, what data analysis approach/tools/technique/method executed, also demonstrate how the credibility of the research has been maintained.*

---

#### **3.1. Research Design**

With the research questions in mind, this research design is mixed (triangulation design) this research design combines both quantitative and qualitative research.

#### **3.2. Research Population**

In this research, the population was selected from manufacturing companies in Ethiopia. See, for example, [table 3.1](#). According to the report published by Ethiopian central statistical agency, more than 64 percent of manufacturing industries are located in Addis Ababa and Oromia region (ECSA, 2012). A total of 302 large and medium companies found in six major industrial group in Ethiopia. The study has taken a sample of 4 companies from Addis Ababa. They were randomly selected with their corresponding address. At the time of the research, the selected manufacturing companies had a total number of employees ranging between 5,000 and more. As a result, it is impossible to include all personnel in the research.

Table 3. 1 Research Population

<b>No.</b>	<b>Company Name</b>	<b>Location</b>
<b>1</b>	MOHA Soft Drinks Industry	Addis Ababa, Teklehaimanot area
<b>2</b>	BGI Ethiopia	Addis Ababa, Mexico area
<b>3</b>	National Alcohol Factory	Addis Ababa, Mekanisa area
<b>4</b>	Coca – Cola	Addis Ababa, Abinet area

### 3.3. Research Sample Size

In this research, simple random sampling was selected. Moreover, according to Daniel (1999) cited in Naing et al. (2006) for infinite sample size calculation, the equations below can be used to calculate the research sample size.

$$n = \frac{Z^2 * p(1-p)}{d^2} \text{----- Eq. (1)}$$

Where:

- n = sample size with infinite population
- Z = Z statistic for a level of confidence
- P = expected proportion (in a proportion of one) &
- d = precision (in a proportion of one)

Naing et al. (2006) suggest that if we take the P value between 20% to 30%, we should select 30% because it will give a maximum sample size, also if we look out the P value between 60% to 80%, we should select 60% because it will give as maximum sample size, finally, if we choose to select the P value between 40% to 60%, we should select 50% as it will give as a maximum sample size for more see the figure 3.2 below.

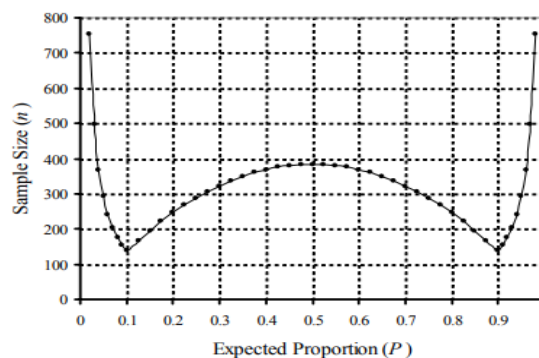


Figure 3. 1 Relationship between sample size and expected proportion (prevalence). Source: (Naing et al., 2006)

Therefore, the sample size is calculated as follows. “For confidence level which is 95% is conventional, the value of Z will be 1.96, whereas investigators who want to be more confident they can take 99% with the value of Z, 2.58” (Naing et al., 2006). P = 0.5, Z = 1.96, d = 0.05.

$$n = \frac{1.96^2 * 0.5(1-0.5)}{0.05^2} = 384.16 \approx 385$$

Table 3. 2 Sampling design

<b>No.</b>	<b>Company Name</b>	<b>Total Population</b>	<b>Sampling Design</b>
<b>1</b>	MOHA Soft Drinks Industry	96	Purposive
<b>2</b>	BGI Ethiopia	96	Purposive
<b>3</b>	National Alcohol Factory	96	Purposive
<b>4</b>	Coca – Cola	96	Purposive

### **3.4. Inclusion Criteria**

The Case Company's General Manager/D.G Manager, Head of Department/Section, QMS coordinators/ Quality Teams and with the help of QMS, the implementation of proposal, development and final evaluation, there have been number of permanent and general staff members who are involved.

### **3.5. Exclusion Criteria**

The Case Company's employees, who were field workers (like purchasers, sellers) and those who are newly employed and had inadequate knowledge/information for the quality management implementation were excluded.

### **3.6. Data Collection Methods**

In this research, due to the sample size, it was difficult to distribute all survey questionnaires to the respondent physically because of the current COVID-19 pandemic. However, to overcome these issues the researcher developed a personal website to collect the data online from the respondent.

### **3.7. Data Collection Instruments**

In this research data were collected using close-ended survey questionnaires and interviews. Close-ended survey questionnaires and interviews were used to obtain data relevant to the research objective and research questions. The purpose of the research is to analyze the effectiveness of the design and implementation of the components of quality management in the MOHA soft drinks industry (Addis Ababa, Teklehaimanot area), National Alcohol Factory (Addis Ababa, Mekanisa area), BGI Ethiopia (Addis Ababa, Mexico area), and Coca-Cola (Addis Ababa, Abinet area).

### **3.8. Pre-Testing (Validity and Reliability)**

The pre-testing (validity and reliability) of the scales utilized in this research is an important factor that empowers the research to provide valuable results. Different techniques have been suggested to validate data quality among them is content validity which contains taking expert opinion and statistical methods (SÜRÜCÜ & MASLAKÇI, 2020). In this research, a statistical method which is factor analysis (exploratory factor analysis) was used to validate the data quality.

