

**A STUDY OF QUALITY CONTROL SYSTEMS USED BY
MANUFACTURING FIRMS IN KENYA**

PRESENTED BY

**REHANA EBRAHIM MITHWANI
REGISTRATION NUMBER D61/71503/2008**


**A MANAGEMENT RESEARCH PROJECT SUBMITTED IN PARTIAL
FULFILLMENT OF REQUIREMENTS FOR THE AWARD OF MASTER OF
BUSINESS ADMINISTRATION DEGREE (MBA) DEGREE, SCHOOL OF
BUSINESS, UNIVERSITY OF NAIROBI.**

OCTOBER 2011

DECLARATION

a) Declaration by the Student


I declare that this is my original work and has not been presented for a degree in any other university.

Signed: .....
REHANA EBRAHIM MITHWANI
Reg. No. D61/71503/2008

Date 14/11/2011.....

b) Declaration by the Supervisor

This project has been submitted for examination with my approval as the University Supervisor

Signed.....

DR. X.N.IRAKI
Lecturer
School of Business

Date.....
10/9/14

ACKNOWLEDGEMENT

After writing the entire project, I find myself with no words to express my thanks to all the people who have helped me get through this journey! Nonetheless, I'll definitely try my best!

First and foremost, I'd like to thank my parents for their unstinting support and tenacious daily calls enquiring as to the current state of my project! This not only helped me through the project, it also gave me the motivation to work faster so I could one day say I was DONE!

I also acknowledge all the respondent organizations of my study, although I'm not at liberty to mention them by name. I thank them for taking time out of their busy schedule to give me the information that I needed.

I'd like to acknowledge my colleagues at the University of Nairobi: the bouncing around of different ideas over coffee made me focus on what was to be done and how it was going to get done.

My family for their generous support during the project, their advice on how to maintain a work-project balance and their numerous calls over vast miles to cheer me up when the going got tough!

Finally, last but not least, my University Supervisor Dr. XN Iraki, without whose advice and input this project would merely be another idea in my head. When the going got tough, it was all about panic calls and emails to Dr. Iraki for a rescue!

THANK YOU.

DEDICATION

This project is dedicated to my father Ebrahim Mithwani, my mother Amina Mithwani and to all of my family. Thank you for putting up with all my ups-and-downs and helping me find my light at the end of the tunnel. A special mention to my sister Raheela: my muse.

ABSTRACT

Despite the vast research done on quality control systems in service firms in Kenya, little is known or perceived of quality control systems used by the Kenyan manufacturing sector. Kenya's manufacturing sector is made up of twelve different types of industries and is responsible for 16.3% of the nation's Nominal GDP.

This research aimed at analyzing the quality control systems used by manufacturing firms in Kenya in a bid to understand how manufacturing firms in Kenya are geared towards following international standards of quality control and to gain an in-depth understanding of the decisions made by operations managers in manufacturing firms in Kenya and their psyche towards implementation of cost-prohibitive quality control mechanisms.

The study was carried out via interviewing a sample of organizations within different industries and analyzing their quality control systems to determine the extent to which global best practice systems are used. The results obtained, while proving that 100% of all manufacturing firms in Kenya have internal quality controls also proved that only 29% of these firms are actually using best practice quality control systems, whereas 33% have very rudimentary quality controls in place.

Another key finding was that of the respondents in the study, 63% were ISO9001:2008 certified and 21% were ISO 22000: 2005 certified. The implications of this on the research objectives is that while specific Kenyan Manufacturing Firms are moving towards World Class Organization status in quality control systems, most are still lagging behind when it comes to adapting best practice quality control systems. This needs to change if Kenya is to create for itself a sustainable competitive advantage on the international scale using quality as a driver.

TABLE OF CONTENTS

DECLARATION.....	II
ACKNOWLEDGEMENT	III
DEDICATION.....	IV
ABSTRACT.....	V
LIST OF TABLES	4
LIST OF FIGURES	5
CHAPTER ONE: INTRODUCTION	7
1.1 BACKGROUND OF THE STUDY	7
1.2 RESEARCH PROBLEM	9
1.2.1 Research Objectives.....	10
1.2.2 Research Questions.....	10
1.2.3 Gaps in Knowledge.....	11
1.2.4 Conceptual Framework	11
1.2.5 Underlying Assumptions.....	12
1.3 IMPORTANCE OF THE STUDY	12
1.3.1 Importance of the Study to Operations Managers and Organizations	13
1.3.2 Importance of the Study to the Government	13
CHAPTER 2: REVIEW OF LITERATURE.....	14
2.1 QUALITY IN GENERAL.....	14
2.2 OVERVIEW OF QUALITY CONTROL SYSTEMS	16
2.3 QUALITY CONTROL TOOLS	17
2.3.1 PDCA Quality Control System.....	17
2.3.2 Failure Testing As A Quality Control System	17
2.3.3 Statistical Methods Of Quality Control	18
2.3.4 Company Quality Control and Continuous Quality Improvement – Through TQM	19
2.3.5 Corrective And Preventive Action (CAPA).....	19
2.3.6 Six Sigma	19
2.4 ISO 9001: 2000 QUALITY MANAGEMENT STANDARDS	20

2.5 EARLIER STUDIES CARRIED OUT ON QUALITY CONTROL MECHANISMS	21
2.5.1 Continuous Quality Improvement Climate Survey: A Case of Colgate- Palmolive Kenya	21
2.5.2 Case Study on Mabati Rolling Mills.....	21
2.5.3 Case Study On Bedi Investments Ltd.	22
2.5.4. Case Study on Competitiveness and Productivity Management in African enterprises: An example of Mauritius and Kenya	22
2.6 RECENT DEVELOPMENTS IN QUALITY CONTROL MECHANISMS	23
2.6.1 SIPOC	23
2.6.2 Visual Control for Controlling Quality by Process Improvement.....	23
2.7 AREAS OF RESEARCH - QUALITY CONTROL IN KENYAN MANUFACTURING FIRMS	24
2.8 SUMMARY	24
CHAPTER 3: RESEARCH METHODOLOGY	25
3.1 RESEARCH DESIGN	25
3.2 POPULATION AND SAMPLING	25
3.3 DATA COLLECTION PROCEDURES.....	26
3.4 DATA ANALYSIS TECHNIQUES	27
CHAPTER 4: DATA ANALYSIS, RESULTS AND DISCUSSION	28
4.0 INTRODUCTION	28
4.1 RESPONSE RATE	28
4.2 GENERAL INFORMATION OF RESPONDENTS.....	28
4.2.1 Respondent Industries	28
4.2.2 Company Ownership	29
4.2.3 Size of Organization (In terms of number of employees).....	30
4.2.4 Exportation of produced goods – Survey.....	30
4.3 QUALITY CONTROL SYSTEMS	31
4.3.1. Types of Production Methods Used.....	32
4.3.2 Types of Quality Management Systems Used	32
4.3.3. Types of Quality Control Systems Used	34
4.3.4 Logic behind Specific Quality Control Systems Used	35
4.3.5 Proactive and Reactive Approaches to Quality Control	36

4.3.6 Tools Used to Implement Quality Control Systems	37
4.3.7 Software Used for Implementation of Quality Assurance and Control	39
4.3.8 Potential Challenges of Quality Control	39
4.3.9 Differences between Quality Assurance and Quality Control	41
4.3.10 Documentation of Quality Control Systems	43
4.3.11 Quality Standards and Certification.....	44
4.3.12 In-Process Identification and Tracing of Products	46
4.3.13 Controls Used in the Production Process	47
4.3.14 Actions Taken for Preventing Recurrence of Non-Conforming Products	50
4.3.15 Actions Taken for Eliminating Potential Causes of Non-Conforming Products	51
4.3.16 Documentation of Processes Resulting from Corrective Action.....	52
4.3.17 Internal Quality Audits.....	53
4.3.18 Statistical Techniques for Verifying Acceptability of Manufactured Goods	54
4.3.19 Employee Training in Quality Control and Management.....	54
4.3.20 Cost as a factor influencing implementation of best quality control systems.....	56
4.3.21 Perception of Best Practice in Quality Control Systems.....	57
CHAPTER 5: SUMMARY, CONCLUSION AND RECOMMENDATIONS.....	59
5.1 SUMMARY AND CONCLUSION.....	59
5.2 RECOMMENDATIONS.....	60
5.3 LIMITATIONS OF THE STUDY	61
5.4 SUGGESTIONS FOR FURTHER RESEARCH	61
REFERENCES.....	62
APPENDICES	64
APPENDIX I: LETTER OF INTRODUCTION TO RESPONDENTS	64
APPENDIX II: QUESTIONNAIRE	65

LIST OF TABLES

Table 3.1 Table showing Population Size and Stratified Sample Size

Table 4.1 Number of organization exporting goods

Table 4.2 Production Methods Employed by Manufacturing Firms in Kenya

Table 4.3 Analysis of Quality Control Systems Used by manufacturing firms in Kenya

Table 4.4 Factors affecting the type of quality control system implemented

Table 4.5 Tools Used for Quality Control by Manufacturing Firms in Kenya

Table 4.6 Potential Challenges of Quality Control

Table 4.7 Study of Quality Management Personnel

Table 4.8 Documentation on Quality Control Systems

Table 4.9 Quality Standards Adopted by Manufacturing Firms in Kenya

Table 4.10 Actions Taken to Eliminate Potential Causes of Non-Conforming Products

LIST OF FIGURES

Figure 1.1 A Quality Controlled Transformation Process

Figure 2.1 Plan-Do-Check-Act Cycle

Figure 2.2 Statistical Method of Quality Control

Figure 4.1 Sample Respondents from the various manufacturing sectors in Kenya

Figure 4.2 Company Ownership

Figure 4.3 Export Countries

Figure 4.4 Production Methods Employed by Manufacturing Firms in Kenya

Figure 4.5 Types of Quality Management Systems employed by manufacturing firms in Kenya

Figure 4.6 Pictorial Representation of Quality Control Systems used (clockwise)

Figure 4.7 Factors Influencing the type of quality control system implemented

Figure 4.8 Pictorial Representation of types of approached to quality control

Figure 4.9 Graphical Representation of Tools Used by Manufacturing Firms in Kenya

Figure 4.10 Biggest Potential Challenges of Quality Control

Figure 4.11 Biggest Potential Challenges (Rank 1 and Rank 2) of Quality Control

Figure 4.12 Distinction Between Quality Assurance and Quality Control

Figure 4.13 Graphical Representation of documentation of quality control systems

Figure 4.14 Graphical Representation of Quality Standards Adopted

Figure 4.15 Percentage of In-process Product Tracing and Identification

Figure 4.16 Pictorial Representation of Actions Taken to Eliminate Potential Causes of non-conforming products (Follow clockwise from HAACP)

Figure 4.17 Internal Quality Audit Time-Chart

Figure 4.18 Graphical Representation of Organizations that train employees in QM

Figure 4.19 Types of Quality Training in Manufacturing Firms in Kenya

Figure 4.20 Graphical representation of cost as a key factor influencing implementation of best practice quality control systems

Figure 4.21 Manufacturing Firms' Perception of Best Practice

LIST OF ACRONYMS

GDP	Gross Domestic Product
ISO	International Organization for Standardization
PDCA	Plan-Do-Check-Act
WCO	World Class Organization
TQM	Total Quality Management
QMS	Quality Management System
SIPOC	Supplier-Input-Process-Output-Customer
KEBS	Kenya Bureau of Standards
KAM	Kenya Association of Manufacturers
CAPA	Corrective Action/Preventive Action

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

Manufacturing firms are organizations that are involved in the transformation of raw materials into finished goods for a number of purposes: profit, intermediate production or secondary production. It includes all steps necessary to convert raw materials, components or parts into finished goods that meet a customer's expectations or specifications.

Manufacturing commonly employs a man-machine setup with division of labor in a large scale production (Gilgeous and Gilgeous, 1999). In the last decade, Kenyan manufacturing firms have opened up to and embraced international standards in the quest to obtain a more superior competitive advantage. They have, now more than ever, begun to embrace management and manufacturing theories, beliefs, processes and practices that have led to the growth of giants globally.

And as other management practices grow and evolve, so do quality control mechanisms. The growth of quality awards at the national and international levels and the wide acceptance of the ISO 9000 series is a clear indication of the global trend of the quality movement, and that is that quality has gone mainstream (Costin, 1999). Quality control processes, mechanisms and systems have undergone a dramatic change in Kenyan manufacturing firms as the firms attempt to create a dynamic shift in quality that enables them to meet the international standards of quality. This is evidenced by the fact that more and more firms are trying to and succeeding in getting ISO 9000 certification.

ISO certification improves consumers' perceptions with regard to all three variables (quality, satisfaction, and corporate image). It is therefore viable to suggest that ISO 9000 certification enables companies to realize marketing benefits as a result of enhanced evaluation of service by consumers (Caro and Garcia, 2009). Today, as the standard of living increases, customers want assurance that the products they buy are of the best quality; be it electronic gadgets, food products, clothes, industrial components or anything that is meant to make life easier and more enjoyable. This

study is aimed at investigating and analyzing the current practices used for quality processing and control by manufacturing firms in Kenya.

Quality control mechanisms are one of the most important parts of the manufacturing process. In fact, without the element of quality control systems, no plant can continuously sustain a competitive product that can not only beat other similar products but also thrive in the local and international environment (Ebert, Natarajan, Newsom, Qu, Kearney, 2010).

Looking at Kenyan Manufacturing Firms, one can clearly see that there is a drastic change in the quality of manufactured products over the last few years. This is evidenced by the amount of new and more innovative products in the Kenyan market as well as the compliance of these products to quality standards such as the ISO 9000. This change has been brought about by the challenges of globalization: disappearance of national borders, falling of barriers to international trade, moves towards unification of a global economy, dynamic shifts in business practices to favor profit and so on, as is prevalent in most countries where manufacturing takes a key role in economic development (Summers, 2000, p. 17)

In Kenya, the manufacturing sector was responsible for 16.3% of the nation's nominal GDP which was \$29.964 Billion in the year 2009. This makes the manufacturing sector third in the overall stakes after agriculture and services (CIA-The World Factbook, 2009). Looking at these figures, it is obvious that the manufacturing sector needs to keep a close eye on their quality control mechanisms and processes in order to maintain and increase productivity and in doing so, enhance Kenya's economy. This being the case, it is imperative that manufacturing firms keep a stronghold on the local and international market segment through quality control mechanisms to stabilize and increase value of their products.

In Kenya, the first ISO 9000 certification was awarded in March 1995, followed by 10 in 1996, 17 in 1997, 32 in 1998 and so on (ISO 9000 Survey, 2000). Today there are 79 manufacturing firms that have ISO 9000 certification (KEBS, 2010). This growth is evidenced by the fact that more and more manufacturing firms believed in the

importance on getting ISO certified in order to increase customers and thus productivity and sales, leading to greater economic development.

The motivation behind this study is to help Kenyan manufacturing firms understand the requirements of quality control and to aid them in undertaking the right processes to gain superior products that can then be used to boost Kenya's growth and economy. The research problem was identified during a brief stint at the Mabati Rolling Mills in Mariakani. It was visible that while quality was taken to be of utmost importance, other key features in the transformation process were also very important. The company achieved its ISO 9001: 2000 certification in the year 2001, the Diamond Mark of Quality and the Kenya Quality Award in 2003 and the Best in Quality Management Award in 2005.

According to Mabati Rolling Mills, the key features that led to their quality strategy were the onset of corporate social responsibility (their stand on going green) and the building of customer focus by understanding customer needs for quality products. This led to the thought that if Mabati Rolling Mills was achieving major milestones in its journey to be the best, were other manufacturing firms in Kenya following the same path?

