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The application of Good Manufacturing Practices as a quality approach to food safety in a food manufacturing establishment in the Western Cape South Africa

by

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DECLARATION

I, Macceline Ngwa, declare that the contents of this dissertation/thesis represent my own unaided work, and that the dissertation/thesis has not previously been submitted for academic examination towards any qualification. Furthermore, it represents my own opinions and not necessarily those of the Cape Peninsula University of Technology.

August 2017

Signed **Date**

ABSTRACT

Good Manufacturing Practices (GMP) is a segment of quality assurance which guarantees that food products produced are uniform and controlled to the appropriate quality standards for their required use and as expected by the marketing authority. A survey was carried out to assess the awareness and implementation level of GMP guidelines amongst manufacturers in the Western Cape, South Africa. Based on a literature review on GMP in the food manufacturing establishments a research problem was identified forming the crux of the research which reads as follows: “the lack of enforcement of approved standards within the food manufacturing establishments in the Western Cape Province, South Africa may result in the food product quality being questioned by consumers”.

The objective of this study was to assess the awareness and implementation of GMP among food manufacturing establishments in the Western Cape. The literature was reviewed to discover what is currently known concerning GMP in the food manufacturing industries. Fresh food produce manufacturing establishments in the Western Cape Province South Africa were targeted for this study, with 52 responding to the questionnaires.

Data was collected by means of self-administered structured questionnaires and individual face-to-face interviews with six of the establishments that participated in the questionnaires. Data for the questionnaires was analysed by means Statistical Package for Social Science (SPSS) version 19 software programme in order to generate descriptive statistical results and to determine potential areas for improvement in the establishments surveyed. Data for individual face-to-face interview was recorded by transcribing and analysed by inductive reasoning. In particular, Cronbach’s alpha was utilized to test the reliability of the key items of GMP.

To achieve the objective of this study, quantitative research methodology was used. The data results, analysis of the findings and recommendations were later conveyed to the food manufacturing establishments which had been surveyed.

The results of this study show that employees of food manufacturing establishments in the Western Cape have not received sufficient training on GMP and that there is

widespread non-compliance. The study also revealed that, there are no GMP training programs in place. The root causes of non-compliance are not generally investigated by the manufacturer and quality improvement tools are not being used in the various food manufacturing establishments.

The following recommendations were made as part of this study; training programs should be implemented for all food manufacturing establishments in the Western Cape. Individual employees of those companies should be selected for GMP training. The root cause of non-compliance should be investigated and quality improvement tools should be used for food manufacturing establishments to improve product quality, quality objectives and auditing of the GMP should be enforced.

Keywords: food, quality, safety, quality and safety management systems, Good Manufacturing Practices.

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DEDICATION

This study is dedicated to my late dad, Mr Ngwa Godlove, who have always believed in education and gave me the best in life, through education. To my sweet mother, Lum Theresia, who never stopped believing in me and to my brothers and sisters who continue to inspire me with positive reflections. Finally to all under-privileged people around the world, because wherever and whoever we are, we really can make a difference!

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GLOSSARY

Continuous improvement: The term continuous improvement refers to the need to continuously refine and improve the effectiveness of the food safety management system (FSMS) (ISO 22000:2005, 2005).

Food safety: Refers to the conditions and practices that preserve the quality of food to prevent contamination and food-borne illnesses (Wilcock, Pun, Khanona & Aung, 2004:58).

Hazard Analysis Critical Control Point (HACCP): HACCP is a methodology and management system, used to identify, prevent and control food safety hazards (ISO22000:2005, 2005).

Food Safety Management System (FSMS): Signifies some features of quality assurance which safeguard that food and food products are manufactured and controlled as per the customer‘s demand and expectation. The purpose of such quality assuarnce systems is to ensure compliance as well as with the quality standards suitable for the purpose used for. They prevent deterioration in the organoleptic characteristics of food and thus prevent danger to human (South African National Standard 10330, 2007).

Good Manufacturing Practice (GMP): GMP is a system of connection of elements that join to fortify that food does not cause any harm to human health once consumed. The segment of the system includes programmes, goals, objectives, policies, standards, control measures, roles, responsibilities, relationships, document

	control, record keeping, and resources needed by food manufacturing industries (ISO22000:2005, 2005).
ISO 22000:2005:	ISO 22000:2005 identify the requirements for a FSMS, ensuring that organization in the food manufacturing industry illustrate their potential to control food safety, and to avoid contamination, so that food is safe for the consumers (ISO22000:2005, 2005).
Hazard:	Refers to biological, chemical, or physical agent in, or condition of, food with the ability to cause harm to human health (Food and Agriculture Organization (FAO) & World Health Organization (WHO) 2001).
Food Hygiene:	The state and measures required for the manufacturing, storage and distribution of food to guarantee it safety, and wholesome food products fit for the end users (FAO & WHO 2001).
Risk:	Refers to the likelihood of harm to human health and the severity of that harm, resulting to a hazard or hazards in food products (FAO & WHO 2001).
Effectiveness:	The length to which tasks are realised and the planned outcomes achieved (South African National Standard 10330, 2007:6).
British Retail Consortium (BRC):	The British Retail Consortium is the leading trade association for retailing. BRC Global Standard for

	Food Safety was developed to help the food manufacturing industries to meet legislative expectations of the EU General Product Safety Directive and the UK Food Safety Act (Cert-id, 2015).
Food:	Can be referred to as any solid or liquid substance, either food or liquid which when consumed can benefit the human body to function effectively. Food substances include drinks, chewing gum and any substance which has been used in the manufacturing, production or treatment of food, but excluding cosmetics, tobacco and substances used only as drugs (FAO & WHO 2001).
Quality Management System (QMS):	QMS refers to control systems, authority, procedures, standards, control processes and management resources to execute the principles thereof, as well as the action lines needed to obtain the quality objectives of an organisation (ISO 9001:2008, 2008).