In reliability cases, there are so many methods suggested by various literature. Among them, the most preferred method is the internal consistency method which includes (split-half, item-total correlation, and Cronbach's-alpha/coefficient alpha). Among these, the most frequently used method is Cronbach's-alpha/coefficient alpha. Even though the Cronbach's-alpha/coefficient alpha is translated in numerous ways in the literature, the most common interpretation is described in table 3.2.

Table 3. 3 The Classification of Cronbach's Alpha Coefficient. Source: (SÜRÜCÜ & MASLAKÇI, 2020)

<b>Cronbach's Alpha Coefficient</b>	<b>Interpretation of Cronbach's Alpha Coefficient</b>
$\geq 0.9$	The internal consistency of the scale is high
$0.7 \leq \alpha < 0.9$	The scale has internal consistency
$0.6 \leq \alpha < 0.7$	The internal consistency of the scale is acceptable
$0.5 \leq \alpha < 0.6$	The internal consistency of the scale is weak
$\alpha \leq 0.5$	The scale has no internal consistency

Briefly, in this research, Cronbach's-alpha/coefficient alpha was utilized to check the internal consistency of the data.

### 3.8.1. Reliability Statistics

The main aim of conducting reliability statistics analysis (Cronbach's-alpha/coefficient alpha) is to identify the internal consistency of the data. Therefore, the table below indicates that the Cronbach's-alpha/coefficient alpha value of each construct falls between  $0.7 \leq \alpha < 0.9$  which shows that the scale has internal consistency.

Table 3. 4 Reliability statistics for Cronbach's alpha. Source: (Author survey,2022)

No.	Construct	Item	Cronbach's-alpha ( $\alpha$ )	N
1	Quality Planning	QP <sub>1</sub>	0.856	120
		QP <sub>2</sub>		
		QP <sub>3</sub>		
		QP <sub>4</sub>		
		QP <sub>5</sub>		
		QP <sub>6</sub>		
2	Quality Control	QC <sub>1</sub>	0.869	120
		QC <sub>2</sub>		
		QC <sub>3</sub>		
		QC <sub>4</sub>		
		QC <sub>5</sub>		
		QC <sub>6</sub>		
3	Quality Assurance	QA <sub>1</sub>	0.726	120
		QA <sub>2</sub>		
		QA <sub>3</sub>		
		QA <sub>4</sub>		
		QA <sub>5</sub>		
4	Quality Improvement	QI <sub>1</sub>	0.786	120
		QI <sub>2</sub>		
		QI <sub>3</sub>		
		QI <sub>4</sub>		
		QI <sub>5</sub>		
		QI <sub>6</sub>		

### 3.8.2. Validity Statistics

#### Exploratory factor analysis

The Kaiser-Meyer-Olkin (KMO) test is used in this research to determine the sampling adequacy of data that will be used for exploratory factor analysis. The KMO test also allows us to ensure that the data we have are suitable for running an exploratory analysis and it also determines whether or not we have specified what we intend to measure.

Furthermore, a KMO score between 0.8 and 1 shows that the sample is appropriate if the KMO value is less than 0.6 the sampling is insufficient for analysis. Therefore, the table below shows that the KMO test value is 0.892 which is between 0.8 and 1 indicating that the sampling is appropriate for further exploratory factor analysis.

Table 3. 5 KMO and Bartlett's test. Source: (Author survey,2022)

KMO & Bartlett's Test		
Kaiser-Meyer-Olkin measure of sampling adequacy		0.892
	Approxi Chi-square	1848.058
Bartlett's Test of sphericity	df.	0.231
	Sig.	0.000

Furthermore, the usefulness of exploratory component analysis was verified by Bartlett's test of Sphericity, which is employed as a measure of the strength of the link between variables. The score of Bartlett's Test of Sphericity (Chi-Square) is 1,848.058, suggesting that the data were suitable to proceed with the exploratory component analysis.

Table 3. 6 Total variances explained. Source: (Author survey,2022)

Total Variance Explained						
Components	Initial Eigen Values			Rotations sums of squared loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	10.236	46.527	46.527	9.965	45.297	45.297
2	3.047	13.851	60.377	2.585	11.749	57.047
3	2.449	11.133	71.510	2.296	10.438	67.485
4	1.804	8.200	79.710	2.152	9.784	77.268
5	1.679	7.630	87.340	1.985	9.021	86.290
6	1.199	5.448	92.788	1.430	6.498	92.788

Note: Extraction Method: Principal Component Analysis



The primary objective of doing exploratory factor analysis is to identify the important factors or dimensions of competing priorities. To assess the number of components to keep for quality management, the researcher applied the notion of Kaiser's rule (Eigenvalue >1), but with a more interpretable factor loading.

Similarly, the leftmost section of the preceding table represents the variation explained by the first solution; only six components in the initial solution have Eigenvalue >1, and the entire cumulative percentage weights 92.788 percent of the variability in the original variables. This suggests that six hidden influences are linked to quality management. However, the remaining components are unexplained variances since their Eigenvalue is less than one.