This led to a deeper investigation on how other conglomerates and companies in Kenya were building up their quality control systems. To what extent would they go in the quest to achieve perfection in their quality? This led to the idea for this study: how do Kenyan Manufacturing Firms achieve the best quality in their products? What stands do they take and what propels them towards the right quality control processes in production?

1.2 Research Problem

There have been a number of studies done on quality of service in the Kenyan service industry which have served to inform and educate operation managers and the general public on the importance of quality in services. In 2002, Akama and Kieti used the SERVQUAL service quality attributes to measure the quality of services at Tsavo National Park. In 2010, Alliance for Financial Inclusion released a case study on the quality of service offered by the Central Bank of Kenya with regard to its treatment of

the M-Pesa service. Ndhlovu, 1995, studied the quality of care in family planning service delivery in Kenya. While there have been hundreds of case studies and research studies done on the quality of service in Kenya, it was glaringly obvious that the same was not true of the manufacturing sector in Kenya. This presented one of the key motivations behind the formulation of the idea and the implementation of this study.

The research problem in its entirety is the in-depth analysis of quality control systems in manufacturing industries in Kenya. Are Kenyan manufacturing firms using the best quality control practices to improve the quality of their products? What are the costs of quality assurance and control in different manufacturing industries in Kenya and how do they relate to the decisions on adaptation of quality control processes made by operations managers?

After extensive research, no studies surfaced that have taken into consideration the entirety of the quality control systems used by most of the manufacturing firms in Kenya. The aim of this study is therefore to evaluate and analyze the goings-on on the quality control systems currently used as well as to educate upon the findings of the research.

1.2.1 Research Objectives

The study is to be launched on a specific set of objectives. These are:

- 1) To understand how manufacturing firms in Kenya are geared towards following international standards of quality control.
- 2) To gain an in-depth understanding of the decisions made by operations managers in manufacturing firms in Kenya and their psyche towards implementation of cost-prohibitive quality control mechanisms. The study will discuss the extent that operations managers can go to ensure that their products are of the highest quality.

1.2.2 Research Questions

It is important to ascertain the questions that form the basis of research for this study. The research questions are integral in that they help provide direction and focus for the study at hand. For this study, the research questions are:

- What are the quality control systems used by the organization in the manufacturing process?
- What is the motivation behind the use of the specific quality control systems used?
- What are the major quality issues that manufacturing firms in Kenya are susceptible to?
- Does the manufacturing firm observe a reactive or proactive approach to quality?
- Can the quality control and quality assurance techniques used by Kenyan manufacturing firms be termed as best practice?

1.2.3 Gaps in Knowledge

Since there are few, if any, previous studies carried out on quality control mechanisms in Kenyan manufacturing firms, there is a large gap in knowledge on the types of quality control systems used, the cost of quality control and the determination of how such quality control systems came into being. The Kenyan Manufacturing Sector is still a complete enigma when it comes to quality control in the transformations sector. It is generally understood that manufacturing firms in Kenya that are under the umbrella of a multi-national corporation will be using the same techniques used by their international counterparts to standardize quality.

On the other hand, manufacturing firms that are indigenous to Kenya will be having their own quality control processes to achieve quality. The gap in knowledge thus arises in that these firms have never been studied with the intention of analyzing their quality control systems. Given the time constraint of this study, there is still a lot of scope for further study of the different elements of quality control and assurance mechanisms in the manufacturing sector in Kenya.

1.2.4 Conceptual Framework

In the context of the study, each organization will be studied with a particular set of principle variables. These variables will thus be used to examine the efficiency and effectiveness of the firm's quality assurance and control mechanisms. Basically, every manufacturing industry has a transformation process: from input to output. This study will be centered mainly on the quality control mechanisms in the operations/transformation section, with a short discussion on the control styles and mechanisms used throughout the firm.

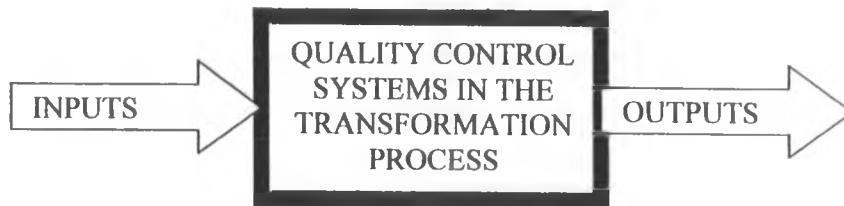


Figure 1.1 A Quality Controlled Transformation Process

Other characteristics will be used to paint an accurate picture of quality control in the different sections of the organization. The importance of these characteristics during the weighted ranking will be determined by international standards such as ISO 9000. The variables that are to be measured will involve individual manufacturing firms and their variable control characteristics (physical characteristics of the products) to ensure that they remain within the lower and upper boundaries of quality requirements. To this extent, quality control charts will be used.

1.2.5 Underlying Assumptions

One of the key assumptions regarding this research is that Manufacturing firms in Kenya use both process and product quality control systems to control the overall quality of their products. Another main assumption is that Operations Managers in Manufacturing Firms endeavor to promote the best quality control mechanisms to gain competitive advantage in their respective industries.

1.3 Importance of the Study

Although quality control is a process that begins with the production of the raw material and continues through the process of transformation to the achievement of the output product, there exists a perception of quality control as a process that works toward removal of faulty products only (Ebert et al, 2010). As discussed by Caro and Garcia (2009), having an ISO 9000 certification enables companies to realize marketing benefits as a result of enhanced evaluation of service by consumers. This suggests that consumers are more aware of the concept of quality and will go for products that carry an international standard of quality.

1.3.1 Importance of the Study to Operations Managers and Organizations

This study is significantly important to Operations Managers in that:

- 1) The results will aid operations managers in understanding the consumer psyche and consumer perception towards quality, so they work towards formulation of quality control systems that will gain them recognition in the market and the industry.
- 2) It will help manufacturing firms reach desired levels of quality assurance of their international counterparts and enable them to gain a stronghold in the market

1.3.2 Importance of the Study to the Government

This project is justified in its entirety since it will report upon the overall quality control processes in process manufacturing and will provide an insight on the general decisions regarding quality that operations managers make, in accordance to ISO Standards and other national and international quality standards. This will help the government form reforms to assure that quality perceptions are met, as well as to ensure that quality in products is achieved in line with Kenya's Vision 2030.

CHAPTER 2: REVIEW OF LITERATURE

As a concept, quality has been with us for millennia. However, it has recently emerged as a formal management function. The discipline is still evolving. In its original form, it was reactive and inspection-oriented; today, quality-related activities have broadened and are seen as essential for strategic success (Costin, 1999, p. 27). In manufacturing, the concept of quality can be defined as: “When a continuing series of lots is considered, a quality level for the purpose of sampling inspection is the limit of a satisfactory process.” (BS4778, 1991). In this study, one of the key points of interest is the manner by which manufacturing firms in Kenya manage to achieve the different forms of quality.

2.1 Quality in General

There are many ways by which quality can be defined. However, there is no one definition that can explain the entirety of the concept of quality. Generally, quality is said to be a measure of excellence of a state of being free from defects, deficiencies and significant variations. Quality is defined as the totality of features and characteristics of a product or service that bears its ability to satisfy stated or implied needs (ISO 8402, 1986). In manufacturing, quality is the strict and consistent adherence to measurable and verifiable standards to achieve uniformity of output that satisfies specific customer and user requirements.

Quality in Goods: According to Feigenbaum (1983), quality is a customer determination which is based on the customer’s actual experience with the product or service, measured against his or her requirements – stated or unstated, conscious or merely sensed, technically operational or entirely subjective – and always representing a moving target in a competitive market. There are different perceptions of quality in products. While a manufacturer may perceive quality in an entirely statistical and logical manner, a consumer may perceive it in a completely different way. And at the end of the day, if the manufacturer can look at quality from the consumer’s point of view, he is already ahead in the game. After all, it is what the consumer perceives quality to be that matters.

When considering the quality of a product, there are different issues that consumers consider to be of importance. These are: performance, durability, ease of repair, service availability, warranty, ease of use, price, appearance and brand name. Generally, people are willing to pay more when they perceive the product to be of a higher quality. Why is quality supposed to be one of the biggest threats to a manufacturer? According to a survey by Mattson and Associates, if 20 customers are dissatisfied with what you're selling, 19 of them will not tell you but 14 of them will take their business elsewhere. Also, dissatisfied customers on an average tell at least ten other people about their bad experience whereas satisfied ones will tell at least five people of their experience. Since it costs manufacturers 5 times more money to attract new customers than to keep existing ones, it follows that loss in quality leads to massive losses for manufacturers. This is why maintaining quality is very important.

In the manufacturing sector, quality can be classified in a number of ways: Quality of Design, Quality of Conformance and Quality of Performance. Quality of Design means that a product has been designed in a manner that ensures that it successfully fills consumer needs; real or perceived. Quality of Conformance refers to conformance to requirements or to the manufacture of the product that meets the specific requirements set by the consumer. Quality of performance means that the product performs its intended function as identified by the consumer (Crosby, 1979). Any manufacturing firm must strive to meet these three forms of quality.

Quality in Services: According to the ISO 9000: 2000, quality is the degree to which a set of inherent characteristics fulfils requirements. When talking about the quality of service, it is important to achieve a sense of precisely what the service is meant to do and its perceived use to the consumer before its quality can be judged. How can one judge quality in services? According to a poll held by the CMC Partnership Ltd. (1991), a 'higher' quality in services is witnessed by courtesy, promptness, a basic sense that one's needs are being satisfied and attitudes of the service provider.

Quality of Processes: In manufacturing, the transformation process must also have a high quality. By this, it should not only meet the requirements of the transformation to be achieved but also the ability to perform this transformation in a manner that caters to health, environmental, national and other important standards. In quality of process,

the quality of the technology used, the human resources involved and the quality of inputs into the transformation process all carry some weight in the overall process quality. The ability to live up to the quality of design is maintained by the quality of the process.

Quality in the Organization: Most organizations practice Total Quality Management in an attempt to ensure that quality in all parts of the organization is met. Every department within the organization has to be involved in maintaining the overall quality of the organization. This is done in an attempt to increase productivity, boost morale, gain a good reputation, increase social and environmental responsibility and boost sales.

2.2 Overview of Quality Control Systems

Quality control and management systems are designed to ensure that all quality standards and requirements are met by the firm. In a manufacturing firm, every person is responsible for the final quality of the product. In this respect, the quality assurance and quality management guidelines as laid down by ISO 9000 are followed to ensure that quality of manufactured products meets the requirements of the same. Quality control refers to the use of specifications and inspection of completed parts, subassemblies, and products to design, produce, review, sustain and improve the quality of a product or service. It goes beyond mere inspection (Summers, 2000, p. 12).

Quality control systems are processes that endeavor to ensure that quality in all factors of production is reviewed. Quality control is different from Quality Assurance in that quality control is mostly involved in the testing of products to determine whether there are any defects while Quality Assurance is the overall process of trying to improve and stabilize production processes such that the factors that lead to defects in the finished product are completely minimized (Summers, 2000, p. 13). Quality control mechanisms can be used to reduce risk, lower costs, improve customer experience and thus enable firms to benefit from repeated sales (Dale, 2003, 15). Therefore, it is essential that every manufacturing firm in Kenya should have a means of quality control as well as a culture for quality control. In this study, there will also be a short discussion on the importance of creating a culture of quality. The one reason as to why so many Kenyan manufacturing firms are heading towards ISO 9000

certification is simple: because it changes the way consumers perceive their goods as well as their operational practices.

2.3 Quality Control Tools

2.3.1 PDCA Quality Control System

The PDCA is a quality control system used in the transformation process. It stands for Plan, Do, Check and Act. PDCA is a basic control mechanism which ensures that you Plan the transformational quality process, implement your plans for quality control, Check to ensure that the plan you've made is working properly and if not, Act to ensure that either a new plan is made or the old one changed to take into account the reasons for its failure. (Costin, 1999, p. 12). PDCA is a process that is perfected over time, and manufacturing companies that are WCOs ensure that the PDCA mechanism never stops.



Figure 2.1 The Plan-Do-Check-Act Cycle

2.3.2 Failure Testing As A Quality Control System

Failure Testing is used as a quality control mechanism by operating the manufactured product in a controlled environment and pushing it to all bounds until the product fails. This helps manufacturing firms to attain knowledge on the quality of the product as well as its shortcomings. The Failure Mode and Effect Analysis (FMEA) was used to systematically review the number of ways a product could fail and on this basis, propose alternative designs (Costin, 1999, p. 38). Generally, the laboratory tests failure of the product through regular wear and tear and a highly accelerated rate and in differing temperatures, pressure, stress and other factors that are bound to destroy

the product. Once the product has been exhausted and the weaknesses observed, improvements to the process and the product can then be made, which increase the quality of the product. This is done in three ways: individual component analysis, derating and redundancy (Costin, 1999, p. 38).

2.3.3 Statistical Methods Of Quality Control

Statistical methods of quality control involve the random sampling of manufactured products and the plotting of their performance on a graph. The use of statistical methods of production monitoring and parts inspection became known as Statistical Quality Control (SQC), wherein statistics are collected, analyzed and interpreted to solve quality problems (Summers, 2000, p.12). Although there are quite a few ways of implementing SQC, the key ones that are generally used are Pareto Analysis, Check Sheets, Histograms, Scatter diagrams, Control charts and Fishbone diagrams.

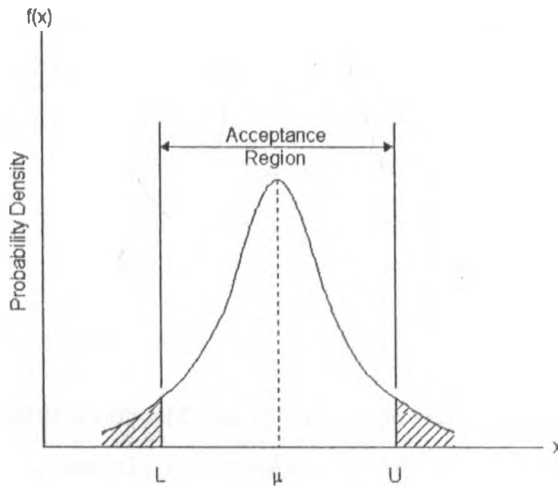


Figure 2.2 Statistical Method of Quality Control

Once the data has been plotted on the graph, it should be seen to be performing at the expected levels within the limits of standard deviation. If this is not the case, it is assumed that the samples used represent the entire batch of products and that all of them do not meet the required levels of quality. This is one of the reasons as to why statistical quality control is very important in the production process. (Costin, 1999, p. 29-30).

2.3.4 Company Quality Control and Continuous Quality Improvement – Through TQM

Company Quality Control is different from other manufacturing quality control mechanisms because in this case, the emphasis is on the human resources and the departments that are in charge of making the products and not on the products themselves. One of the key Company Quality Control mechanisms is through Total Quality Management (TQM) which focuses on all aspects of the company to achieve not only higher quality products but also quality overall. TQM is an easy concept to grasp but a difficult one to implement, especially when firms are large with a big range of products and many departments (Dale, 2003, p. 26-30).

During the course of the research for this study, some elements of TQM in Kenyan manufacturing firms will also come into play, especially those that involve quality in process. The ten integral sections of TQM are: To pursue new strategic thinking, to know one's customers, to set true customer requirements, to concentrate on prevention, not correction, to reduce chronic waste, to pursue a continuous improvement strategy, to use a structured methodology for process improvement, to reduce variation, to use a balanced approach and last of all, to apply this to all functions of the organization.