CHAPTER 1: THE SCOPE OF THE RESEARCH: INTRODUCTION AND MOTIVATION

1.1 INTRODUCTION

Quality assurance schemes are becoming increasingly utilised in the food industry and agricultural sector globally (Schiefer & Rickert, 2004:662). There is a growing demand for quality from customers particularly the large manufacturers and processors, and a number of food crises residues in foodstuffs, which have undermined consumers' assurance in food safety and revealed the absence of transparency in food supply chains (Theuvsen, Plumeyer & Gawron, 2007:564).

Chaloner-Larsson, Anderson, Egan, Da Fonseca Costa Filho and Gomez Herrera (1997:6) define Good Manufacturing Practices (GMP) as a segment of quality assurance which guarantees that food products are uniformly manufactured and well controlled as per the quality standards suitable for their use and as expected by the marketing authorization.

GMP is often referred to as cGMP, with the 'c' indicating 'current' or the modern technology and systems that are needed or are being implemented (Baş, Yüksel & Çavuşoğlu, 2007:124). It is an essential element in GMP systems as it prevents misinterpretation in other standards (Gillian, 1997:3). For example, GMP requirements of one or two decades ago are almost certainly unacceptable by today's higher standards. GMP is a term that is well known globally for the effective control and proper management of manufacturing and quality control testing of foods, pharmaceutical products and medical devices. GMP covers various matters, including facilities design, documentation, production, quality control, product delivery and validation (Baş, *et al*., 2007:124).

Most GMP requirements give flexibility for individual manufacturers to decide for themselves what the best ways are to meet the necessary controls. Hence, a conclusion can be made that GMP is an 'open ended' requirement and not rigid. According to Shaikh and Sial (2007:63), the primary objective of GMP is that quality should be implemented into a product and GMP is not to be used only as a way of assessing the finished product quality. With GMP compliance and implementation, the guarantee is that the finished product not only meets the

consumer expectation, but the same safety and control measures are being enforced each time a product is made throughout the entire production process.

GMP provides benefits in the sense that it reduces the operating cost of rework, customer rejects, complaints, and that it increases efficiencies and customer's acceptance of products. Due to the various benefits of GMP, it is crucial for the establishment to implement GMP guidelines without compromising. Unfortunately, there is a lack of information on GMP implementation amongst manufacturers and other quality systems such as Hazard Analysis Critical Control Point (HACCP) and International Organisation for Standardisation (ISO).

1.2 MOTIVATION

The motivation for this study is that GMP, although widely adopted in South African food manufacturing establishments it is not legally enforceable and food manufacturing establishments make their own decisions whether GMP should be implemented to ensure food safety, quality and control measures in their establishment. In South Africa the multiple agencies that ensure that safety and control of food systems remain characterised by the fragmentation of the legislation structure and functions have not been able to respond strategically (South Africa. Department of Health, Department of Trade and Industry and Department of Agriculture, Forestry and Fisheries, 2013:1). The main aim regarding food safety in developing countries is the prevention of illness and the reduction of food contamination (Bolton, Doherty & Sheridan, 2001:173).

Food Safety Development (FSD) attempts to reduce the negative impact of food-borne illnesses (Gessner, Beller, Middaugh & Whitford, 1994:95). Both food and water borne diseases are leading causes of illness, diarrhoea and death in the fewer developing countries and are responsible for affecting 1.8 million people annually (World Health Organisation, 2004:16).

For this reason, the motivation of this study is to explore the GMP processes employed by food manufacturers in food manufacturing establishments in order to produce safe food products for consumers through the various processes that are involved.

1.3 BACKGROUND TO THE RESEARCH PROBLEM

In the last decade large food manufacturers have put considerable effort into establishing and implementing global food safety initiatives, schemes and private standards to ensure the safety of their products (Henson & Reardon, 2005:242). The stated rationale for this strategy is the increasing consumer demand for food safety and the supermarkets' concerns about food scares. Supermarkets set strict safety standards to exploit consumers' willingness to pay and to avoid potential liabilities (Henson & Humphrey, 2010:1629).

Economic literature reveals that some manufacturers seem to be mostly unaware of the existence of food safety standards (FSS) and supermarkets are not putting any significant effort into advertising and promotion (Hammoudi, Hollman & Surry, 2009). The main goal of FSS is meeting consumers' demand, because the lack of information prevents supermarkets from gaining a price premium for the increased food safety.

Due to worldwide recognition of standardised systems and processes pertaining to food safety and food quality (Trienekens & Zuurbier, 2008:107-109), usually there is a need to enforce good manufacturing practices and to integrate it into the requirements of the consumer needs in South Africa (South Africa. Department of Health, Department of Trade and Industry & Department of Agriculture, Forestry and Fisheries, 2013:2). Although many food manufacturers have GMP in place, these systems are not being implemented effectively.