Likewise, the rightmost half of the preceding table represents the variation explained by the extraction factor after rotation. The rotation factor model makes minor modifications to all six components.

Following the completion of the aforementioned stage, which is the KMO and Bartlett's Test of Sphericity, the researcher conducted exploratory factor analysis utilizing the principal component extraction method with quartimax rotation and Kaiser Normalization. Kaiser normalization is used to provide solution stability across samples; in this analysis, all elements have equal weight while rotating.

Similarly, quartimax is used for orthogonal rotation because it finds overall factors as well as optimizes squared loading such that each item loads most strongly onto a single factor. Similarly, orthogonal rotation analysis presupposes that all factors are independent or unrelated to one another.

Table 3. 7 Exploratory factor analysis of components quality management. Source: (Author survey,2022)

<b>Rotated component matrix</b>						
<b>Construct</b>	<b>Components</b>					
	1	2	3	4	5	6
QP <sub>1</sub>	0.929					
QP <sub>2</sub>	0.912					
QP <sub>3</sub>	0.757					
QP <sub>4</sub>	0.840					
QP <sub>5</sub>	0.795					
QP <sub>6</sub>	0.856					

QC <sub>1</sub>	0.516
QC <sub>2</sub>	0.762
QC <sub>3</sub>	0.750
QC <sub>4</sub>	0.900
QC <sub>5</sub>	0.779
QC <sub>6</sub>	0.850
QA <sub>1</sub>	0.964
QA <sub>2</sub>	0.473
QA <sub>3</sub>	0.667
QA <sub>4</sub>	0.979
QA <sub>5</sub>	0.642
QI <sub>1</sub>	0.903
QI <sub>2</sub>	0.736
QI <sub>3</sub>	0.689
QI <sub>4</sub>	0.855
QI <sub>5</sub>	0.883
QI <sub>6</sub>	0.502

Note: Extraction Method: principal component analysis

Rotation Method: Quartimax with Kaiser Normalization

Rotation coverage in 7 iteration

### **3.9. Ethical Considerations**

[Kaewkungwal & Adams \(2019\)](#) assert that research ought to be outlined, checked on, and conducted, and the result dissemination mechanisms, with logical astuteness, and concordant with ethical considerations. Besides, the research should provide a clear explanation to participants about who the researcher is, what the intent of the research is, what data will be collected from them, how the data will be collected from them, and what level of commitment is required from them, how this data will be used and reported, and finally what are the potential risks of taking part in the research ([Fleming & Zegwaard, 2018](#)).

### **3.10. Result Dissemination Mechanisms**

[Stephen Ifedha Akaranga & Makau \(2016\)](#) state that research results can be disseminated using journal articles, books, and thesis or dissertations. So, the researchers used a thesis report as the result dissemination mechanism.

## CHAPTER FOUR

### 4. RESULT and DISCUSSION

*This chapter presents the results/findings of the research investigation and demonstrates how different manufacturing firms design and implement crucial quality management components.*

#### 4.1. Results/Findings

After having the research objective in mind, two types of data collection instruments were used in this research. These instruments comprise interviews (open-ended questionnaires) and survey questionnaires (close-ended questionnaires). First, the interview was undertaken in selected manufacturing companies for a specified duration and scheduled one on one meetings with quality managers, general managers, QMS coordinators/ quality teams, and the head of a department/section.

Then, after collecting the interview response data, it's necessary to find and select an appropriate method and software to analyze it systematically. To do so, [Saldaña, \(2012\)](#) established a methodology in his book on how to undertake a qualitative analysis of data from an interview (open-ended questionnaires). Moreover, this methodology includes detailed coding, categorizing, themes, and theory analysis. See, for example, [figure 4.1](#) below.

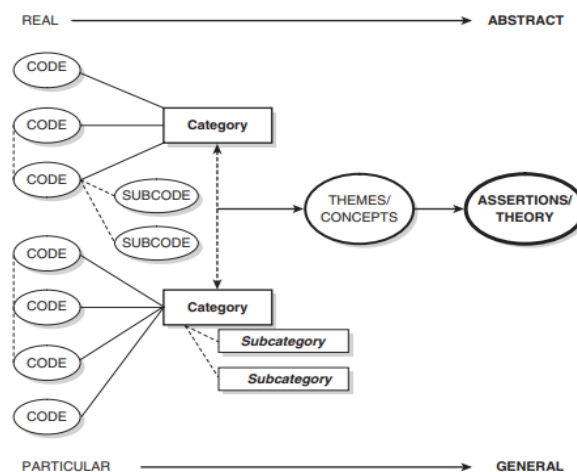


Figure 4. 1 A streamlined codes-to-theory model for qualitative inquiry. Source: [\(Saldaña, 2012\)](#)

## Data formatting process

Consequently, in this research, [Saldaña's \(2012\)](#) methodology and Nvivo 11 plus software have been used to analyze an interview's response data systematically. As have described earlier, using the method in the qualitative analysis, the first step was to organize and sort the interview response data manually. See, for example, [figure 4.2](#).