2.3.5 Corrective And Preventive Action (CAPA)

CAPA is a quality control concept that is within the Good Manufacturing Practice. It emphasizes on the systematic investigation of failures and deviations in product quality in an attempt to prevent their recurrence or occurrence. To make sure that corrective and preventive actions are effective, the systematic investigation of the failure incidence is pivotal in identifying the corrective and preventive actions undertaken.

2.3.6 Six Sigma

Six Sigma is one of the most popular forms of quality control tools used by manufacturing and service firms. It was originally developed by Motorola in the United States in the year 1981, and is still going strong as one of the most favored quality control tools today. It works by improving the quality of process outputs by

identifying and removing the causes of errors and minimizing variability in manufacturing processes. A six-sigma process is one in which 99.99966% of the products manufactured are statistically expected to be free of defects (3.4 defects per million) (Tennant and Geoff, 2001). At that time, Motorola was trying to control its quality issues and so it set a goal of 'Six Sigmas' for all of its manufacturing operations. Today, Six Sigma is so widely used that the word 'Six Sigma' has become synonymous with quality control processes. Six Sigma is implemented in two ways: DMAIC (Define, Measure, Analyze, Improve and Control) and DMADV (Define, Measure, Analyze, Design and Verify) (Tennant and Geoff, 2001).

2.4 ISO 9001: 2000 Quality Management Standards

International Standards offer local firms practical solutions to problems arising from globalization and liberalization (Lai, 1996). They can thus be used as a strategic tool to achieve competitiveness (Lai, 1996). The ISO 9001 is a family of standards that is used to control the quality of products and services. It is a set of quality standards laid out by the International Organization for Standardization. It has specific rules that manufacturing companies must meet in order to motivate change within their organization. Some of the standards include establishing procedures that cover all the key manufacturing processes, monitoring the processes to check for product variations, maintaining accurate records, checking for defects and taking corrective action when defects are identified, regular review of the quality system to ensure that the products produced are effective, constant improvement within the company (John, 2010).

The ISO 9001: 2000 certification helps manufacturing companies to gain more customers, and increases their worth in the market. Having an ISO 9001: 2000 certification automatically means that the manufacturing firm is in production of high-quality goods. Generally, manufacturing firms use ISO 9001: 2000 with the PDCA quality control mechanism, in both implementation and monitoring of the entire chain of processes (John, 2010). The ISO 9001: 2000 QMS places emphasis on customer satisfaction and uses the process approach as a means to continual improvement of the Quality system, through improved efficiency, improved management, improved staff motivation, better customer service leading to increased customer demand, reduced waste and therefore reduced costs. The Kenya Bureau of Standards (KEBS) certifies

firms to ISO 9001: 2000 QMS as a means of adding value to products and services offered by certified firms.

2.5 Earlier Studies Carried Out on Quality Control Mechanisms

There have been many studies on the quality of services that have been carried out in Kenya. However, there seem to be few or none done that discuss the entirety of quality control systems used in manufacturing firms in Kenya. This may be because of the lack of information available due to the preconceived prevalent culture of using secrecy as a means to gain competitive advantage. However, let's take a look at the earlier studies done on Quality Control Mechanisms in a bid to understand the scope and rationale behind this research.

2.5.1 Continuous Quality Improvement Climate Survey: A Case of Colgate-Palmolive Kenya

In this research project, a case study on Colgate-Palmolive Kenya was used to bring out the essential need for TQM and CQI in the manufacturing firm. Although the case study was not an analysis of all quality control mechanisms used in the firm, it painted an accurate picture of the means and importance of quality and quality control and assurance through CQI. The purpose of conducting CQI Climate Survey was to assess the prevailing continuous quality improvement (CQI) climate at Colgate-Palmolive Kenya. The study found out that Colgate-Palmolive Kenya did not have internal customer focus and that there was low understanding of external customer requirements and statistical tools and techniques for quality control. Also, there were no forums to address questions or challenges. Muema (2006) came to the conclusion after carrying out a survey on CQI in Kenya that TQM is improperly implemented and this has led to a loss in quality of products.

2.5.2 Case Study on Mabati Rolling Mills

In its quest to achieve high product quality and in process quality, Mabati Rolling Mills endeavored to change old processes and design new ones according to the PDCA cycle. To this extent, they borrowed \$11.5 million in an attempt to build and commission a hot dip galvanizing plant in Kenya (Aluminum-Zinc coating for the roofing market in East Africa) and thus replace two existing old technology facilities with a single new technology unit. This was done to not only improve their product

quality but also to gain a bigger share of the market through customers perception of better quality, industry reputation and in the process reduce waste and embrace green practices. This led to a spurt of growth that ensured that the Mabati Rolling Mills plant was working at 120% of its designed capacity (International Finance Corporation).

2.5.3 Case Study On Bedi Investments Ltd.

Bedi Investments Ltd. Was established in 1975 as an investment firm, which integrated backwards to make fabrics and yarns and emerged as one of the most modern integrated textile-garment plants in the country. It moved into exports and by the year 1994, had an export value of \$4 million. In the early 90s, when most manufacturing firms in Kenya had no concept of the importance of ISO 9000, Bedi had already chosen to adapt the same. The implementation of the quality control standards ISO 9000 enabled Bedi Investments Ltd. To gain more foreign buyers for their products and doubled Bedi's labour productivity growth to six per cent per year between the years 1989 to 1994 (Ganeshan Wignaraja, 1997).

2.5.4. Case Study on Competitiveness and Productivity Management in African enterprises: An example of Mauritius and Kenya

The attention paid to formal quality management varies considerably among the garment firms. At one end are firms with formal systems for quality control (based on final inspection), a full-time department and reject rate data. At the other end are firms where the entrepreneur does ad hoc checks on the finished products and reject rates are not recorded. In the case study, nine firms had a full-time quality control staff and eight kept track of reject rates.

The findings of the study suggested that import competition had a positive impact on quality control efforts, which improved since 1989. The average internal defect rates fell from 2.6 to 1.8 per cent. The conclusion of this study was that while Kenyan manufacturing firms were adapting quality control mechanisms to compete with imports, the adaptation was not as rapid or all-encompassing as was possible (Ganeshan Wignaraja, 1997).

2.6 Recent Developments in Quality Control Mechanisms

In the last decade, there has been a gradual change in quality control mechanisms. Today, most manufacturing firms are opting for an amalgamation of qualitative and quantitative quality control systems. Here are a few business tools that manufacturing firms are now adapting to improve quality of products.

2.6.1 SIPOC

SIPOC is a business tool that stands for Suppliers, Inputs, Process, Output and Customers and is used to improve business practices in manufacturing thus improving overall quality of products. It involves the connection of each in manufacturing: obtaining inputs from suppliers, adding value to inputs through processes and working to provide quality outputs that add value to customer needs and requirements (Abilla, 2010).

SIPOC aids in quality control by ensuring that questions regarding Suppliers, Inputs, Processes, Outputs and Customers are answered: Who is supplying the Inputs to the process?, What are the specifications placed on the Inputs?, Who are the customers in this process?, What are the customers' specific requirements and how can they be met?, are a few samples of these questions.

Manufacturing firms benefit greatly from SIPOC tools. In many instances, a firm will have a number of small problems or deficiencies which are relatively minor alone but when put together, they can lead to decreased quality, more problems, and ultimately failure of the firm. SIPOC can help to eliminate these problems and result in better manufacturing practices, higher level of quality, and more satisfied customers. SIPOC can help improve quality in a manufacturing firm that is disorganized, lacks vision or purpose and has poor communication. A SIPOC diagram can help to identify and then fix these problems that are holding back the plant's success and quality of products by clearly breaking down and mapping out what needs to be done with specific projects. (Abilla, 2010).

2.6.2 Visual Control for Controlling Quality by Process Improvement

Manufacturing firms are adapting visual control in an effort to increase their production efficiency. Visual control helps employees perform their jobs easier

because they can look at a visual sign to see what they need to do. Visual control does exactly what it states, it makes things visual. It uses the argument that when things are visible, they tend to remain in the minds for a longer period of time (Chu, 2008). Having these visual reminders around the plant will provide employees with constant reminders, thus allowing them to make quick decisions when necessary. Visual Control is a valuable tool in manufacturing industries since it helps in the avoidance of workplace accidents and defect of products.

2.7 Areas of Research - Quality Control in Kenyan Manufacturing Firms

The areas requiring research in manufacturing firms in quality control and assurance in Kenyan manufacturing firms include the efficient use of total quality management, the use of statistical methods of quality control, the use of lean techniques to prevent waste and increase productivity and the use of methods such as failure testing and PDCA.

2.8 Summary

The literature review for this study covers the different types of quality assurance and control systems that are globally in use. It also encompasses specific studies done of quality control in Kenya. The differences between the studies done and the study to be embarked on are explored in detail, and the gaps in knowledge are expounded upon. In line with this, the study to be done is developed.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Research Design

The study will make use of the descriptive research design to get an accurate picture of the quality control systems used in manufacturing firms as well as to get a deeper understanding of other issues that limit the efficiency of the quality control systems and the cost of the right quality control processes, including others, if they exist. The data to be gathered involved quality control processes used, their importance to the overall quality of the product, their implementation and the attitudes towards the same. The data will be gathered from large and medium-sized manufacturing firms from all over the manufacturing sector.

3.2 Population and Sampling

The samples to be used in this study are medium and large-sized manufacturing firms that are either leaders of industry or towards the top in their respective industries. The population will be stratified into different industries, and then the sample size will be determined by the confidence interval, the accuracy required and the timing. With the time available for the study, n is taken to be 5% of the total sample size.

$$n = 5\% \text{ of } 621 = 31.05 \approx 31$$

The sample size n will represent the key manufacturing sector of Kenya. In this study, we will use stratified probability sampling to ensure that the manufacturing firms used are an accurate representation of the entire manufacturing sector in Kenya. To this extent, a list of all manufacturing firms listed with the Kenya Association of Manufacturers (KAM) is taken and stratified sampling carried out. Once the sample size, n , has been identified, then n_k (sample size per strata) will be:

$$n_k = (N_k / N) * n$$

where n_k = Sample size per strata (k), N_k = Population size per strata (k), N = Total Population Size and n = sample size for the total population.

The Sampling Population (N): 621 (N)

The number of Strata (k): 12

The Sample Size (n): 31

The sampling technique is: Stratified Random Sampling

In the Stratified Random Technique, each member of the population has an equal chance of being selected as a subject. The entire process of sampling is done in a single step with each subject selected independently of the other members of the population (Castillo, 2009). The sampling frame is the number of manufacturing firms in each strata listed with the Kenya Association of Manufacturers (KAM) – 621, which also happens to be the total size of the population listed. Knowing n_k and N_k , the table of random numbers is used to obtain the samples.

Name of Industry	No. of Firms	n_k
Energy, Electrical and Electronics	43	2
Plastics and Rubber	66	3
Textile and Apparels	68	3
Food, Beverages and Tobacco	155	8
Pharmaceutical and Medical Equipment	22	1
Metal and Allied	62	3
Paper and Paperboard	69	3
Leather Products and Footwear	9	1
Chemical and Allied	71	4
Motor Vehicle Assembly and Accessories	23	1
Building, Construction and Mining	15	1
Timber, Wood Products and Furniture	18	1

Table 3.1 Table showing Population Size and Stratified Sample Size

$$n = \sum n_k$$

$$n = 2 + 3 + 3 + 8 + 1 + 3 + 3 + 1 + 4 + 1 + 1 + 1 = 31$$

3.3 Data Collection Procedures

The data to be gathered encompasses the quality control and assurance processes, technologies and tools. This data will be gathered through both primary and secondary data sources (through statistical information, journal studies and case studies carried out on individual organizations). As far as is possible, data will be collected through:

1) Structured Questionnaire – One section of the questionnaire created by the researcher will be in a structured form that should be filled in by the operations managers and strategic managers in the sample manufacturing firms. This questionnaire will address the need for basic information on the company.

2) Open-ended questionnaire: The second section of the questionnaire created by the researcher will have open-ended questions that will address the issues of quality control mechanisms on the factory floor as well as the overall strategy of the organization.

3) Observation – Where possible, the researcher will carry out an observation exercise to gather some qualitative data and ideas regarding the implementation of quality control in process procedures. Obviously, this method can only be used if the sample firms will provide access for a brief period to the administration and manufacturing sections of the organization.

3.4 Data Analysis Techniques

The research to be done on quality control systems used is mostly in qualitative form and is meant to answer a few important research questions regarding the existence and use of efficient quality control systems in Kenya. Therefore, after collection of the data, it is going to be collated, organized, summarized and described in a manner that will aid in understanding the current standing of quality control systems in the manufacturing sector in Kenya.

Depending on the information gathered, graphs will be created that will be used to illustrate the important findings. The data will be analyzed in a manner that compares and complements the different quality control systems used. Since the data to be gathered is across the manufacturing sector and dependant on the size of the sample firm and its capital outlay, it might not be possible to glean figures of variables that can fairly be used in comparison studies. To this end, the data collected will be grouped in clusters before it can be studied and used to gain an accurate picture of the state of quality controls in manufacturing firms in Kenya.

CHAPTER 4: DATA ANALYSIS, RESULTS AND DISCUSSION

4.0 Introduction

This chapter focuses dominantly on the findings of the study. It takes into account the quality control systems used by manufacturing firms in Kenya, looks at the different factors involving quality control systems and the different parameters used by manufacturing firms to implement quality control. This chapter summarizes the responses obtained, and showcases the in-depth study carried out to determine the presence and magnitude of quality control in manufacturing firms in Kenya.

4.1 Response Rate

This study targeted 31 organizations from the different manufacturing industries in Kenya. A total of 31 questionnaires were distributed via email addresses to the operations/production departments as well as to the department of quality control within the respondent organizations. The response rate was 77%, with the rest refusing to take part in the study due to matters of confidentiality. The respondents on behalf of their organizations ranged from Quality Assurance Managers to Productions Managers to Safety, Health Environment and Quality (SHEQ) Coordinators to Overall Operations Leaders.

4.2 General Information of Respondents

The first section of the questionnaire enquired about the general information of the respondents in terms of the industry the organizations were in, the size of the organization in terms of number of employees, the ownership of the organization and the extent of exportation of produced goods.

4.2.1 Respondent Industries

In Kenya, manufacturing organizations register with the Kenya Association on Manufacturers (KAM) in order to enjoy certain benefits. These organizations formed the population size for this study, and the population frame was chosen from this through stratified sampling. The respondent industries are as seen in the graph.