1.4 STATEMENT OF THE RESEARCH PROBLEM

Food safety is highly recognized globally as the relationship between food and health are increasingly recognized (Ericksen, 2008:246-249). Food safety and quality remain critical issues as the epidemic of food borne illness results in high costs to the consumer, the food manufacturing industries and the economy (Käferstein, Motarjemi & Bettcher, 1997:503-504).

Global food safety initiatives have realised a number of standards and schemes that should be accepted by every major role player in the food industry in both the local and the international trade (Busch & Bain, 2004:333-335). South Africa however, does not have an official body that enforces food safety standards

though the standards are in place. Therefore, most of the South African food manufacturers do not have any of the approved systems implemented.

The research problem that is addressed in this study is that, GMP is currently perceived as minimal food safety measures by most food manufacturers. Therefore, the lack of enforcement of approved standards within the food manufacturing establishments in Western Cape Province, South Africa may result in the food product quality being questioned by consumers.

1.5 RESEARCH QUESTION

1.5.1 The primary research questions

The primary research questions is: What are the measures that food manufacturers in the Western Cape Province of South Africa need to have in place in order to guarantee safe food products to customers and if there are any measures in place that will force the Western Cape food manufacturing establishments to adopt GMP in order to guarantee safe food products to the customers?

1.5.2 Investigative questions

Four investigative questions were examined in support of the primary research questions:

- What hinders effective implementation of GMP amongst food manufacturing establishments in the Western Cape?
- What are the perceived barriers within the food manufacturing establishments that ensure GMP compliance?
- Are food manufacturers aware that GMP will improve their confidence to manufacture and deliver products that conform to safety standards of their customers?
- Which key factors measures performance of GMP within the food manufacturing establishments?

1.6 PRIMARY RESEARCH OBJECTIVES

The identified primary research objectives of this research study are listed below:

- To explore the awareness and implementation of GMP among food manufacturing establishments in the Western Cape.
- To determine the perceived barriers within the food manufacturing establishments with regard to adhering to GMP.
- To suggest an effective approach to highlight the benefits of GMP for the broader South African food manufacturing establishments.
- To determine the key factors that measures performance of GMP within the food manufacturing establishments.

1.7 RESEARCH PROCESS

Badenhorst (2008:51) views the fundamental stages in the research process to all scientific based investigation as:

- **Conceptualising:** simplifying, and making decisions towards the problem identification.
- **Research management**: conducting on decisions and ideas for an abbreviated literature review.
- **Evidence:** formulate the research proposal by presenting evidence.
- **Contribution to knowledge**: conduct research by translating the data into knowledge.
- **Scholarship**: culmination and a beginning, a thread carried through the entire project.
- Write up the dissertation.

Collis and Hussey (2003:16) indicated six fundamental stages in the research process.

- The identification of the research topic.

- Definition of the research problem.
- Determining how the research is going to be conducted.
- Collection of the research data.
- Analysis and interpretation of the research data.
- Writing up of the dissertation or thesis

Remenyi, Williams, Money and Swartz (2002:64-65) explain the research process in eight phases and in similar steps as used in this study.

The following research processes were implemented in this study:

- The researcher identified a research topic regarding a quality assurance problem experienced in the food manufacturing establishment.
- Build a theoretical framework of existing quality tools with the objective of improving quality system in the food industry.
- The research question was formalised.
- Research design and methodology were established and described. Data was collected as evidence and analysed.
- Finally the results were discussed and the conclusions and recommendations were made.

1.8 RESEARCH DESIGN AND METHODOLOGY

According to Welman and Kruger (2005:133), research methodology is the application of methods, techniques and principles in order to create scientifically based knowledge. Leedy and Ormrod (2001:9) point out that research methodology guides the research effort. The study set up a means of redefining the raw data and formulates an approach to manifest the underlying meaning.

There are several types of research methodologies that can be used, which depend on the study and the goal to be achieved (Stuart & Wayne, 1996:3 and Collis &

Hussey, 2003:10). These various types of research can be categorised with regard to:

- The ‘purpose’ of the research (exploratory, descriptive, and analytical, research).
- The ‘logic’ of the research (deductive or inductive research).
- The ‘outcome’ of the research (applied or basic research).
- The ‘process’ of the research (qualitative or quantitative).

In terms of research methodology, this study is framed by the positivistic quantitative paradigm. This research study is theoretical in nature, using a positivist (quantitative) research paradigm as its basis. Babbie (2005:25) states that, “recognizing the distinction between qualitative and quantitative research doesn’t mean that you must identify your research activities with one to the exclusion of the other. A complete understanding of a topic often requires both techniques”.

In this study quantitative method was utilised by using a structured tool to generate numerical data as well as statistics to interpret, organise, and represent the collected data. Frequency tables and graphs were used to analyse and interpret the findings. In order to supplement the questionnaires, individual face-to-face interview was conducted with six of the establishments that participated in the questionnaires and data explained by inductive reasoning. The research design is survey research.