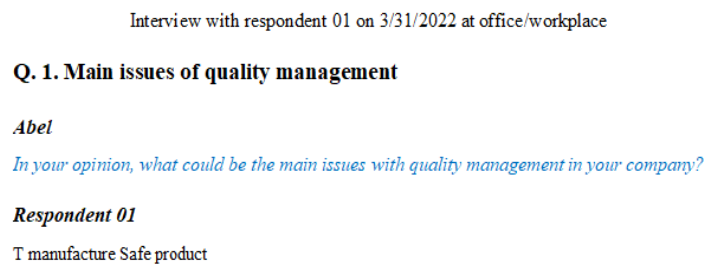


Figure 4. 2 Interview response data. Source: [\(Author survey,2022\)](#)

Following the first step, the next step will be importing those interview response data into the Nvivo 11 plus software for further analysis. In line with this, Nvivo 11 plus software will help us to conduct a qualitative analysis through detailed steps or procedures, which contain coding, categorizing, themes/synthesizing, and theorizing of the interview response data. See, for example, [figure 4.3](#).

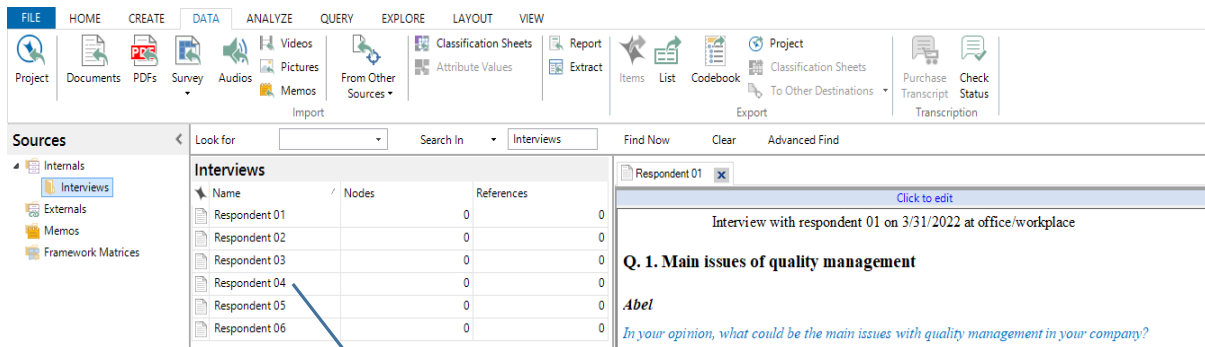


Figure 4. 3 Nvivo 11 plus software: Interview transcript. Source: [\(Author survey,2022\)](#)

Interview transcript

### Pre-Coding process

Before beginning to code each interview transcript, first, each interview transcript must be labeled by using source style and structure. After that, each interview transcript will be grouped based on its associated label. See figure 4.4 for a complete breakdown of the analysis.

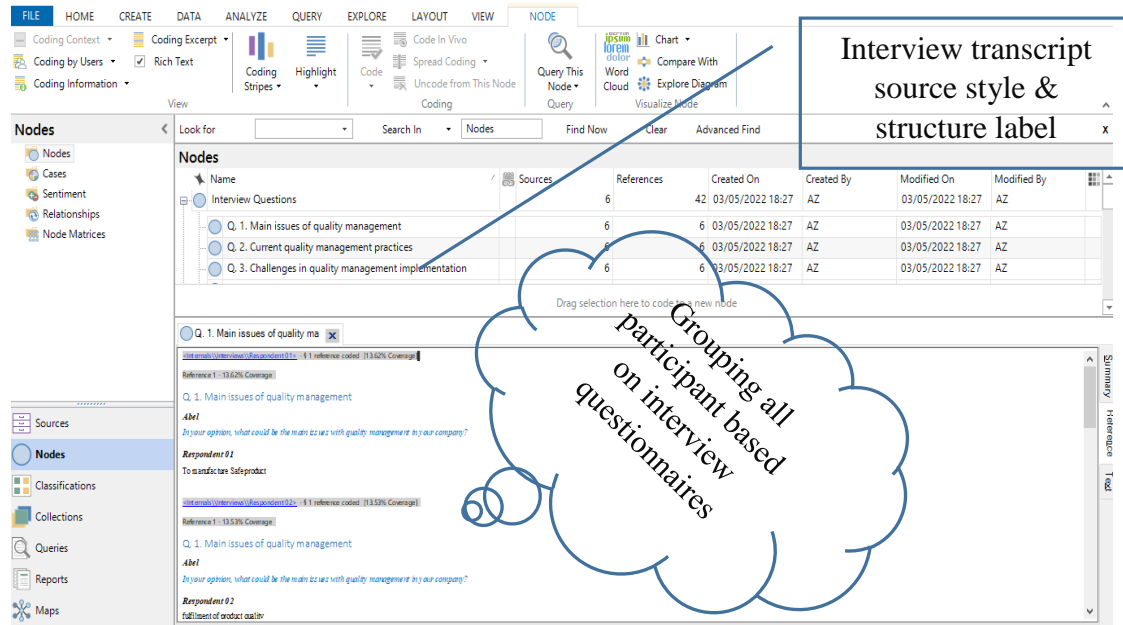


Figure 4. 4 Pre-coding process. Source: (Author survey,2022)

### Coding process

After finishing the pre-coding process, the next step is to begin coding each interview transcript. The fundamental goal of this procedure is to code each response depending on the sorts of interview questionnaires.