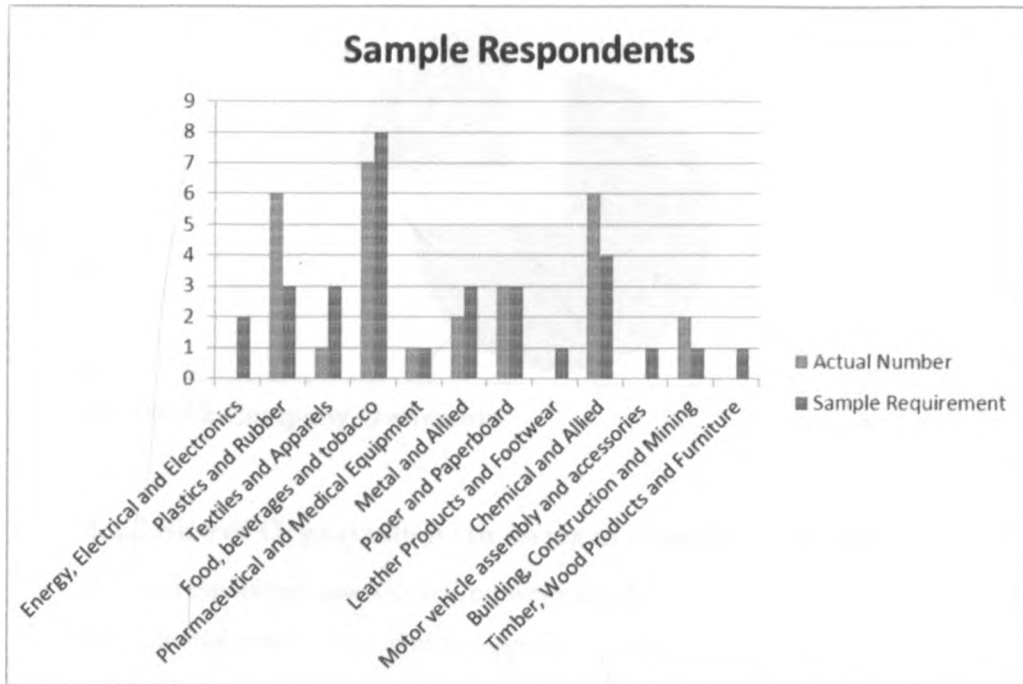


Figure 4.1 Sample Respondents from the various manufacturing sectors in Kenya

4.2.2 Company Ownership

To determine whether Kenyan standards of quality control in manufacturing are at par with international standards, the question of ownership comes into play. Are locally owned organizations on the same playing field as multinational corporations? This section will help address this in preparation for correlating local against foreign-owned organizations and determining the extent of best practice systems used.

100% of foreign-owned firms taking part in the study respond positively on the use best practice quality control systems, whereas only 64% of local firms taking part in the study do the same.

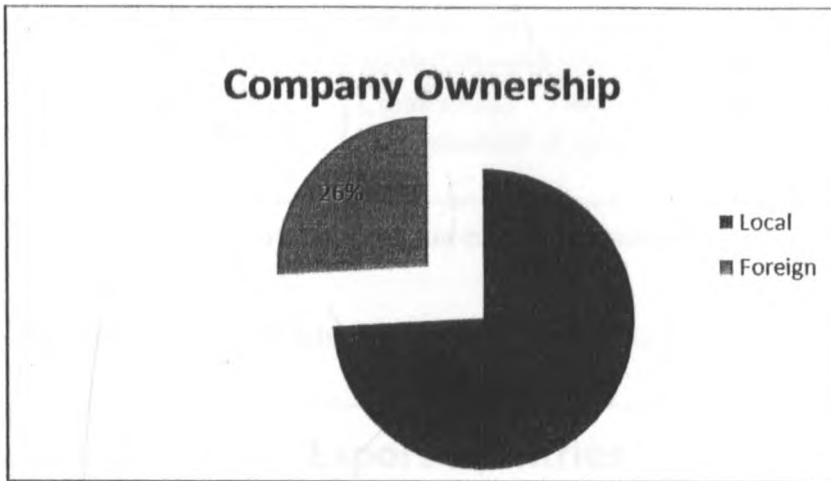


Figure 4.2 Company Ownership

4.2.3 Size of Organization (In terms of number of employees)

As the respondent questionnaires were analyzed, the correlation between the size of the manufacturing firm and the quality control systems used was determined. The respondent organizations range from small to large with number of employees varying from 25 to 4,500. Although some smaller manufacturing firms have comprehensive quality management systems, the consensus is that the bigger the organization, the more they are geared towards use of best practice systems.

4.2.4 Exportation of produced goods – Survey

Companies that export their good have to meet or surpass quality standards set nationally by KEBS, as well as the quality standards required by the countries products are being imported into. The manufacturing industry in Kenya has grown over the last decade, with most of the respondent firms carrying out exportation of their goods. This shows that in the last decade, quality control practices and systems have developed in line with exportation policies.

Of the respondent organizations, 92% export their manufactured products to other countries with the East African community and outside..

		Frequency	Percentage
Exportation of goods	YES	22	92%
	NO	2	8%
	Total	24	100
Analysis	These numbers show that more and more		

		Kenyan organizations are exporting goods, especially within the East African Community, which explains the sophistication of quality control systems used.	
--	--	--	--

Table 4.1: Number of organization exporting goods

The figure below gives a breakdown of countries that goods are exported to.

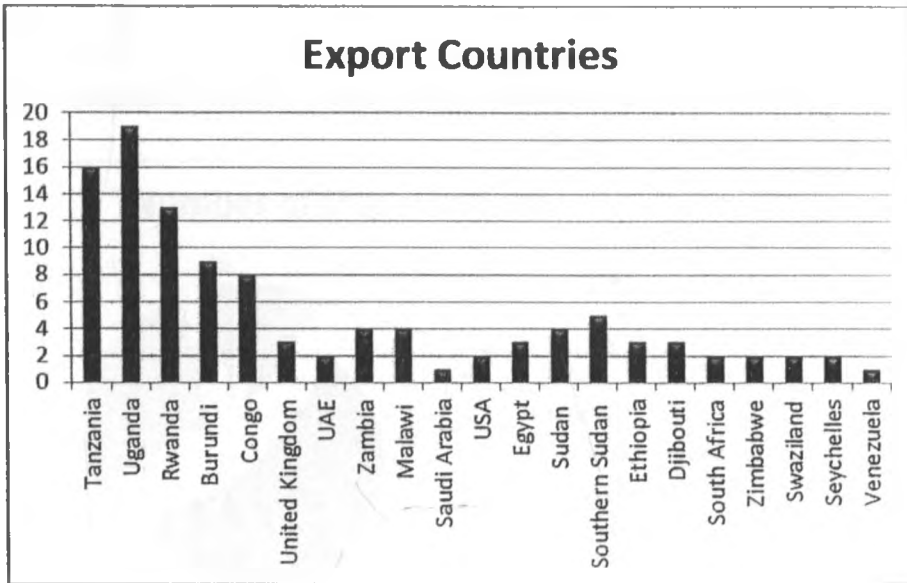


Figure 4.3 Export Countries

From the figure above, it is observed that more companies export goods to countries within the East African Community (Uganda, Tanzania, Rwanda and Burundi). This infers that the quality standards for these countries closely match Kenyan standards of quality in products.

4.3 Quality Control Systems

This section seeks to determine the types of quality control systems used by manufacturing firms in Kenya, looks at the different factors involving quality control systems and the different parameters used by manufacturing firms to implement quality control.

4.3.1. Types of Production Methods Used

Since the quality control system used depends on the type of production method employed, this section studies the different types of production methods used and their effect on quality control systems employed by specific firms.

Production Method	Frequency	Percentage
Job	3	13
Batch	17	71
Continuous Flow	9	38
Intermittent Flow	1	4

Table 4.2 Production Methods Employed by Manufacturing Firms in Kenya

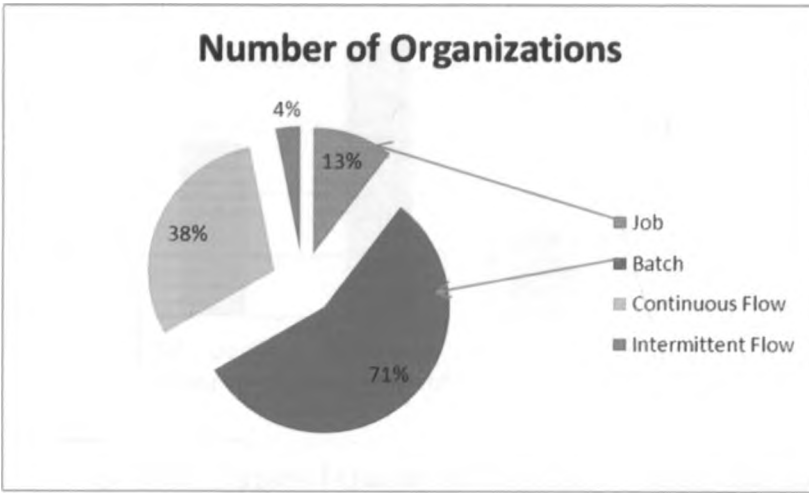


Figure 4.4 Production Methods Employed by Manufacturing Firms in Kenya.

According to the above analysis, 71% of Kenyan firms use Batch Production whereas 38% use Continuous Flow Method. The quality control systems used are thus more geared towards batch production and continuous flow production. This suggests that the quality control systems are of a higher complexity and require statistical tools to implement as compared to QC systems used to control quality in job production.

4.3.2 Types of Quality Management Systems Used

According to the respondents, Continuous Improvement (CI) as a Quality Management System is the most popular among manufacturing industries in Kenya with 92% opting for it. CI is mostly common with manufacturing firms using Batch

Production as their integral production process. Following Continuous Improvement is Total Quality Management (TQM) with 58% opting for it.

Among the respondents opting for TQM, 55% use Continuous Flow as a production mechanism. However, only 29% use Business Process Reengineering, and this percentage is made up of organizations using batch production methods. This shows that the type of production system used greatly influences the type of Quality Management System employed.

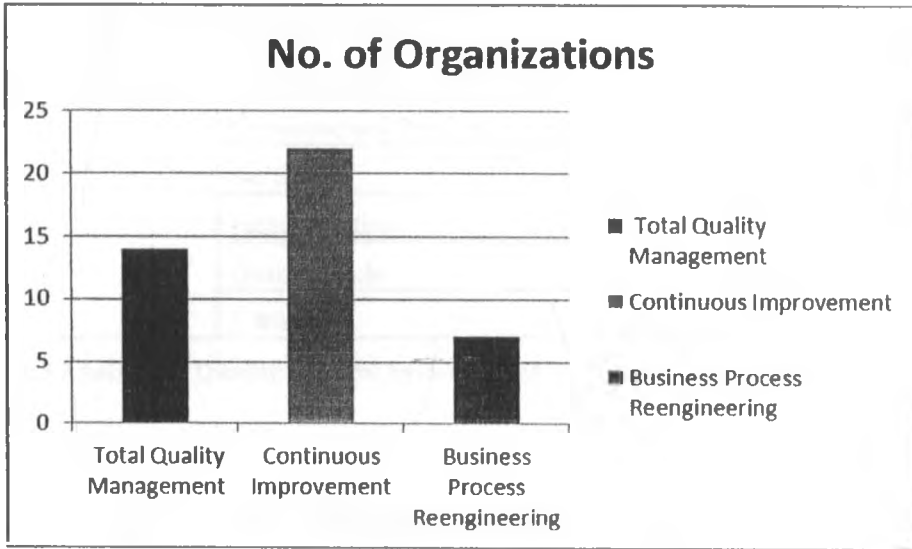


Figure 4.5 Types of Quality Management Systems employed by manufacturing organizations in Kenya

The popularity of Continuous Improvement as a Quality Management System stems from its simplicity of use, its emphasis on the production process quality and its inherent quality improvement documentation and procedures. For manufacturing firms in Kenya, not only is Continuous Improvement easy to adopt, it always avails a layer of ease to all employees in production: quality personnel or not.

Total Quality Management, while popular with 58% of manufacturing firms in Kenya, is not as wide-spread as CI in manufacturing firms in Kenya, since it tends to concentrate of all aspects of the organization and is quite complex. Business Process Reengineering is one of the most complex Quality Management Systems, but it is also 100% effective if the implementation follows the vision. In Kenya, BPR is not

popular because of the costs involved in overhauling the entire organization's core processes.

4.3.3. Types of Quality Control Systems Used

Of the types of quality control systems used by manufacturing industries in Kenya, the respondent organizations had a wide and varied response correlating to the type of production method used, the type of overall quality management system employed and other parameters relating to quality control.

Type of Quality Control System Used	Percentage
Statistical Quality Control	23%
Plan-Do-Check-Act (PDCA)	27%
Corrective and Preventive Action (CAPA)	33%
Six Sigma	4%
Failure Testing	9%
Quality Circle	2%
5 Whys	2%

Table 4.3 Analysis of Quality Control Systems Used by manufacturing firms in Kenya

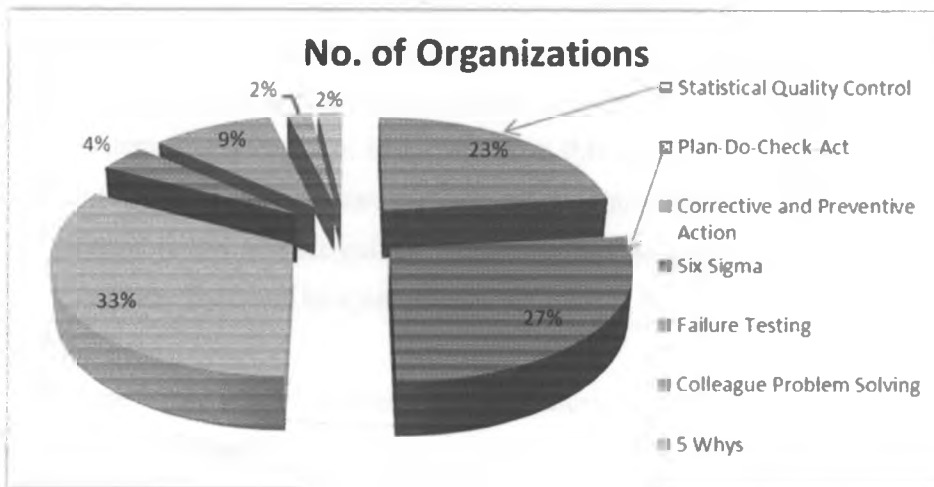


Figure 4.6 Pictorial Representation of Quality Control Systems used by manufacturing firms in Kenya (clockwise)

Overall, Corrective and Preventive Action (CAPA) seems to be the most widely used QC system with 33%, followed by Plan-Do-Check-Act (PDCA) with 27% and Statistical Quality control at 23%.

In terms of popularity, the others lag behind, with Six Sigma at only 4% and Failure Testing at 9%. This shows that manufacturing firms in Kenya have not yet evolved to using Six Sigma which is one of the best practice systems employed globally in a bid to perfect the manufacturing process and achieve complete perfection in quality.

Corrective Action/Preventive Action (CAPA) is the most popular type of Quality Control System used since it emphasizes on the systematic investigation of failures and deviations in product quality in an attempt to prevent their recurrence or occurrence. Plan-Do-Check-Act is also popular due to the ease of use as well as its inherent property enabling continuous improvement of product quality, which makes it a two-edged sword used for both quality assurance and quality control.

4.3.4 Logic behind Specific Quality Control Systems Used

Apart from production methods and overall quality management systems used, there are other factors that influence the types of quality control systems used. These factors, to a greater extent, influence decision-making on the type of quality control system to put in place, as is seen from this study. The figures in Table 4.4 show the influence of these factors on the quality control systems used. As is seen, the biggest factor is the benefit gained from using a particular QC system, followed by Best Practice, followed by Cost of system.

Ease of use at 25% proves that manufacturing organizations do not really look into the complexities of a QC system, as long as they obtain what they require, best quality, at the end of the production process. Also clear is that most organizations do not place too high a value on QC systems benchmarked with other leading industries in Kenya, as is seen by the percentage: 37%.

Logic	Frequency	Percentage
Cost	12	50%
Benefit Gained	16	67%
Best Practice	15	63

Benchmarked System	9	21
Ease of Use	6	25
Availability	3	12.5

Table 4.4 Factors affecting the type of quality control system implemented

Availability is by far the least of issues to look into when opting for a QC system with 12.5%. This is because most QC systems are readily available, with instructions and manuals on them available in most online stores.