1.9 DATA COLLECTION DESIGN AND METHODOLOGY

Data collection is a means by which a researcher collects reliable information in order to meet the research objectives. For this research study, a questionnaire was serve as a data collection methodology and supplemented by individual face-to-face interviews. A questionnaire is a technique designed to obtain reliable responses by providing to respondents, a list of carefully structured questions chosen after considerable testing. Questionnaires form part of the wider definition of ‘survey research’. A ‘survey’ is defined by Remenyi *et al.* (2002:290), as the collection of a large quantity of evidence usually numeric, or evidences that will be converted to numbers, normally by means of a questionnaire.

Structured questionnaires focusing on GMP were used for data collection in the ambit of this research project. For this study, only the Western Cape province of South Africa was used for data collection. The target population was fresh food produce manufacturing establishments to whom questionnaires were randomly sent and delivered to them to answer the research question based on their wiliness to implement GMP and those who have already implemented GMP.

1.10 DATA VALIDITY AND RELIABILITY

The following aspects pertaining data validity and reliability were applied to this research study:

1.10.1 Validity

The old methods for validity find their roots in the positivist tradition, defined by a systematic theory of validity. Within the positivist terminology, "validity is the result and culmination of empirical conceptions, namely, universal laws, evidence, objectivity, truth, actuality, deduction, reason, fact and mathematical data to name just a few" (Winter, 2000:1-2).

Greener (2008:37) explains validity in quantitative research as that which determines whether the research truly measures what it was intended to measure or how truthful the research results are. Researchers generally determine validity through statistical measures.

1.11 ETHICS

Research ethics refers to the proper way of behaviour in correlation to the right of those who become the subject of research, or are affected by it (Saunders, Lewis & Thornhill, 2000).

The following ethical considerations were observed in this research study:

- **Right to privacy**: participant's performance was confidential;

- **Confidentiality or Anonymity**: well-structured research illustrate to offer confidentiality or anonymity, as this will help the respondent to give more open, fairly and honest response;

- Explanation of voluntary participation and informed consent;

- An area for the participant to sign and date the consent form, indicating an agreement to participate;

- An offer to provide detailed information about the study (e.g. a summary of findings) upon its completion;

- **Honesty with professional colleagues:** researchers should report their feedback in a complete and honest way, without misleading what they have done or intentionally misleading others as to the nature of their investigations. Under no circumstance should research falsify information to aid the conclusion made.

Collis and Hussey (2003:38-39) caution that dignity of participants must be upheld, that no harm is caused to participants, the company or the community. Badenhorst (2008:189) adds that the data ethics and integrity mean respect for the respondents, their response should be valued and the researcher should act with honesty and integrity.

This study adopted the above principles and prepared a consent letter between the researcher and the food safety team leader in different food manufacturing establishments for data collection. The researcher also ensured that the data presented did not conceal or falsify information. All the responses were fairly and logical ordered appropriately. In order to protect all participants from possible negative repercussions such as identification of their details were kept strictly confidential and anonymous. In addition, this study emphasises the 'right of privacy' and the participants were allowed to continue or withdraw their participation at any time.

1.12 RESEARCH ASSUMPTIONS

Research assumption is a researchable problem that is relevant to the study (Badenhorst, 2008:82). In this study, the following assumptions were considered:

- Quality representatives in the food manufacturing establishment are responsible for the maintenance of GMP systems within the food establishment and they have received adequate training.

- GMP is implemented to satisfy and meet customer requirements.

- GMP is methods through which food manufacturers can ensure that the end product is of good quality for the end users.

1.13 RESEARCH CONSTRAINTS

Constraints identify limitations and research weaknesses, and identify the areas that cannot be included in the research scope (Badenhorst, 2008:149). The following criteria were constrained in this study:

- Due to lack of information from previous studies within the food industry, the researcher only looks into the common aspects of GMP.

- The study was conducted only in the Western Cape of South Africa amongst selected food manufacturing establishments. Hence, this research is restricted to fresh food produce manufacturing establishments in this province.

1.14 DE-LIMITATIONS PERTAINING TO THE RESEARCH

Quality Management System is relatively covered in more broad perspectives and disciplines. This study only addresses those systems which are derived from part of the Global Food Safety Initiatives for the food manufacturing industry such as, Hazard Analytical Critical Control Point, Good Manufacturing Practice and ISO 22000:2005 which have been implemented as Food Safety Management System, International Food Standard (IFS), GLOBALGAP, and the British Retail Consortium (BRC), ISO 9001.

1.15 SIGNIFICANCE OF THE PROPOSED RESEARCH

There is no doubt that the food industry plays a major role in the South African economy. For this reason GMP is merely a licence to trade locally and internationally.

GMP is not only limited to the food manufacturing industry. As food is defined as an article or substance ordinarily eaten or drunk by humans (SANS 10330, 2007:6) the findings and recommendations concluded in this study therefore not only benefit the food manufacturing industries, but also the wine industries in the Western Cape.

Finally this study determined an alternative approach to GMP in the Western Cape in the food industry. Given the complexity of the GMP, this study provides some useful information to food manufacturing establishments in the Western Cape that uses or may consider the implementation of the GMP approach as a quality tool in order to improve product safety.

1.16 OVERVIEW OF THE RESEARCH STRUCTURE

This study contains six chapters. The chapter and content analysis with the headings of each chapter are briefly discussed in terms of each of their proposed content. The following content of the research will be defined:

- **Chapter 1: Scope of the research:** This chapter provides an introduction, background and motivation to substantiate the need for the research to be conducted. The aim, the research problems and objective of the research will be addressed. The value that GMP may add to the research problem in the food manufacturing industries will be highlighted.