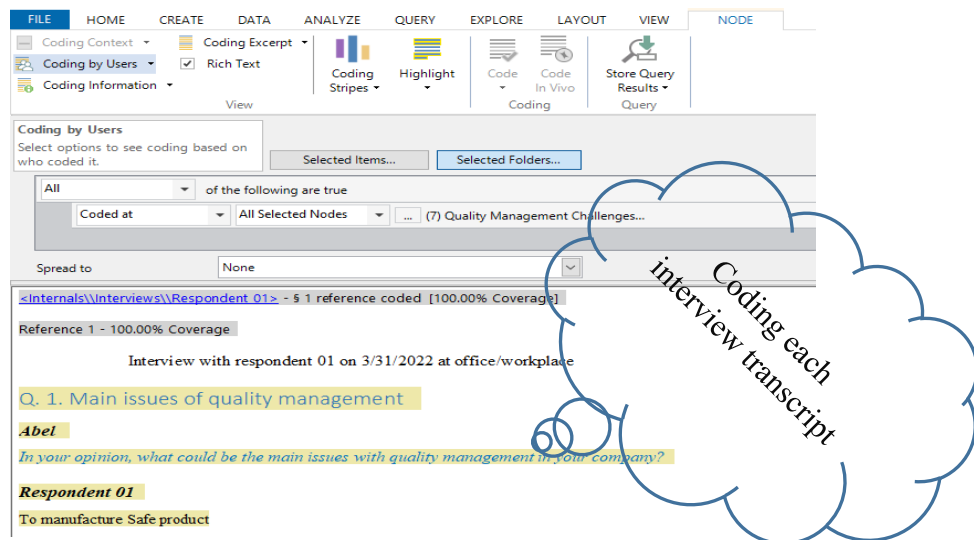


Figure 4. 5 Coding interview transcript. Source: (Author survey,2022)

### Categorizing process

The essential phases in the categorizing process are to map and place each code in its appropriate nodes (containers). The interview transcript is divided into nodes of the different labels of classes, as shown in [figure 4.6](#).

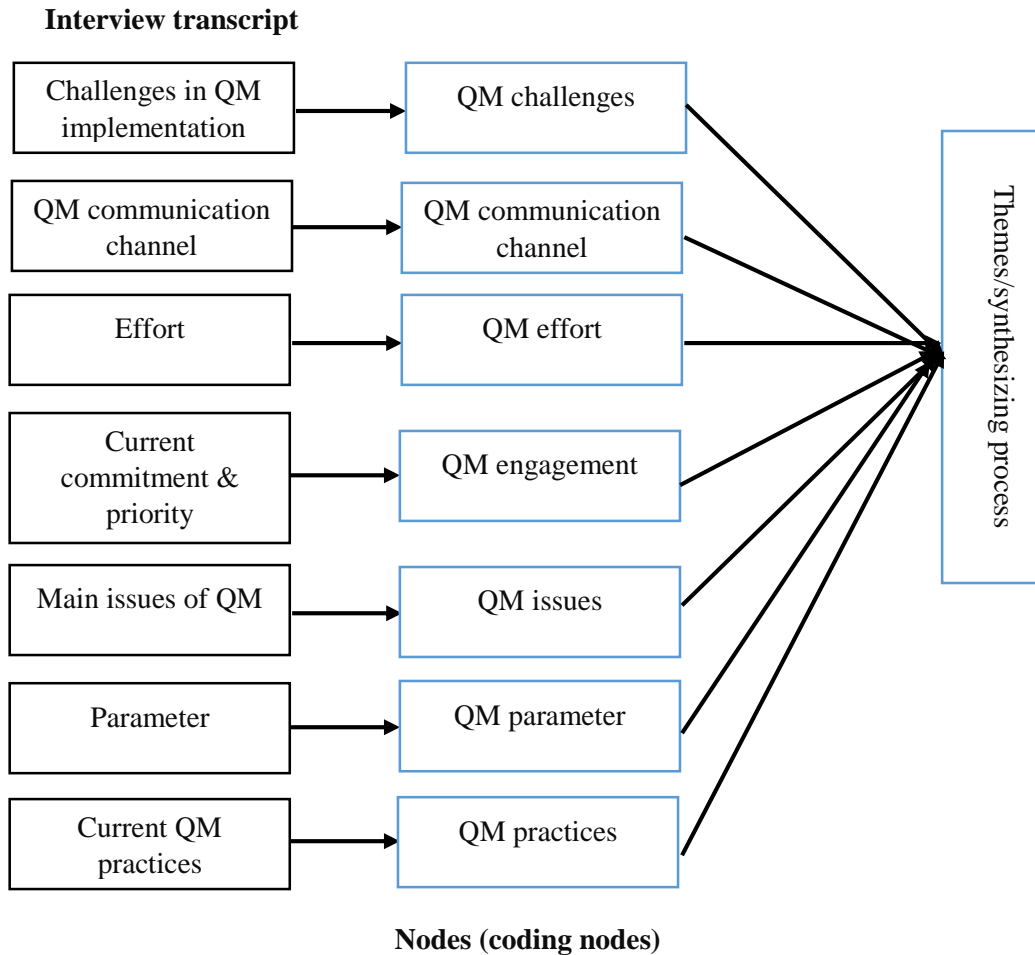


Figure 4. 6 Categorizing process. Source: [\(Author survey,2022\)](#)

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**Themes/synthesizing process**

The themes/synthesis process is a critical analysis that determines what source and reference units are about and/or what they mean.