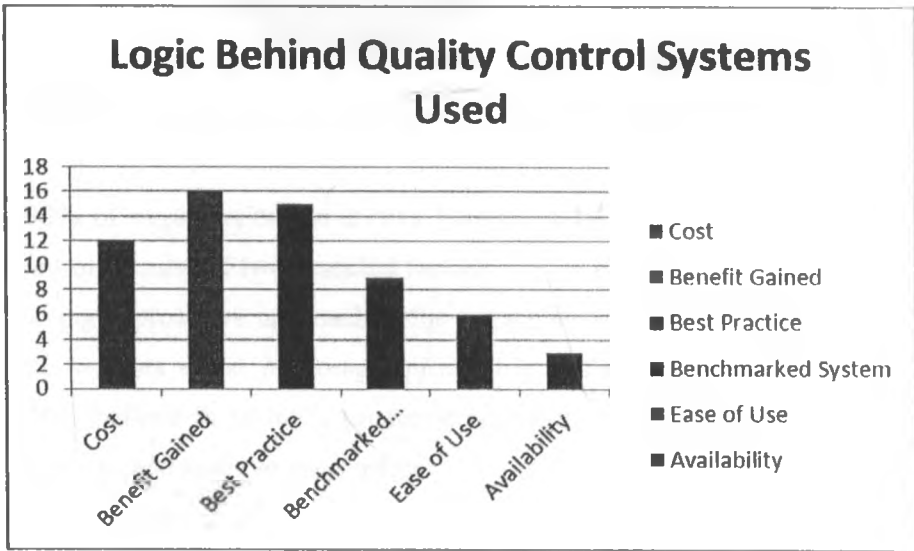


Figure 4.7 Factors Influencing the type of quality control system implemented

4.3.5 Proactive and Reactive Approaches to Quality Control

A proactive approach to quality control is essentially a system whereby quality issues are anticipated in advance and measures taken to prevent them from occurring whereas a reactive approach to quality control is whereby measures to control quality of products are only taken at the end of the production process when acceptance sampling renders the product unacceptable for the consumer market. 88% of respondents take a proactive approach to quality control, whereas only 12% have designed QC systems that are both proactive and reactive.



Figure 4.8 Pictorial Representation of types of approached to quality control

100% of organizations in Kenya believe in taking a proactive approach to quality control because of two essential factors: cost of production and cost of quality control. Taking a proactive approach helps organizations move towards lean manufacturing due to costs saved in storage, processing and assembly sampling. However, while 100% believe in taking a proactive approach, only 12% of organizations take both proactive and reactive approaches.

This is because a reactive approach is an indication of quality measures that only follow once production is complete, and only increase the cost of production. Having an only reactive approach to quality control is detrimental to firms, while having both proactive and reactive approaches leads to a safer, more comprehensive QC system.

4.3.6 Tools Used to Implement Quality Control Systems

There are different tools used to implement quality control systems. These tools vary from cause-and-effect diagrams and control charts to stratification and scatter diagrams. The more complex and comprehensive the tools, the easier the quality audit process and the more efficient the quality control system. 92% of respondents use Check Sheets, while 42% are predetermined towards Cause-and-Effect Diagrams and 38% towards Control Charts.

Tools	Frequency	Percentage
Cause and Effect Diagrams	10	42%
Check Sheets	22	92%
Control Charts	9	38%
Histograms	3	13%
Pareto Charts	5	21%
Scatter Diagrams	0	0
Stratification	1	4%

Table 4.5 Tools Used for Quality Control by Manufacturing Firms in Kenya

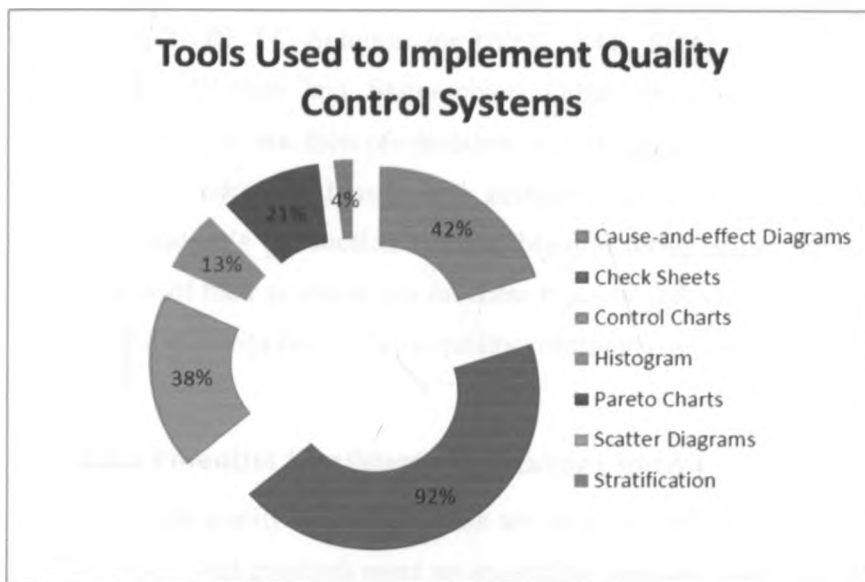


Figure 4.9 Graphical Representation of Tools Used by Manufacturing Firms in Kenya

Check sheets are the most popular control system tools used by manufacturing firms in Kenya at 92%. This is due to two main factors: ease of maintenance and ease of use. Check sheets are almost exclusively used in the production process to keep tabs on raw material parameters and inspection point parameters, thus simplifying the proactive quality control approach. Cause and Effect diagrams are more complex, and therefore mostly used in large organizations with a keener approach to quality, mostly to keep in line with ISO standards. Control charts, one of the best practice tools for quality control, are used by 38% of the manufacturing sector in Kenya. Their

complexity of maintenance is the main factor for their reduced use in the sector. In any case, it is companies that are thoroughly dedicated to proactive quality control that use control charts to maintain quality in products.

4.3.7 Software Used for Implementation of Quality Assurance and Control

Quality Control System Software is generally used for tracking the components of quality assurance and control through the use of databases and charting applications. As observed by the figures, software for quality control is a concept embraced by 54% the manufacturing sector, although this has yet to gain favour for the other 46%. The different types of software used for quality control solutions include Ebiz Flame 7.3, ORION, LC Solution for HPLC, SAP, SCALA, QCX, LIMS, Libre Office, Excel, Statistica and Statgraphics. Other firms use tailor-made quality control solutions that are then pre-installed into the system used. An example of this is the software used for tensile and compression testing which is integrated into the organization's production system. Manufacturing firms that are very dedicated to quality of their products opt for these types of software, which are usually complex to handle and require dedicated quality control personnel to run.

4.3.8 Potential Challenges of Quality Control

Although quality control systems are used to control deviation of certain parameters to ensure that products meet an acceptable standard, there are other issues beyond the control of the system that pose a threat, or rather, a challenge to the system. Some of these issues are deviations from specifications of products in process, human resources, age of processing equipment and machinery, machine capabilities, poor initial design of product, issues in reception of quality raw materials and more.

Using a ranking system, it was determined that issues in reception of quality raw materials and age of processing equipment and machinery are two of the widest concerns faced by manufacturing firms in Kenya. These are followed by another major issue: deviation from specifications of the product in-process. Poor design of products is another issue. Not as strong as the others, it is nonetheless cause for concern. The overall response for human resources as an issue concerning quality control was standard, it impacted by 50%.

	RANK					
	1	2	3	4	5	6
Issues in reception of quality raw materials	7	5	2	3	2	1
Product Defects	4	2	4	6	3	1
Deviation from the specifications	2	9	6	2		1
Poor Design of Product	1		3	2	5	3
Human Resources	1	4	3	3	3	3
Age of processing equipment and machinery	5		2	3	4	3
Machine Capability	1				1	1

Table 4.6 Potential Challenges of Quality Control

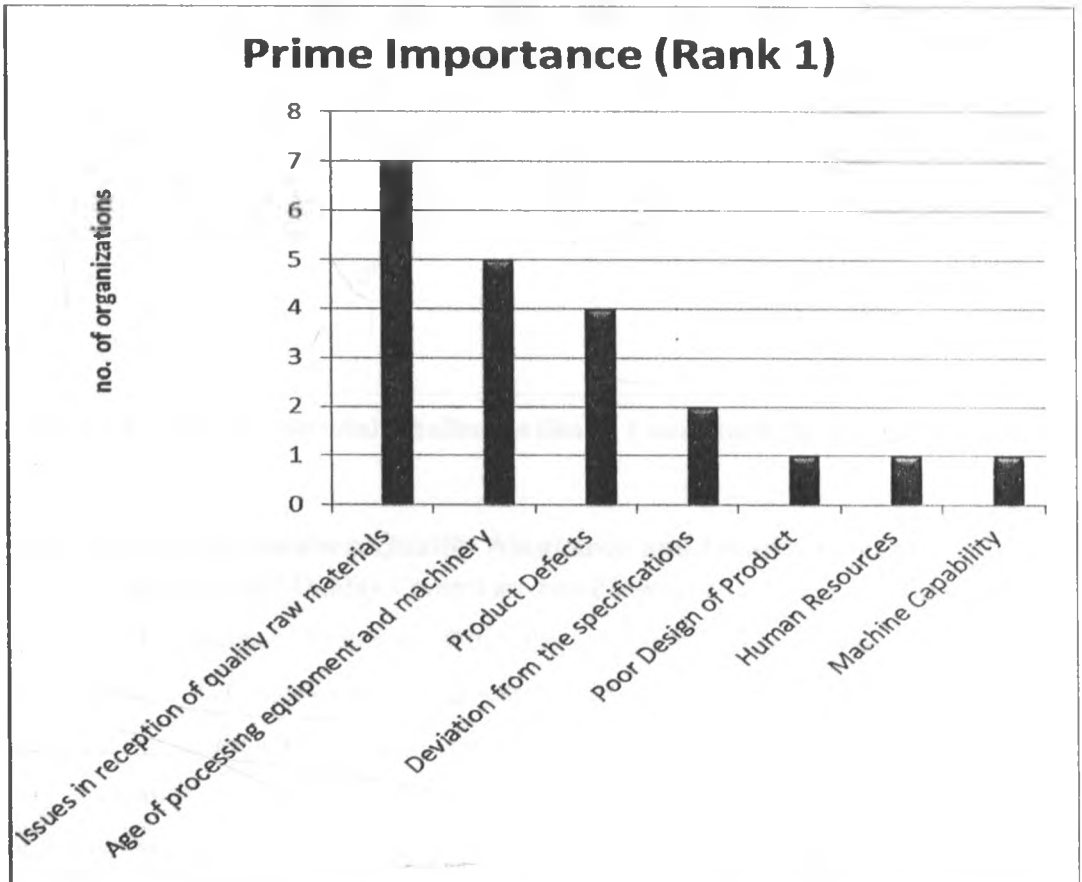


Figure 4.10 Biggest Potential Challenges of Quality Control

From Figure 4.10, it is clear that the biggest potential challenge of quality control in manufacturing firms in Kenya is Issues in reception of quality raw materials, which stands at 30%, followed by Age of processing equipment and machinery, which

stands at 21%. Also, from figure 4.11, another key potential challenge that comes to the fore is deviation from product specifications, which stands at 37.5%

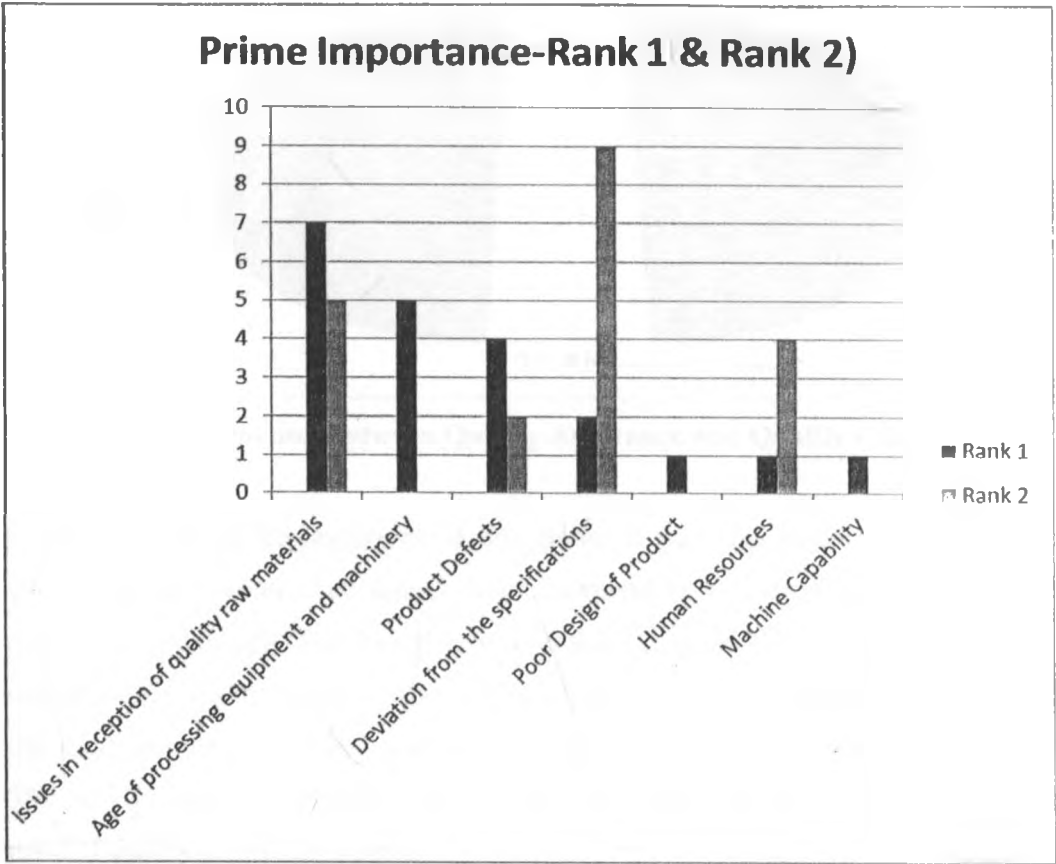


Figure 4.11 Biggest Potential Challenges (Rank 1 and Rank 2) of Quality Control

4.3.9 Differences between Quality Assurance and Quality Control

Quality Assurance and Quality Control are two different concepts, both coming under Quality Management Systems. With the responses obtained by the sample respondents, it becomes clear that almost half of the manufacturing sector in Kenya takes quality assurance and quality control as two separate entities, with some having both a Quality Assurance Manager as well as a Quality Control Manager. 47% of organizations take quality assurance and quality control to be one entity and design their quality control systems accordingly, whereas 53% take quality assurance and quality control to be two separate entities and have measures for both quality assurance and quality control.



Figure 4.12: Distinction Between Quality Assurance and Quality Control

In the interests of the objectives of this study, it was also essential to determine whether quality control personnel were independent of other activities such as production and design. This would serve to inform as to the level of an organization’s dedication to quality control. From the responses, 62% of organizations were clear that quality control personnel were independent of the production process, whereas in 38% of all organizations taking part in the study, quality control was just one of the roles of quality control personnel.

100% of all respondents assured that quality control personnel have full authority to stop production if quality requirements are not met. This is a significant improvement for manufacturing firms in Kenya, and proves that the manufacturing sector in Kenya is gaining a deeper awareness of the losses obtained by completing manufacture of non-conforming products

	Frequency	Percentage
Quality Assurance Manager	22	92
Quality Control Manager	10	42
Chief Inspector	3	13

Table 4.7 Study of Quality Management Personnel

92% of respondents have Quality Assurance Managers, while only 42% have Quality Control Managers. As seen from the responses, the Quality Assurance Manager is the overall head of Quality department, and answers either to the Productions Manager or directly to the General Manager. Only 13% of respondents have a Chief Inspector who is the overall head of the quality department and responsible for internal quality audits.