- **Chapter 2: Background to the research environment: A holistic perspective:** This chapter provides an overview of the research environment and also describes the background of the research. The various food safety systems will be explained.

- **Chapter 3: Literature review:** This chapter presents an extensive literature review, focusing on the application and validation of food safety systems and the application of some of the current systems and quality tools in the food industries. The importance of GMP in the food industry will be reviewed. It provides an overview of other similar previous studies.

- **Chapter 4: Research design and methodology:** This chapter explains the research methodology, the study area, target population, research

instrument, data collection procedures, and the presentation and analysis of the data.

- **Chapter 5: Results and discussion:** This chapter provides detailed results through a comprehensive data analysis and discussion. The data was discussed in terms of the research question, in relation to the findings.

- **Chapter 6: Conclusion and recommendations:** In this concluding chapter, key aspects pertaining to the study were revisited. Research findings were brought into the context of the overall study, recommendations were made, and final conclusions were drawn.

1.17 CONCLUSION

This chapter concluded with the research processes and steps were explained as well as the research methodologies that were used. The research problem, investigative questions as well as the objectives of this study were also outlined in this chapter.

In the next chapter, a holistic perspective will be provided on the various establishments that are implementing GMP or who might consider the implementation of GMP.

CHAPTER 2: OVERVIEW OF THE RESEARCH ENVIRONMENT: A HOLISTIC PERSPECTIVE OF GMP IN THE WESTERN CAPE PROVINCE OF SOUTH AFRICA

2.1 BRIEF OVERVIEW OF GMP IN FOOD MANUFACTURING ESTABLISHMENT

The World Health Organisation (WHO) (Chaloner-Larsson, Anderson, Egan, Da Fonaeca & Gomez, 1997:6) defines Good Manufacturing Practices (GMP) as a segment of quality assurance which guarantees that food products are uniformly manufactured and well controlled as per the adequate quality standards suitable for their use and as expected by the marketing authorities. GMP is a system which is globally accepted and used for the proper control and effective management of manufacturing and quality control of food products, pharmaceutical products and medical instruments. GMP cover various matters, including facilities design, documentation, production, quality control, product delivery, and validation of products (Närhi & Nordström, 2005:399-401).

Over one hundred countries worldwide from pharmaceutical regulators and the pharmaceutical industry are using the GMP version of World Health Organization (Chaloner-Larsson *et al*., 2007:23). The European Union's GMP (EU-GMP) and the United State Food and Drug Administration's (FDA) version enforce similar requirements to World Health Organization (Karmacharya, 2014:104-107). Other countries that also use similar GMP are Australia, Canada, Japan, Singapore, and others who have implemented and adopted GMP requirements and standards. In the United Kingdom, the Medicines Act (1968) covers most aspects of GMP and is commonly referred to as '*The Orange Guide'*, because of the colour of its cover (Chaloner-Larsson *et al*., 2007:23). Officially it is known as Rules and Guidance for Pharmaceutical Manufacturers and Distributors (Cox Cad, 2008:4-5).

GMP is enforced by the US FDA, under Section 501(B) of the 1938 Food, Drug, and Cosmetic Act (21USC351). The regulations use the phrase *'current Good Manufacturing Practices*' (cGMP) with the 'c' indicates 'current' or the modern technologies and procedures that are required (Chowdary & George, 2011:58-70). GMP requirements and standards are not relevant and approved to describe

the guidelines. As of June 2010, the same cGMP requirements started to be applicable to all manufacturers of dietary supplements (FDA Issues Dietary Supplements Final Rule) (United States of America, 1938:74).

In 1999 the International Conference on Harmonization (ICH) published GMP for Active Pharmaceutical Ingredients (Shabir, 2003:57-59). Since then, GMP is adopted in countries and trade groupings that have signed agreements with ICH namely the European Union, Japan and the United States of America and is also applied in other countries that adopt ICH guidelines for the manufacture and testing of active raw materials, such as Australia, Canada and Singapore (Brhlikova, Harper & Pollock, 2007:9).

Most GMP requirements provide flexibility for individual manufacturers to decide what the best ways are to meet the necessary controls. Hence, the conclusion can be made that GMP are open-ended requirements rather than rigid rules. The primary objective of GMP is that quality is implemented and adopted during the manufacturing of a product, and not just the quality of the finished product. Therefore, the guarantee is that the product not only meets the final expectation, but that it has been made by using the same process and control measures under the same conditions at the time it is produced (Thanh, Wilcock, & Aunge, 2004).

GMP provides benefits in the sense that they reduce operating cost of rework, customer rejects, and complaints, and that they increases efficiencies and customer's acceptance (Mangelsdorf, 1999:421-422). Due to the various benefits of GMP it is crucial for the industry to implement GMP guidelines without being compromised. Unfortunately, there is a lack of information on GMP guideline implementation among manufacturers and some studies focus on other guidelines such as Hazard Analysis Critical Control Point (HACCP) and the International Organization for Standardization (ISO).