Table 4. 1 Themes/synthesizing process. Source: (Author survey,2022)

No.	Description	Source/file	Reference
	<b>QM issues</b>	<b>6</b>	<b>13</b>
1	Documentation	8	24
	Communication	9	23
	Regulatory & statutory criteria	14	28
	Availability of raw materials	10	26
	Lack of awareness of quality management	15	34
	<b>QM practices</b>	<b>5</b>	<b>6</b>
2	QMS	7	13
	EMS	5	13
	LMS	4	11
	TQM	11	22
	Lean six sigma	6	12
	FSSC-22000 police	8	15
	<b>QM challenges</b>	<b>5</b>	<b>11</b>
3	Employee competence	9	18
	Management & employee commitment	6	29
	Lack of training	4	14
	Exceeding customer requirement	7	28
	Format/procedure	6	15
	ISO standard requirement	4	22
	Adoption of ISO standard	7	25
	Familiarizing the system within the organization	9	49
	<b>QM engagement</b>	<b>6</b>	<b>7</b>
4	Management	10	50
	Employee	12	38
	<b>QM communication channel</b>	<b>6</b>	<b>13</b>
5	Memo	8	35
	Meeting	6	29
	Email	7	49
	Document release	8	58
	<b>QM effort</b>	<b>5</b>	<b>13</b>
6	Trained personnel	4	18
	Cooperation	6	11

*Analysing the Effectiveness of the Design and Implementation of the Components of Quality Management in Selected Manufacturing Companies, Ethiopia*

	Engagement of people	3	21
	Team spirit	2	13
	Commitment	3	11
	Communication	4	13
	Skilled manpower	6	17
	<b>QM parameters</b>	<b>7</b>	<b>13</b>
	Frequent training	2	17
	Management & employee commitment	10	33
	Planned policy	5	15
7	Top management involvement	12	27
	Adequate resource allocation (personnel, machine, raw materials)	16	64
	Proper documentation	8	21
	Teamwork	6	19
	Skilled professional	5	22

### Theorizing process

The following outcome or theories are identified based on the analysis obtained from the themes/synthesis process. To illustrate, let's consider the following theories. And the current main quality management issues found in those selected manufacturing companies include such as documentation, communication, etc.

Similarly, QMS, EMS, LMS, TQM, FSSC-22000 police, and lean six sigma are examples of current quality management approaches in chosen manufacturing organizations. Furthermore, each of the selected manufacturing organizations is confronting obstacles related to staff competency, management & employee dedication, lack of training, and other quality management challenges.

Secondly, survey questionnaires (close-ended questionnaires) were distributed to respondents online through [abelzewde.blogspot.com](http://abelzewde.blogspot.com), and the collection of survey data was undertaken online, in line with this, the participation was voluntary.



### Descriptive statistics analysis

Descriptive statistics analysis indicates that the majority of the quality management components' practicality is very low in selected manufacturing companies. This means the manufacturing companies should note the crucial quality management components.

Table 4. 2 Descriptive statistics. Source: (Author survey,2022)

<b>Manufacturing industries</b>			
Construct	Std. deviation	Skewness	Kurtosis
QP <sub>1</sub>	1.2050	-0.942	-0.050
QP <sub>2</sub>	0.8982	-0.849	0.182
QP <sub>3</sub>	1.0241	-0.275	-1.038
QP <sub>4</sub>	0.5021	0.000	-2.034
QP <sub>5</sub>	0.8754	-0.514	-0.283
QP <sub>6</sub>	0.2148	-0.756	-0.124
QC <sub>1</sub>	0.9258	-1.938	2.643
QC <sub>2</sub>	0.7515	-0.348	-1.151
QC <sub>3</sub>	0.4602	-0.884	-1.240
QC <sub>4</sub>	0.9204	-1.673	-1.953
QC <sub>5</sub>	0.4920	-0.413	-1.860
QC <sub>6</sub>	0.4017	-1.519	0.312
QA <sub>1</sub>	0.8754	-1.321	1.450
QA <sub>2</sub>	0.4602	-0.884	-1.240
QA <sub>3</sub>	0.4602	-0.884	-1.240
QA <sub>4</sub>	0.8096	-1.159	-0.454
QA <sub>5</sub>	0.4602	-0.884	-1.240
QI <sub>1</sub>	0.8341	-1.251	1.615
QI <sub>2</sub>	0.9204	-1.673	1.953
QI <sub>3</sub>	0.8341	-0.191	-1.540
QI <sub>4</sub>	0.4920	-0.413	-1.860
QI <sub>5</sub>	0.8754	-1.321	1.450
QI <sub>6</sub>	0.4920	-0.413	-1.860

This analysis enables us to identify the major causes of the problem related to components of quality management implementation in selected manufacturing companies. This helps the companies to understand the quality management system drawback and improve the system.