The presence of Quality Assurance Managers in 92% of the respondent firms is an indication that manufacturing firms are becoming more proactive in quality management and taking a deeper interest in quality control to not only balance themselves in their specific industries but also to gain a bigger competitive advantage.

4.3.10 Documentation of Quality Control Systems

For a manufacturing firm to put into place a quality control system and ensure that it is implemented successfully, it must also ensure that the right documentation for implementation and follow-through is available. To this effect, the respondents were asked as to whether they had a full set of quality procedures, work instructions and a complete quality assurance manual. The responses are summarized in the table below.

Documentation	Present	Absent	Percentage Present
Quality Assurance Manual	20	4	83
Quality Procedures	22	2	92
Work Instructions	22	2	92

Table 4.8 Documentation on Quality Control Systems

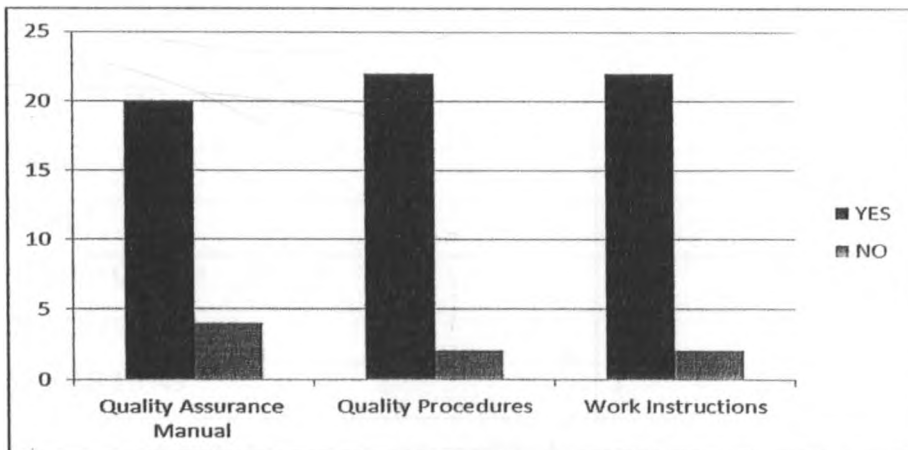


Figure 4.13 Graphical Representation of documentation of quality control systems

As per the figure above, it is observed that 83% of respondent organizations have Quality Assurance manuals in place, while 92% have both Quality Procedures and Work Instructions to inform and instruct quality and production personnel on the exact procedures to be followed to maintain quality in products. This documentation is a positive step showing the dedication manufacturing firms are gaining towards quality and the emphasis they are providing to enhance quality of products.

4.3.11 Quality Standards and Certification

All products manufactured in Kenya have to be certified by the Kenya Bureau of Standards. However, products that are being exported to other countries also have to be certified using international standards or quality standards from the importing countries. To become a bigger force on the international market, many industries in the Kenyan manufacturing sector have undertaken international certification such as ISO 9001:2008 and ISO 22000:2005. Other firms food, beverages and tobacco sector have chosen to adopt FSSC2200 while others have opted to adapt quality management systems such as ISO/TS 16949:2009 and Alberto Calvers.

The summary of organizations having adopted different sets of standards is shown in the table below.

National/International Standard	Frequency	Percentage
ISO 9001: 2008	15	63
ISO 22000: 2005	5	21
KEBS	18	75
ICH	1	4
WHO	1	4
cGMP	2	8
Alberto Calvers	1	4
FSSC2200	1	4
ISO/TS 16949	1	4

Table 4.9 Quality Standards Adopted by Manufacturing Firms in Kenya

International Standards Adopted for Quality Control

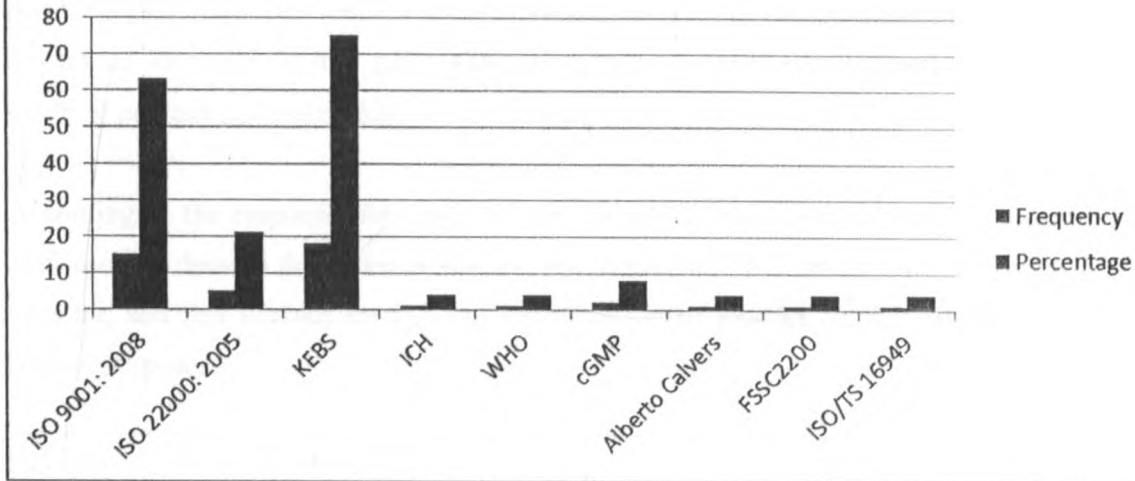


Figure 4.14 Graphical Representation of Quality Standards Adopted by Manufacturing Firms in Kenya

There are specific standards to which manufactured products are tested. The products leaving the production process need to meet certain standards set by the Kenya Bureau of Standards, or the International Organization of Standards, depending on whether the goods are meant to be sold in Kenya or abroad. Some of these standards include KEBS-KS 948 and KS 03-575, KS 09 PART IV, BSI 1874, KS 517-1:2007, KS 65:2009, KS 608: 2008, KS05-684: 1988, KS 03-591: 1987 and KS 184:2009 Pt 1 and Pt 2. Each of these standards is specific for certain products, ranging from steel-welded cylinders to black tea.

The figure above shows that 63% of respondent organizations have adopted ISO9001: 2008 standards while 21% have adopted ISO 22000:2005. KEBS standards have been adopted by 75% of respondent organizations, and the only organizations falling out of this standard are either foreign firms who export and export processing zone (EPZ) organizations whose products match the buyer's standards. The climb towards obtaining ISO certification is difficult, and the fact that 63% have obtained ISO certification is an indication that Kenyan manufacturing firms are now more aware and have moved from awareness to action in terms of quality.

4.3.12 In-Process Identification and Tracing of Products

To have an exemplary quality control system, there is a need for inspection/hazard point checks, where the quality of the product in-process can be determined and deviations identified at that point either corrected or production stopped to avoid waste of product and undertaking of corrective action.

According to the response obtained, 96% of all respondent organizations can trace their product through the entire production process. Also, 71% have a tracing system of some sort that enables tracing and identification of product batches for quality control purposes.

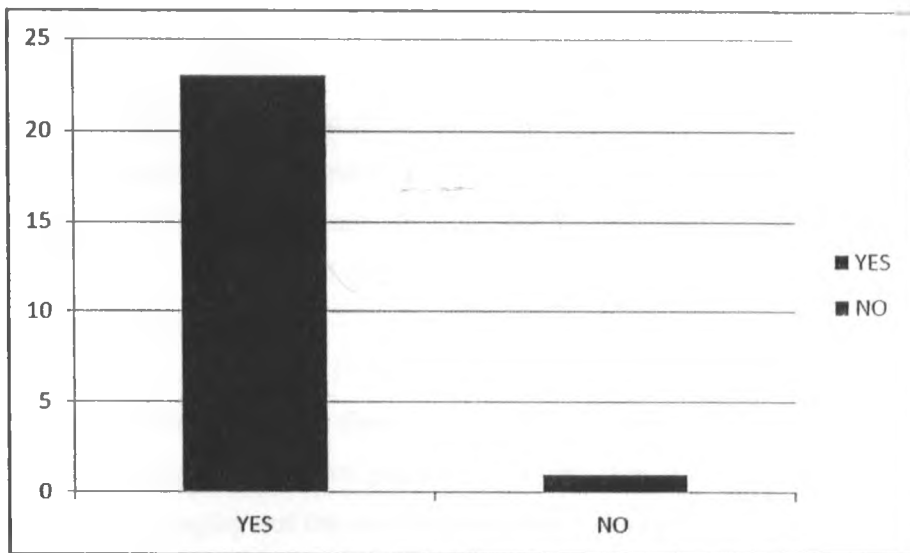


Figure 4.15- Percentage of In-process Product Tracing and Identification in manufacturing firms in Kenya

Different organizations use different tracing systems for identification and quality control. For some, an identification number is used for each batch of raw material used and this number is used all the way from processing to packing to dispatching. This number is also recorded in the in-process, storage and dispatch inspection records, making it easier to check quality of final product and making product recall easier. Status /identification tags are used for this purpose.

Other manufacturing firms using batch production process use job cards for each production stage. The quality control system is set such that the product at each stage needs to be approved by the Quality Control Manager before the product can be moved to the next stage in production. For continuous flow processes, the traceability procedure remains somewhat the same, with the product only moving on to the next process once it has met the requirements of the previous process, after inspection by sampling.

The traceability process varies from one organization to another, with firms in the same industry generally making use of similar tracing and identification systems. Some manufacturing firms also use lot tracing systems, whereas others assign serial or batch numbers at the start of the production process, which are generated by a SAP system.

The best traceability system is one that kicks into place once raw materials enter the plant and finishes with dispatch, with the finished product having a specific code that is linked to all product details, such as time of manufacture, batch of raw materials used, process line used and production and quality control personnel on shift for the specific process line.

For smaller manufacturing firms, due to smaller levels of production per batch and specific numbers of batches produced per day, the traceability of each product is clear: from bringing out the raw materials from storage to mixing, blending, pouring, setting, cooling and packaging. The product can be traced at any of these steps.

4.3.13 Controls Used in the Production Process

To ensure conformity to specific parameters to achieve quality products, specific controls are put into place in case of non-conformance at different levels. A qualitative analysis of these controls was carried out.

4.3.13.1 Controls Applied for Non-Conforming Products at Receiving Inspection

There are different controls applied when non-conforming products are received as raw materials. In most cases, the raw materials that fall outside the parameters set are rejected and sent back to the supplier. The responses range from outright rejection to

quarantine/segregation to alternate usage. The procedure for non-conformance at reception differs from one organization to the next.

From an extensive analysis of the control systems applied for non-conforming products at receiving inspection, a pattern seems to be clear as to the controls applied. This begins with raw materials prior to conformity assessment quarantined and held in a pre-inspection storage bay. A quarantine tag is affixed on these products. After the raw materials have been tested and found to be non-conforming, a rejection tag is affixed and the goods are then dealt with in three different ways:

1. Quarantine, followed by direct rejection and shipping back to supplier at supplier cost. In some cases, the parameters of non-conformance are indicated and supplier asked to take corrective/preventive action before re-dispatch at concession.
2. Carrying out conformance tests for other similar process lines to determine if the raw materials for one product can be used for other products
3. Using the non-conforming products after a concession from the supplier in terms of price, and upgrading the raw materials through specialized processes (e.g. blending) to render them conformed to requirements.

While these controls are accepted as best practice, other organizations also use control procedures that involve accepting the non-conforming raw materials at concession and altering machine requirements to enable production to continue. In such a case, controlled trials are carried out in process to ensure that the final product will be within acceptable standards. This control can only be used if the cost of production is low and the raw materials are just slightly outside the limits of conformance.

4.3.13.2 Controls Applied for Non-Conforming Products at In-Process Inspection

In-Process Inspection requires identification of control points or hazard points where products have to be tested for conformance before they can be moved to the next stage in the production process. These tests are essential to ensure that the end-product is of acceptable quality (free from defects). Different organizations use different controls when control point checks yield non-conforming products. These controls range from stopping the production line to determine source of non-

conformance to rejecting for disposal at that point to prevent incurring costs of production for inferior quality products.

The five most important quality controls applied for non-conforming products at in-process inspection are:

1. Identification of the deviating parameter and then reworking of the non-conforming product batch into a similar product whose parameters match those of the initial non-conforming product.
2. Re-grading the product to match the conformance properties of either a higher or lower grade.
3. Reject the unfinished product and dispose off as appropriate taking into account the environment and bio-hazard disposal requirements. Following rejection, a root cause analysis is generally undertaken and CAPA kicks into place.
4. Identification of non-conforming parameter and correction of the production function through application of appropriate process manipulation regimes, after which a sample is drawn from the corrected material and submitted to the quality function for conformity verification.
5. Continued run to the end of the production line and sold at concession rates to the final consumer.

The controls undertaken at this stage indicate that the quality control processes in manufacturing firms in Kenya are reaching towards best practice, as statistical controls and variable methods of quality control are applied, with acceptance sampling undertaken at the end to ensure conformity.

4.3.13.3 Controls Applied for Non-Conforming Products at Final Inspection

There are many factors that can influence non-conformance of products to a state of inferior quality at the end of the production process. These parameters range from a difference in pH that was not detected during the production process to a slight difference in viscosity from an undetected change in temperature. In any case, when the production process ends and final inspection is carried out, either manually through acceptance sampling or automatically through mapping via statistical software and non-conformities are detected, the right controls have to be applied.

In manufacturing firms in Kenya, these controls are:

1. Segregation of products.
2. Use of pre-control processes to identify non-conformities before making the final decision.
3. Re-working/reprocessing of the product through the production process to ensure conformity.
4. Re-grading the final product into a different class with each class having its own conformance requirements.
5. Rejecting the non-conforming batch of products and disposing appropriately.
6. Tag for release depending on the extent of non-conformance. If the variance is very slight from the limits of control, most companies that go this route prefer to release. However, if the non-conformance variation is too high, then the same organizations would rather dispose off than release and risk potential returns and tainting of the company brand name.
7. Root Cause Analysis is carried out to establish the actual cause of non-conformity and corrective actions are further put into place to proactively predict and prevent recurrence of the same.

4.3.14 Actions Taken for Preventing Recurrence of Non-Conforming Products

The respondent organizations were asked to describe the actions they take to prevent recurrence of non-conforming products, to get an in-depth understanding of the variety and scope of the quality control systems used. 50% believed that a root cause analysis of non-conformance must be undertaken to prevent non-conformance from recurring, whereas 30% believed that Corrective and Preventive Action (CAPA) guidelines should be followed to reduce chances of recurrence after analysis.

On the chemical and allied sector, there is a wider consensus of carrying out reverse engineering to determine points of non-conformance (undertaking HACCP) followed by Corrective and Preventive action. Also, 17% believe that recurrence can only be prevented by following the set standard operating procedures, leaving no room for deviation. 4% believe that performing in-process quality control checks during the production process (hazard point checks) prevents recurrence of non-conformance.

4.3.15 Actions Taken for Eliminating Potential Causes of Non-Conforming Products

On this front, the clear consensus on eliminating potential causes of non-conforming products falls on continuous process line maintenance and using Good Manufacturing Practices (GMPs). The following is a table of the actions taken elimination of potential causes of non-conforming products.