2.2 GENERAL PICTURE OF SOUTH AFRICAN ECONOMY

According to Adam (2000:245-263), the structure of the South African economy changed considerably during the 1980's, because the South Africa government pursued an intense industrialisation strategy. The South African manufacturing industry focused on import-substitution and export promotion, in conjunction with

low wages, and low price commodities, with particular reference to agricultural products (Altman & Mayer, 2003). South African efforts were directed at diversifying the agricultural economics as a means of economic growth and with the aim of increasing the gross national product. It was thought that this strategy would obtain a more balanced development of agriculture and other industry sectors.

South African economic crises were caused by both external and domestic factors, which in many instances were interrelated (Adam, 2000:246). One of them was the exceptionally high rate of growth, driven for many years by foreign investment and export. Part of the foreign capital was allocated to investments in non-tradable sectors such as property.

2.3 OVERVIEW OF SOUTH AFRICAN FOOD MANUFACTURING INDUSTRIES

South Africa is located at the southernmost tip of the African continent. It is surrounded by Namibia, Botswana, Zimbabwe and Mozambique and totally surrounds Lesotho (Coovadia, Jewkes, Barron, Sanders & McIntyre, 2009:817-819). During recent years, South African food industries have shown consistent growth being characterised by a relative slowdown during the global recession. The manufacturing industries were one of the areas where the financial crush seriously hit manufacturing. South Africa's agricultural policy has had food safety as a major objective until recently (Bourlakis & Weightman, 2004). South Africa has, to some extent achieved this goal (Food safety goal) by the introduction of food legislation and standards that can be used within the food manufacturing industries especially certified standards (South Africa, Department of Health, Trade and Industry, Agriculture, Forestry and Fisheries, 2013:5).

2.4 SOUTH AFRICAN AGRICULTURAL PRODUCTS

South African agriculture helps in building the industrial sector by supplying food, labour, markets, outlets, saving and foreign exchange, which is necessary for industrialisation. In doing this, the agricultural sector has been subjected to government taxation and various other restrictions that have benefited the industrial sector (Haggblade, 2011:10-12).

2.5 GOOD MANUFACTURING PRACTICES IN THE FOOD MANUFACTURING INDUSTRY

The food manufacturing industry is one of the major industries in South Africa. It covers all the processes from growing of raw materials, harvesting and food processing plants to its relationship with the consumer. This industry ensures that food security and its products should be of very high quality and free of harmful bacteria. There should be safeguards for the consumers against ill health consequences from the products and to ensure that companies are not sued for poor quality or harmful products (Grunert, 2005:270-271).

According to Sauer and Schrader (2011), GMP are the foundation for other food safety programmes. GMP which are enforced by the Food and Drug Administration (FDA) in the U.S, are the procedures and programmes used in food facilities to guarantee the safety of food production. GMP encompass procedures for sanitation, food safety, Hazard Analysis Critical Control Points (HACCP), and maintenance to ensure that facility is produce quality products that are safe for consumption, while still maintaining the safety of the employees.

The term ‘GMP’ usually refers to recalls that could have been prevented if had the proper GMP been in place. Suggestions have also been made that using GMP properly can help a company to succeed, by reducing waste, increasing employee commitment, and allowing a company to market itself as a more desirable supplier (Velasquez, 2007).

By implementing proper controls and programmes, a company can reduce the amount of product that is wasted (Sauer & Schrader, 2011). Products are usually wasted due to poor sanitation conditions, poor equipment maintenance and irresponsible mistakes in production. By implementing programmes that monitor these conditions, waste can be reduced, which can save money.

According to Laird, Holton and Naquin (2003:6), training employees in the programmes implemented, makes them feel important to the process and encourages them to pay more attention to detail. This in turn helps with the other areas of the programme, such as reduction in waste, because tasks are completed correctly the first time. By decreasing waste and increasing employee commitment, companies can expect better final products. This allows them to

promote the facility as a desirable and reliable supplier. GMP are ideal for a food manufacturing establishment to adopt since it guarantee the safety of the product (Moe, 1998:211-212). However, GMP is enforced further down the supply chain in facilities such as grain elevators. GMP plays a role in promising food quality results such as compliance.

2.6 OVERVIEW OF FOOD SAFETY SYSTEMS

In this section, a range of food safety systems that are used nationally and internationally are described these include: HACCP, International Organisation for Standardisation, Safe Quality Food, British Retail Consortium's Global Food Safety Standard, International Food Standard, and Quality Management System.

There have been a number of processes that have been used to preserve foods which have also helped to keep food safe and for a longer duration. The general practices of frying, freezing, heating, cooking, drying, cooling, blanching and salting that were useful thousands of years ago are still the same methods which are used today to ensure food safety and to improve the quality of food products (Pearce, Shendan & Bolton, 2006:162-164). There have been rapid growths in the food manufacturing industry in the recent years which have made manufacturers to consider the implementation of preservation as one of the major ways of maintaining and improving food safety and food quality.

A range of food safety standards are used globally and in South Africa. There have been additional numbers of standards that seek to promote food safety in the food manufacturing industry. These include the British Retail Consortium's (BRC), the Dutch Hazard Analysis and Critical Control Point (HACCP), the Safe Quality Food (SQF), ISO 22000:2005, which has been implemented as Food Safety Management System (FSMS), International Food Standard (IFS), GLOBALGAP, and ISO 9001 which are approved standards (Trienekens & Zuurbier, 2008:111-115).