## **4.2. Discussion**

### **4.2.1. Interview question analysis**

There were 10 distinct staff members from top management, middle management, and employees for this study, all of whom were critical sources of information. The number of interview questions is seven, as stated in the appendix A.

According to the interview. Each of the selected manufacturing organizations is confronting obstacles related to staff competency, management & employee dedication, lack of training, and other quality management challenges. Additionally, documentation, lack of communication, regulatory & statutory criteria, availability of raw materials, and Lack of awareness of quality management are the major factor for the ineffective implementation of quality management.

On the other hand, even though they had difficulties throughout the entire quality management implementation process, they had set a requirement for the successful implementation of quality management.

Accordingly, for successful implementation of quality management, cooperation, people involvement, team spirit, dedication, communication, and a qualified workforce are required. And regular training, top management and employee engagement, planned policy, sufficient resource allocation (people, machines, raw materials), and correct documentation are all necessary.

### **4.2.2. Descriptive statistics analysis**

The study looks into the efficacy of the design and execution of a quality management component. The goal is to achieve the study's objective by using systematic procedures. The first step is to identify the critical quality management components. By this, thorough literature research was done to identify these components. Accordingly, to investigate the practicability of applying these components in selected manufacturing companies. A descriptive statistics are conducted.

The overall four crucial quality management components have been acknowledged for the case companies to investigate the practicability of applying these components in selected manufacturing companies.

A 23-item questionnaire has been designed consisting of quality planning, quality assurance, quality control, and quality management. Three hundred eighty-five inquiries were addressed and returned with a 100% response rate. The reliability and measurement of the items are a minimum of 0.5 value using the Cronbach's Alpha Coefficient with all groups. The coefficient total value of the supplementary accreditation was said to be 0.869. Therefore it is suitable to give more inquiries.

Based on the descriptive statistics obtained, under quality planning, there are six sub-criteria. Among these companies, employees are given adequate time to plan for and test improvement and each department and workgroup within this company/division/team maintains specific goals to improve quality are exceptionally skewed negatively.

Under quality control, there are six sub-criteria. All of them are skewed negatively. However, the quality and supervision organization is sited enough to ensure satisfactory quality control in the companies, the company/division/department/teams have adequate knowledge to challenge quality control results in the organizations, and quality control is performed efficiently at the companies are significantly skewed negatively. Similarly, under quality assurance, there are five sub-criteria.

The companies/divisions/departments/teams view quality assurance as continuing search for ways to improve, and the company has an independent quality assurance department within the company that is strongly skewed negatively. Finally, under quality improvement, there are six sub-criteria. All of them are skewed negatively. Nonetheless, the company/division/department/teams provide highly visible leadership in maintaining an environment that supports quality improvement, and the company/division/department/teams allocate adequate organizational resources (e.g finance, people, time, and equipment) to improve quality, and quality improvement only involves managers are significantly skewed negatively.

## **CHAPTER FIVE**

### **5. CONCLUSION and RECOMMENDATION**

#### **5.1. Conclusion**

The present research contributes to the dearth of research on quality management components in emerging manufacturing companies, particular in Ethiopia, whereas past research has solely, focused on the total quality management practices, however, the present research has focused on exploring the crucial quality management components that are significant for the success of any manufacturing companies. And investigate the challenges of implementing crucial quality management components and the viability of utilizing these components in Ethiopian selected manufacturing companies.

Based on the survey of 4 manufacturing firms in Addis Ababa, Ethiopia, this research address the current situation of quality management components in Ethiopia. Strategies for improving the situation are also presented which hope to be useful for Ethiopian manufacturing industries.

The findings of the interview analysis indicate that the manufacturing businesses are confronted with obstructions relating to staff competency, administration & representative devotion, training requirements, and other quality administration issues. Documentation, the necessity for communication, administrative and regulatory standards, the accessibility of raw materials, and the need for quality management mindfulness are all key factors in the ineffective execution of quality management.

Besides, for effective usage of quality management, participation, individual association, group soul, devotion, communication, and a qualified workforce are required. And normal preparation, best administration, worker engagement, arrangement, adequate asset assignment (individuals, machines, crude materials), and rectifying documentation are all vital.

The outcome of the descriptive analysis support that the practicality of quality management components in selected manufacturing companies was found to be low throughout all tents, including quality planning, quality control, quality assurance, and quality improvement, according to an analysis of the quality management components self-assessment report evaluation.

## **5.2. Recommendation**

Based on the analysis made, a result obtained, and a conclusion drawn the following recommendation is forwarded. The manufacturing companies adopt and implement the crucial quality management components for comparison and selecting the best practices for improved operational performance.