Actions Followed/Taken	Percentage of Organizations
Using HAACP as control	7
Good Manufacturing Practices	10
Routine Personnel Training	6
Continuous Process Line Maintenance	10
Poka Yoke methodology	3
5 Whys Methodology	3
Root Cause Analysis and Comprehensive Action Planning	10
Continuous Improvement of product process	3
Failure Mode and Effect Analysis	10
Risk Analysis on all Processes	6
Corrective Action/ Preventive Action	13
Standard Operating Procedures	19

Table 4.10 Actions Taken/Followed to Eliminate Potential Causes of Non-Conforming Products

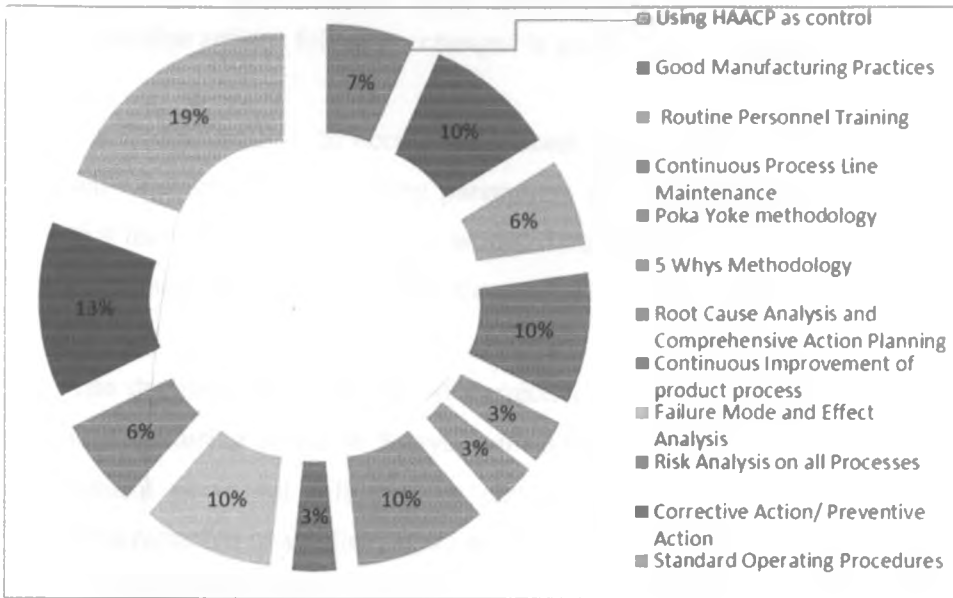


Figure 4.16 Pictorial Representation of Actions Taken to Eliminate Potential Causes of non-conforming products (Follow clockwise from HAACP)

19% of respondent organizations are of the opinion that using Standard Operating Procedures (SOPs) without deviating from them is the best cause for eliminating any and all causes of non-conforming products, while 13% believe in using CAPA. 10% believe in using Failure Mode and Effect Analysis, Root Cause Analysis and Comprehensive Action Planning, Continuous Process Line Maintenance and Good Manufacturing Practices

From this information, it is clear that a bigger percentage of manufacturing firms have rigid product process lines, which should not be deviated from. Also, carrying out Corrective Action and Preventive Action to remove the path to non-conformity is integral to a quintessential production process free of non-conformance.

4.3.16 Documentation of Processes Resulting from Corrective Action

This is necessary to ensure that the corrected actions are taken for implementing the corrected processes. For companies with ISO 9001: 2008 and ISO22000: 2005 certification, this process is mandatory and has to be carried out within specific timelines after corrective actions are taken on product processes. 53% of all

respondent organizations have documented procedures for documentation of corrective actions following changes in product process lines.

For documentation to occur, the process change has to be implemented effectively with a record of conforming parameters for all batches created henceforth to prove that the corrective mechanism works. This is done via monitoring, follow-ups, audits of the new process and routine acceptance sampling (validation practice).

The documentation process of corrective actions is reasonably standard across the manufacturing sector in Kenya, with 67% believing in procedure review by quality control personnel followed by communicating need for change to management representative in smaller organizations. In the larger firms taking part in the study, a documentation control procedure is in place, whereby the Quality Manager takes the onus of responsibility to amend documentation. After the documentation is altered, the relevant departmental heads review and approve, after which these become official documents.

In other cases, a change approval document is raised and approved, followed by review of procedures to take into account changes made and final documentation worked upon, after which the older process documents are disposed of appropriately and new ones circled to production staff of the process line.

4.3.17 Internal Quality Audits

All orgs in the study carry out internal quality audits, some very rudimentary and others very comprehensive. The internal quality audit varies from simple acceptance sampling every month to a more complex system of team audits with production control, quality control, machinery maintenance and quality assurance. The timelines for audits vary from one firm to another.

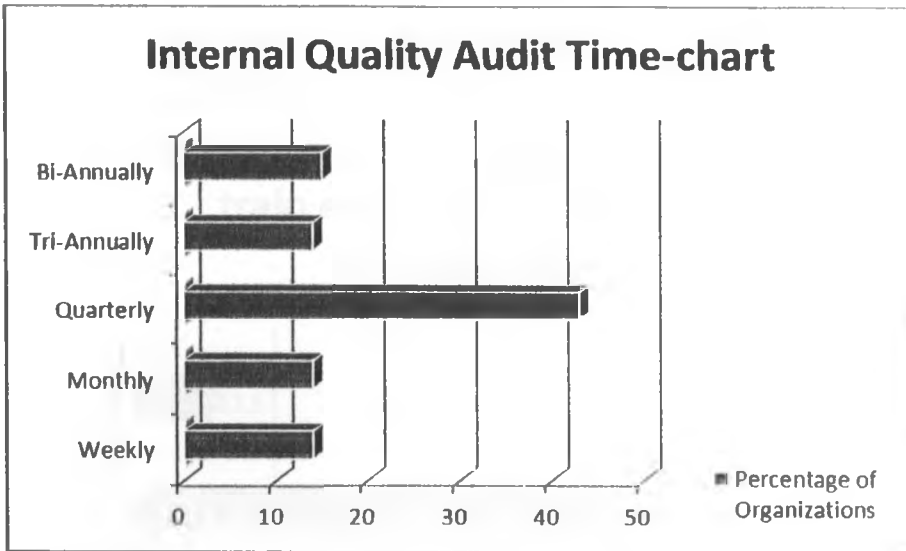


Figure 4.17 Internal Quality Audit Time-Chart

In a few cases, internal quality audits are carried out as per the audit procedure in the respective quality management system, following the exact procedure, lines of responsibility, reporting relationships, corrective action procedures and implementation procedures. While all manufacturing firms in the respondent study carry out quality audits, 21% have a superficial audit whereby the logs of the daily and monthly production records are randomly checked to determine conformance to standards.

4.3.18 Statistical Techniques for Verifying Acceptability of Manufactured Goods

50% of all organizations in the study use statistical techniques to determine acceptability of products at final inspection. Some of these statistical techniques involve in-house sampling panels, acceptance sampling on statistical tools such as STATISTICA, use of trend carts and run charts and Pareto analysis.

4.3.19 Employee Training in Quality Control and Management

To ensure that the quality control systems that have been put in place are efficiently and cohesively used in tandem with the overall quality management system, it is necessary for organizations to train their human resources in these systems. From the response obtained from the respondents in the study regarding training, the conclusion

was that 87.5% of organizations in Kenya train employees in quality control, either directly or through other forms of training involving production.

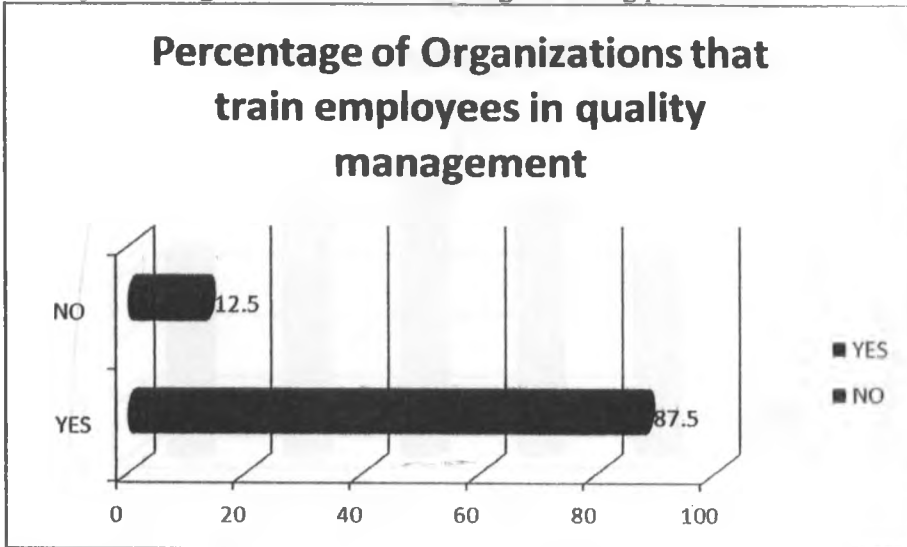


Figure 4.18 Graphical Representation of Organizations that train employees in QM

In many organizations where quality is taken to be one of the main parameters of branding the company, the concept of training follows a general training procedure which begins with the development of a personal performance management system that is geared towards developing competence matrices for all activities in the production and process line and evaluating with the staff competence profiles. This is followed by a Training Needs Assessment to bring out the skills gaps between what is required and what is present. This, in turn, helps decide the type of training required and the people skilled to carry it out. After training, a follow-up is generally carried out to ensure that the training material was implemented.

For other organizations, training on implementation of the QMS system is carried out by external consultants affiliated to the QMS firm. This training is provided to selected staff, who then implement it for their divisions. Once the QMS system is fully in place, these staff are further trained as Internal Auditors and finally as Lead Auditors. For all quality issues, the buck stops with them.

Most organizations in the study have taken the middle ground: cost is a factor influencing implementation of best quality control systems, but not to the extent where the quality suffers drastically due to lack of good quality control systems.

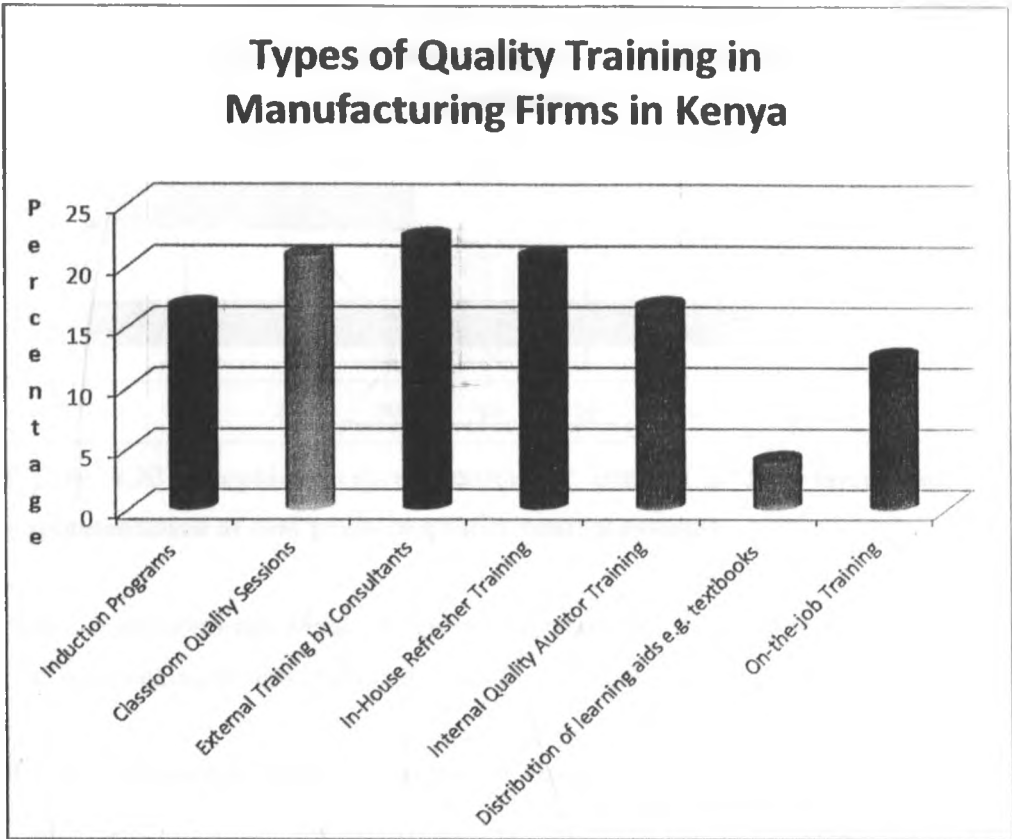


Figure 4.19 Types of Quality Training in Manufacturing Firms in Kenya

In some cases, organizations are putting off using the best quality control systems due to costs involved not only in installation but also in implementation: initial training of quality personnel, refresher training on modern methods of analysis, cost of raw materials tested under the new systems and destroyed, cost of reference materials, cost of regular calibration and more.

4.3.20 Cost as a factor influencing implementation of best quality control systems

When respondent organizations were questioned as to whether cost is a factor influencing their implementation of the best quality control systems in their particular sector of the manufacturing industry, 67% responded with Yes. This gives rise to the question, if cost of quality control is a driving factor influencing implementation of best quality control systems, to what extent is the manufacturing industry hindered in terms of quality of products?

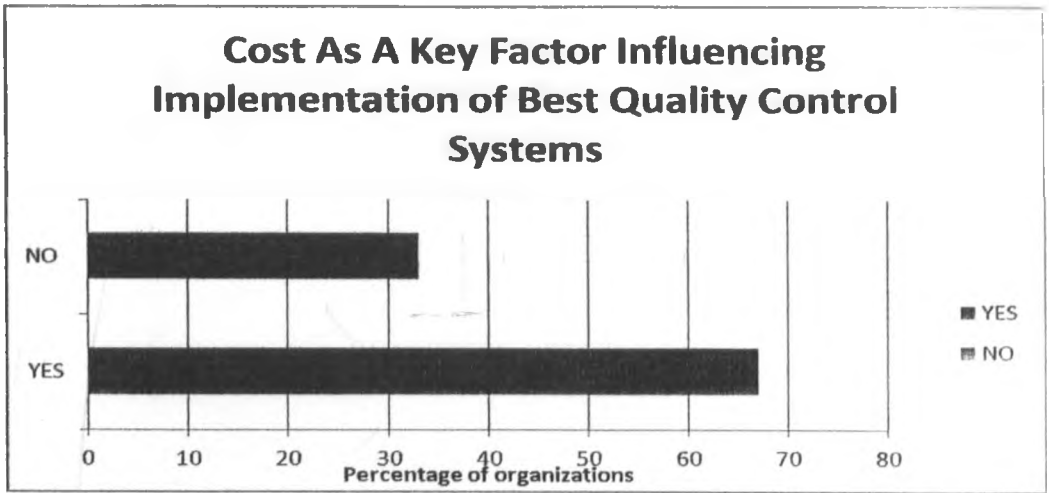


Figure 4.20 Graphical representation of cost as a key factor influencing implementation of best practice quality control systems

When these costs are weighed against their benefits, 67% of organizations find the decision-making process gets that much more difficult.

4.3.21 Perception of Best Practice in Quality Control Systems

The perception of best practice systems is skewed, as per the responses obtained. 75% of all respondents believe they employ best practice quality control systems, whereas 20% believe they still have to step up to get there. Taking a look at the overall responses regarding the types of quality control systems used for all sectors of the manufacturing sector in the study, their implementation and tools used, there is a clear demarcation between organizations that do have best practice systems and those that perceive to have them.