2.6.1 Hazard Analysis and Critical Control Point

Hazard Analysis and Critical Control Point (HACCP) is a "consistent, preventive and scientific approach for assuring food safety which addresses physical, chemical and biological hazards as a means of prevention rather than finished

product inspection" (Thanh, Wilcock, & Aunge, 2004:132).The implementation of HACCP system is usually used in the food industry to identify potential food safety hazards, in order for key actions, known as Critical Control Points (CCP) to be taken and controlled. CCPs are used to eliminate the risk of hazards thereby protecting public health. The system is designed for use in all sectors of the food industry from growing, harvesting, preparing, processing, manufacturing, packaging distributing and merchandising to food consumption. Normally, HACCP is established to prevent and eliminate contaminants from food and to minimise the effects of contamination before it occurs. HACCP usually consists of a combination of three elements – principles of food microbiology, quality control and risk assessment (Amjadi & Hussain 2005:173-175).

The establishment of HACCP came into existence in the 1960s when the US National Aeronautics and Space Administration (NASA) asked Pillsbury to design and manufacture the first foods for space flights (Nguyen, Wilcock & Aung, 2004:656-657). After that, HACCP has been well-known and adopted internationally as an inspection tool to be used in the food industry to prevent the occurrence of any potential hazard.

The initial idea to establish a standard for certifying Control HACCP was launched by the Dutch food-processing industry (Nguyen *et al.,* 2004:656). The first version, 'criteria for the assessment of an operation HACCP-system was introduced in 1996. Six years later it was renamed 'Requirements for a HACCP-based food safety system'. The structure of the standard is based on the seven basic principles and the twelve steps of HACCP, with additional requirements for a quality management system (SCV, 2008). The Dutch HACCP was designed by the Dutch National Board of Experts, to specify the requirements for HACCP-based food safety systems. The standard specifies the codes of practice within a management system framework and is particularly suitable for suppliers to the Dutch market.

The requirement for the adoption of HACCP (SANS, 10330:2007) was established by the South African Bureau of Standards (SABS), based on ISO 9001:2008. It is the best system available for developing processes to assist food firms in producing food that is safe to consume (Food Codex, 1995). The greatest benefit of HACCP over the other food safety systems is that it pre-empts all the activities in the food process, thus reducing risks in food-borne diseases.

According to Taber (1993), the hazard of any material is identified by chemical, physical and biological properties.

Some of the food manufacturing industries have implemented HACCP voluntarily since its creation, whereas others have been mandated (Henson & Holt, 2000). Food manufacturing industries currently mandated for HACCP implementation are seafood since 1997, meat and poultry from1998, and juices from 2002. The smaller manufacturing plants were given more time to develop their HACCP plans due to limited or no resources and personnel as compared to larger plants (Bowers, 1998). The canning industries do not have a mandatory HACCP requirement.

Prerequisite programmes like GMP are essential foundations for the development and implementation of successful HACCP plans (Wallace & Williams, 2001). To verify that the procedures are being implemented, inspection schedules, review plans, records and sampling should be incorporated into the methods, procedures and tests of the whole preparation process.

There are many factors that lead to contaminated food. Todd (1996) estimates that 5% of all food-borne illnesses may be traced to abusive industrial practices. 95% are associated with abusive practices in food service, restaurants or home preparation of foods. The first CCP of a product is at the receiving area where those responsible must examine the condition of each item as it is unloaded, from known and approved suppliers who should have functional temperature indicators which should be checked to monitor quality (Firestone, 2004). Food fried in bad quality oils may absorb the degraded fat, causing gastrointestinal distress. Complaints of this nature and studies on oil quality led to the development of regulations governing restaurants frying oils in developed countries (WHO, 2004).

The benefits of HACCP for government include;

- enhancing public health;
- proper and targeted food safety control;
- minimize public health costs budget;

- Trade facilitation and increased confidence of the community in the food industry (Sarter, Sarter & Gilabert, 2010:254).

Benefits of HACCP in the industry include;

- There will be increased consumer and government satisfaction;
- Reduced legal and insurance costs;
- Increased market access;
- Reduction in production costs;
- Improved staff management and commitment to food safety and:
- Decreased business risks.

To the consumer, there will be minimum risks of food-borne diseases, increased awareness of basic hygiene, increased confidence in the food supply chain and no food related health risks. An estimate of the present value of 20 years of cost saving benefits from HACCP-programmes was reported to range from $1.9 to $171.8 billion in 1995 (Kennedy, Losinger & Hoag, 2000:198).

Barriers to the implementation of HACCP systems are external conditions, which increase the pressure on the strategies for its implementation such as regulatory market forces, promotion by public health and food control authorities (WHO, 2007). Others could be internal factors such as reduced level of knowledge or resources and lack of government or industry support. Managements' commitment, attitudes and organizational culture towards changes in the system could be barriers to implementation.

HACCP system consists of seven principle activities (WHO, 2004). During the implementation of the process, each step should be applied in a manner consistent with the needs and resources of the establishment (Hulebak & Schlosser, 2002:548-550). The activities are hazard analysis determining CCP to establish critical limits, monitoring procedures and corrective action. The final steps are to establish verification procedures and documentation procedures.

HACCP implementation has led to an overall increase in productivity and production efficiency, increased product safety and continuous manufacturing for extended periods without any stopped due to processes breakdown.