Manufacturing firms in Ethiopia have to benchmark themselves against the best firms globally to enhance competitiveness. To enhance the quality management components the following approach is suggested.

- The management should sustain their commitment to quality management components initiatives and take an active role in all quality management components.
- A program of ongoing, on-the-job training, needs to be developed and implemented.
- A culture of teamwork and cooperation must be developed throughout the organization.
- There must be adequate resource allocation (manpower, machine, raw material, etc.)
- There must be proper documentation and high-quality management components awareness must be developed throughout the organization.

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## **APPENDIX**

### **Appendix A**

#### **Cover Letter**

Dear Respondent:

My Name is Abel Zewde, I am currently researching a thesis as partial fulfillment of the requirement for the degree of Master of Science in quality and productivity management, at the School of Graduate Studies of St. Mary's University (SMU). The research is carried out to *analyze the Effectiveness of the Design and Implementation of the Components of Quality Management in Selected Manufacturing Companies, in Ethiopia*. And you have been nominated to participate in this research, due to the importance of your information in the research. Also, the information you provide will be used only for this research, and your information will be kept strictly confidential.

If you have any queries, concern please do not hesitate to contact me, and I am available at my Mobile number, \_\_\_\_\_; Email address, \_\_\_\_\_.

Thank you for your valuable time.

2022  
Addis Ababa, Ethiopia

## Quality Management Components Survey Questionnaire

**Direction:** - This questionnaire contains statements about quality management components belief that the company should have the features described by each statement. Please mark (√) or (X) in the provided space.

No.	Questionnaire	Likert scale				
		Strongly disagree	Disagree	No opinion	Agree	Strongly agree
		1	2	3	4	5
<b>Quality Planning</b>						
1	Companies employees are given adequate time to plan for and test improvement					
2	Each department and workgroup within this company/division/ team maintains specific goals to improve quality					
3	The company/division/department/team's quality improvement goals are known throughout the organization					
4	The company/division/department/team's employees are involved in developing plans for improving quality					
5	Middle managers (e.g, department heads, program directors, and first-line supervisors) are playing a key role in setting priorities for quality improvement					
6	Non-managerial employees are playing a key role in setting priorities for quality improvement					
<b>Quality Control</b>						
7	The quality and supervision organization is sited enough to ensure satisfactory quality control in the companies					
8	The support provided by the company/division/department/team is					

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	satisfactory to control quality issues in the companies					
9	The organization's quality control requirements are established and communicated throughout the companies					
10	The company/division/department/teams have adequate knowledge to challenge quality control results in the organizations					
11	The organization management system is adequate for efficient quality control in the companies					
12	Quality control is performed efficiently at the companies					
<b>Quality Assurance</b>						
13	The companies/divisions/departments/teams view quality assurance as continuing search for ways to improvement					
14	The quality assurance staff effectively coordinate their efforts with others to improve the quality of product and service the company provides					
15	The companies/divisions/departments/teams regularly check equipment and supplies to make sure they meet the quality requirement					
16	The company has an independent quality assurance department the company					
17	In the company deviations and non-conformance investigations are documented and filed					
<b>Quality Improvement</b>						
18	The company/division/department/teams provide highly visible leadership in maintaining an environment that supports quality improvement					

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19	The company/division/department/teams allocate adequate organizational resources (e.g. finance, people, time, and equipment) to improve quality					
20	The companies seek information on needs and suggestions for quality improvement directly from external customer					
21	Quality improvement only involves managers					
22	The Companies quality improvement considers information from clients or customers					
23	The Companies quality improvement involves data					

## Quality Management Components Interview Questionnaire

- 1.) In your opinion, what could be the main issues with quality management?
- 2.) What is the weakness of the organization in quality management at the site?
- 3.) What are the challenges you face in quality management implementation in your organization?
- 4.) Which improvement would you suggest to have efficient and satisfactory quality management on-site?
- 5.) How and in what ways are quality management-related issues communicated?
- 6.) What do you think must be fulfilled for successful quality management implementation in general?
- 7.) How do you see management commitment and priority for quality management implementation?



## Appendix B

No.	Name	Description	Source/file	Reference
1	<b>Quality management challenges</b>	This node will store all perceptions about current quality management challenges found in the manufacturing company (a manufacturing company where my participants work)	5	11
2	<b>Quality management communication channel</b>	This node will store all perceptions about the current quality management communication channel found in the manufacturing company (a manufacturing company where my participants work)	6	13
3	<b>Quality management effort</b>	This node will store all perceptions about current quality management efforts found in the manufacturing company (a manufacturing company where my participants work)	5	13
4	<b>Quality management engagement</b>	This node will store all perceptions about current quality management engagement found in the manufacturing company (a manufacturing company where my participants work)	6	7
5	<b>Quality management issues</b>	This node will store all perceptions about current quality management issues found in the manufacturing company (a manufacturing company where my participants work)	6	13
6	<b>Quality management parameter</b>	This node will store all perceptions about current quality management parameters found in the manufacturing company (a manufacturing company where my participants work)	6	13
7	<b>Quality management practices</b>	This node will store all perceptions about current quality management practices found in the manufacturing company (a manufacturing company where my participants work)	5	6