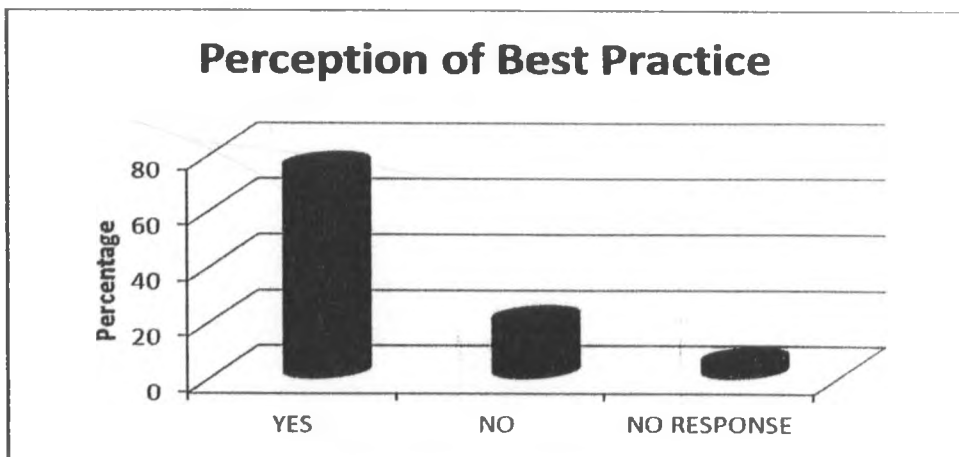


Figure 4.21 Manufacturing Firms' Perception of Best Practice

In line with the information obtained from the study, 29% of respondent organizations have moved towards best practice systems, 33% are on a step-ladder to achieving best practice and 33% still have very rudimentary quality systems.

CHAPTER 5: SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary and Conclusion

The key objectives of this research were to understand how manufacturing firms in Kenya are geared towards following international standards of quality control and to gain an in-depth understanding of the decisions made by operations managers in manufacturing firms in Kenya as well as their psyche towards implementation of cost-prohibitive quality control mechanisms.

To this end, the study was quite successful since it covered both objectives and featured very relevant information on quality control systems in manufacturing firms in Kenya. The need to provide an overview of quality control systems in the manufacturing sector in Kenya and its context was great, and this need was fulfilled by this study.

This study established that a majority of manufacturing firms in Kenya have moved beyond mere awareness of quality into actively embracing quality control systems in order to dig deep and plant themselves firmly into the ground with an unbeatable sustainable competitive advantage. Their conversance with the different types of quality management systems, quality control systems and quality control tools comes through, suggesting that they have grasped the power of conformance to consumer specifications in building a brand.

The study also proves that 100% of all manufacturing firms in Kenya have internal quality controls, some rudimentary while most are quite comprehensive and complex. Another key finding was that 75% of manufacturing firms in Kenya perceive that the quality control systems they are using are best practice. As best practice systems form the top tier, these organizations will either be motivated and challenged towards always keeping to current best practices while others will stop pushing on the matter of quality, confident in the fact that they are already at best practice levels. The latter is

a big threat to manufacturing firms in Kenya, as is seen from the level of current quality control practices.

Another interesting insight obtained from the study was the number of manufacturing firms adapting ISO standards. The fact that stratified random sampling was used to determine the sample respondents makes the fact that 63% of organizations are either ISO certified or have undertaken testing and re on course to be certified (both ISO 9001: 2008 and ISO 22000: 2005) even more incredible. This suggests that the Kenyan manufacturing sector is on par when it comes to quality with many other developed countries.

5.2 Recommendations

The study brought to light interesting aspects regarding quality control systems in manufacturing firms in Kenya. Some of these aspects encompass internal quality audits, cost of quality control and perception of best practice quality control systems.

Internal quality audits are recommended to be done every quarter, with the resulting review presented at the quarterly performance review meetings. These audits ought to be done by lead auditors who have a grasp of the concept and have the power/authority to make changes to the quality control process as required. Also, cost of quality control, while important, cannot overshadow the profit margins for the company. A balance has to be defined between cost and benefit of quality control.

Perception of best practice systems is a two-tong fork: it can make and it can break. If an organization perceives that it is using best practice systems even when the tools used for quality control do not match up to said best practices, then this organization is bound to misinterpret its values of quality and the consumer's perception of it. It can also become lax in controlling quality because it believes it is already using the best systems. On the other hand, an organization with perceived and actual best practice systems needs to be on top on the game: continually motivated to seek the best in terms of quality control. Most Kenyan manufacturing firms are climbing the mountain, they have yet to meet the leaders at the peak.

5.3 Limitations of the study

There were a few essential limitations of the study: One of the key ones was confidentiality. Most organizations in the manufacturing sector have policies regarding quality systems that encourage complete confidentiality regarding documentation. To this extent, it was difficult to get hold of quality control documentation that could have provided more insight into the subject matter of the study.

Another key limitation was the response rate, which was lower than expected by the researcher. This response rate was 77%, which impacted on the value of the findings as a representation of the entire population. Since confidentiality was key and proof documents non-forthcoming, it is assumed that the research has deviated to a very small extent, with organizations due to an element of discomfort with self-disclosure.

5.4 Suggestions for further research

This research was aimed at quality control systems in manufacturing firms in Kenya. In the field of quality and overall quality management systems, there is plenty of scope for further and deeper research. Some of these opportunities lie in analyzing and understanding the demand of quality in manufacturing firms on the environment, linking it to the limitations of pollution due to production outlined in Vision 2030.

Another interesting study off-shooting from this one is an analysis of the different quality management systems used within the same industry in the manufacturing sector and the differences obtained in quality used each. This will help determine the best quality management systems that can be used in the Kenyan manufacturing sector. Also, if the East African Community is coming into play to offer the world bigger things, then the same study could be undertaken for the entire East African Community i.e. Kenya, Uganda, Tanzania, Rwanda and Burundi.

REFERENCES

Laura Martínez Caro, Jose Antonio Martínez García, (2009) "Does ISO 9000 certification affect consumer perceptions of the service provider?", *Managing Service Quality*, Vol. 19 Iss: 2, pp.140 – 161

Ebert, J., Natarajan, V., Newsom, A., Qu, D. and Kearney, A.T., (2010, August 18). Rebalancing Quality Priorities. *Industry Week*. Article [online], available from: http://www.industryweek.com/articles/rebalancing_quality_priorities_22562.aspx

Ebert, J., Natarajan, V., Newsom, A., Qu, D. and Kearney, A.T., (2010, August 18). Transforming Quality Culture By employing a strategic mindset for quality, companies can improve performance and better address the challenges ahead. *Industry Week*. Article [online], available from: http://www.industryweek.com/articles/transforming_quality_culture_22564.aspx

Saunders, M., Lewis, P. & Thornhill, A., (2007). *Research Methods For Business Students*. Essex, England: Pearson Education Ltd.

Costin, Harry, (1999). *Strategies For Quality Improvement (Second Edition)*. Fort Worth, Texas: The Dryden Press

Summers, Donna C. S., (2000). *Quality (2nd Ed.)*. New Jersey, USA: Pearson Education Ltd.

Dale, Barrie G., (2003). *Managing Quality (4th Ed.)*. Malden, UK: Blackwell Publishing Ltd.

Slack, N., Chambers, S. and Johnston, R., (2001). *Operations Management (3rd Ed.)*. Essex, UK: Pearson Education Ltd.

Gorbach, Greg (2009, January 26). Achieving Compliant Manufacturing Excellence through Real-time Performance Management. White Paper [online]. Available from: http://whatis.bitpipe.com/detail/RES/1232732828_526.html

Abilla, P. (2010, July 17). Suppliers, Inputs, Process, Output, Customers (SIPOC). *Shmula*. Article [online]: available at: <http://www.shmula.com/3289/suppliers-inputs-process-output-customers-sipoc#ixzz0xQQiq8bY>

John, (2010). ISO 9001: Understanding the Process Approach, *Buzzle.com*. Article [online], available at: <http://www.buzzle.com/articles/iso-9001-understanding-process-approach.html>

Dr. Chu, Chao-Hsien (2008). Vision Control For World Class Manufacturing. Article [online], available at: <http://net1.ist.psu.edu/chu/wcm/vc/vc.htm>

Castillo, Joan Joseph (2009). Simple Random Sampling. Article [online], available at: <http://www.experiment-resources.com/simple-random-sampling.html>

Akama, J.S., Kieti, D.M., (2002). Measuring Tourist Satisfaction with Kenya's Wildlife Safari: a Case Study of Tsavo West National Park. Article [online], available at: emeraldinsight.com

Crosby, Philip (1979). *Quality is Free*. New York: McGraw-Hill.

Tennant, Geoff (2001). *SIX SIGMA: SPC and TQM in Manufacturing and Services*. Gower Publishing, Ltd., p. 6.

APPENDICES

Appendix I: Letter of Introduction to Respondents



UNIVERSITY OF NAIROBI
SCHOOL OF BUSINESS
MBA PROGRAM - LOWER KABETE CAMPUS

Telephone: 020-2159162
Telegrams: "Vuesly", Nairobi
Telex: 22095 Vuesly

P. O. Box 30197
Nairobi Kenya

DATE 16th SEPTEMBER 2011

TO WHOM IT MAY CONCERN

The bearer of this letter ... RGHANN EBRAHIM MUTHWANI
Registration No DG1/171503/2008

is a Master of Business Administration (MBA) student of the University of Nairobi.

He/she is required to submit as part of his/her coursework assessment a research project report on a management problem. We would like the students to do their projects on real problems affecting firms in Kenya. We would, therefore, appreciate if you assist him/her by allowing him/her to collect data in your organization for the research.

The results of the report will be used solely for academic purposes and a copy of the same will be availed to the interviewed organizations on request.

Thank you.

DR. W.N. IRAKI
CO-ORDINATOR, MBA PROGRAM

UNIVERSITY OF NAIROBI
SCHOOL OF BUSINESS
MBA OFFICE
P. O. Box 30197
NAIROBI

Appendix II: Questionnaire

UNIVERSITY OF NAIROBI
SCHOOL OF BUSINESS
MASTER OF BUSINESS ADMINISTRATION

**QUESTIONNAIRE FOR RESPONDENT ORGANIZATIONS ON STUDY ON
 QUALITY CONTROL IN MANUFACTURING FIRMS IN KENYA**

Please provide answers for the following questions by checking the correct answer and giving the necessary details in the spaces provided.

1. Information about the firm

1. What is your Position/Title in the organization?

2. Company Ownership

- | | | | | |
|--------------------|-------|--------------------------|----|--------------------------|
| a. Local | Yes | <input type="checkbox"/> | No | <input type="checkbox"/> |
| b. Foreign | Yes | <input type="checkbox"/> | No | <input type="checkbox"/> |
| c. Other (Specify) | | | | |

[Check as appropriate]

3. How many employees does your organization have?

4. Please indicate the industry you are primarily involved in.

Name of Industry	Please Check ONLY One
Energy, Electrical and Electronics	<input type="checkbox"/>
Plastics and Rubber	<input type="checkbox"/>
Textile and Apparels	<input type="checkbox"/>
Food, Beverages and Tobacco	<input type="checkbox"/>
Pharmaceutical and Medical Equipment	<input type="checkbox"/>
Metal and Allied	<input type="checkbox"/>
Paper and Paperboard	<input type="checkbox"/>
Leather Products and Footwear	<input type="checkbox"/>
Chemical and Allied	<input type="checkbox"/>
Motor Vehicle Assembly and Accessories	<input type="checkbox"/>
Building, Construction and Mining	<input type="checkbox"/>
Timber, Wood Products and Furniture	<input type="checkbox"/>

5. Do you export your manufactured products? Yes No

If yes, to which countries do you export your manufactured goods?

2. Information on quality control systems

1. What production methods are used by the manufacturing firm in the manufacture of products?

- a. Job Method
- b. Batch Method
- c. Continuous Flow Method
- d. Intermittent Flow Method

2. Does your organization practice

- a. Total Quality Management? Yes No
- b. Continuous Improvement? Yes No
- c. Business Process Reengineering? Yes No

(Check as appropriate)

3. What type and form of quality control systems does the company use to control product quality?

- a. Statistical Quality Control
- b. Plan-Do-Check-Act
- c. Corrective and Preventive Action
- d. Six Sigma
- e. Failure Testing
- f. Other (Please list here)

4. What is the logic behind the use of the specific quality control systems used? (Please check all that are correct)

- a. Cost
- b. Benefit Gained
- c. Best Practice
- d. Benchmarked System
- e. Ease of Use
- f. Availability

5. Does your organization observe a reactive or proactive approach to quality?

(Do you react to quality issues such as defects after they occur [reactive] or do you anticipate quality issues and take measures to prevent them [proactive]?)

- a) Reactive Approach
- b) Proactive Approach

6. What tools does the company use to implement these systems?

- a. Cause – and – effect diagram
- b. Check Sheet
- c. Control Charts
- d. Histogram
- e. Pareto Chart
- f. Scatter Diagram
- g. Stratification

7. Do you utilize computer software in the implementation of the quality control system? Yes No

If yes, what software do you use?

8. What are the potential problem areas when it comes to quality control? Please rank in order from most problematic to least problematic.

- a. Issues in reception of quality raw materials []
- b. Product defects []
- c. Deviations from the specifications []
- d. Poor design of product []
- e. Human Resources []
- f. Age of processing equipment and machinery []
- g. Other (Please list here) []

9. In your organization, are Quality Assurance and Quality Control taken to be two different processes? Yes No

10. Are the Quality Assurance/ Quality Control personnel independent of other activities such as design and production? Yes No

11. Does your organization have:

- a. A Quality Assurance Manager Yes No
- b. A Quality Control Manager Yes No
- c. A Chief Inspector Yes No

If Yes, to whom do they report?

12. Do the Quality personnel have the authority to stop production if quality requirements are not being met? Yes No

13. Does the organization have a documented Quality System? Does the system include:

- | | | |
|----------------------------|------------------------------|-----------------------------|
| A Quality Assurance Manual | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| Quality Procedures | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| Work Instructions | Yes <input type="checkbox"/> | No <input type="checkbox"/> |

14. What National/International Quality Standard (i.e. ISO 9001 or equivalent) does your quality system meet?

15. Is your Company's Quality System certified to that standard? Yes No

If yes, please provide a copy of the certificate.

16. Can the product and its inspection status be identified and traced at any stage of the manufacturing process? Yes No

Please explain or attach a copy of your procedure

17. What controls are applied when a non-conforming item is found at:
a. Receiving Inspection

b. In-Process Inspection

c. Final Inspection

18. To what National/International Standard or procedure is the subject product tested?

Please provide a sample of your factory routine test procedure, if available.

19. Are non-conforming items segregated and their status clearly indicated on them?

Yes No

20. Describe the actions taken for:

1) Preventing recurrence of non-conforming product(s)

2) Eliminating potential causes of non-conforming product(s)

3) Ensuring that corrective actions are implemented and are effective

4) Documenting necessary changes in procedures resulting from corrective action.

21. Are internal quality audits carried out periodically to verify the implementation and effectiveness of your quality system? Yes No

If yes, please describe your audit program, showing responsibility and distribution of the audit reports

22. Do you apply any statistical technique to verify acceptability of the process/product? Yes No

If yes, please explain briefly

23. Does the organization train employees in quality management? Yes No
If yes, please provide a brief on how the training occurs

24. Is cost of quality control a factor in the implementation of the right quality control systems? Yes No

If yes, to what extent?

25. Can the quality control techniques used by your manufacturing firms be termed as best practice? Yes No

Thank you. Your assistance in this study is highly appreciated.

NOTES:

1. All information provided in this survey is strictly confidential: the name of the respondent organization and their response in the survey will not be dealt out in the final presentation or report.
2. Respondent organizations can request for a copy of the final report, which will be available on or before the 1st of January 2011.