2.6.2 International Organisation for Standardisation ISO 22000:2005

ISO 22000:2005 refers to international certification standard that state the requirements for effective food safety management systems (Filipović, Njari, Kozačinski, Cvrtila Fleck, Mioković, Zdolec & Dobranić, 2008:465). The standard is implemented in the food manufacturing industries which include farming, harvesting, processing, storage, packaging, transportation, as well as distribution to the market. The system further highlights the importance of management responsibility, human resources as well as commitment and involvement from top management.

The standard addresses all food safety issues that arise. The system ensures food safety from the point of harvesting until the final consumption of the product by the consumer. This standard specifies the need for consumer communication regarding safety requirements and providing feedback to the consumers in case of any food safety issue.

2.6.3 Safe Quality Food (SQF 2000)

The Safe Quality Food Programmes belong to the Food Marketing Institute (FMI) in Washington since 2003. SQF standard involves both food safety and quality management system for all supply chains which include the production, processing and finally distribution to the consumers. The implementation of SQF standard mostly includes the primary production as well as processing of food. This standard clearly states the code of practice within the food management system and this is suitable for the suppliers market. The requirement of the standard depends on the expectation set out by Codex Alimentarius and those of ISO. SQF is mostly implemented by farmers' representatives since they were directly involved in developing it (Filipović *et al*., 2008:465).

2.6.4 British Retail Consortium's Global Food Safety Standard (BRC)

The British Retail Consortium (BRC) standard is a trade association which was launched in 1998, in the United Kingdom to be implemented by the retailers starting from smaller retailers to personally owned retailers. BRC is one of the recognised standards that falls under the Global Food Safety Initiative and accepted globally to assist retailers in meeting customer satisfaction and food safety requirements (Henson & Humphrey, 2009:30). With the implementation of the standard, retailers and other sectors of the food industry were requested to take all necessary measures to eliminate any problem, which could pose a risk to consumer's health. The standard benefits other industries such as food manufacturers, exporters, catering as well as suppliers of ingredients.

2.6.5 International Food Standard (IFS)

The International Food Standard was established in 1999 by the association of German retailers Bundesvereininung Deutscher Handelsverbände to assist manufacturers who produced labels to have a proper monitoring process to conform to the finished product specification. The accomplishment of the requirement of the standard is based on compliance with the requirement of the standard. It helps suppliers to comply with labelling requirements as accepted by the Global market (Henson, 2008:66).

2.6.6 Quality Management System

The Quality Management System consists of a set of rules, policies, standards and processes which are used in any industry to ensure and guarantee the safety of the finished product to meet the expected specifications (Alavi & Leidner, 2001). The system is made up of four stages such as Plan, Do, Check and Evaluate to monitor continued improvement of the system.

According to Jakobsson and Vauglin (2001:2877:2879), the CERCO Working Group on Quality standard will assist any organisation to achieve performance excellence which will result in customer satisfaction. According to the Department of Trade and Industry (2000), the standard includes management responsibility and top management commitment for effective implementation and suitability.

2.7 SOUTH AFRICAN NATIONAL STANDARD (SANS) 15161

The South African National Standard (SANS) (SANS15161, 2003:1) is a standard that provides guidelines to organizations in complying with the requirements of ISO 9001 during the development and implementation of a QMS in the manufacturing industry. This national standard also gives direction on the possible relationships between ISO 9001 series of standards and the HACCP systems for food safety requirements (SANS 15161, 2003:1).

2.8 THE ROLE OF REGULATORY BODIES

Internationally, the roles of regulatory bodies are to approve and document chemical, pharmaceutical, toxicological and clinical characteristics of the product, for example, in the pharmaceutical industry it is to ensure that the patient will get a safe and effective product of the quality needed (Muller, Jones, Kawagishi, Aizawa & Macnab, 1996).

The food and Drug Administration (FDA) in the U.S. recently purposed a cGMP rule for the manufacturing, packaging and storage of dietary supplements (Rapaka & Coates, 2006). The industry's manufacturing, production, and marketing practices are subject to FDA review, which today regulates 25% of the United States gross national product (Hoffmann, Sternberg & Herskowitz, 1992). Besides the review of new drug entities, FDA has also been responsible for the regulation of the production of pharmaceuticals since 1963. The application of the methods, facilities, and controls used in manufacturing, processing, and packaging of products are required (Sarantopoulos, Altiok & Elsayed, 1995). Therefore, the role of the regulatory bodies is to make sure that products are safe for human consumption.

2.9 FOOD SAFETY LEGAL REQUIREMENTS IN SOUTH AFRICA

According to Jackson (2006), there are a number of food regulation documents in South Africa. Of these, fourteen are legal Acts that govern the food safety industry in South Africa. However, only three of the documents are enforced by law (Jackson, 2006:18). Law enforcement is the responsibility of local authorities, which ironically do not report back to the national departments responsible for setting these laws that local authorities are required to enforce. According to

Jackson (2006:18-19), the 14 regulations binding South African food industries are:

- The Foodstuffs, Cosmetics and Disinfectants Act. Act 54 of 1972.
- The Health Act, Act 63 of 1977.
- The Medicine and Related Substances Control Act, Act 101 of 1965.
- The International Health Regulations Act. Act 28 of 1974.
- The Meat Safety Act. Act 40 of 2000.
- The Agricultural Product Standards Act, Act 119 of 1990.
- The Liquor Product Act. Act 60 of 1989.
- The Animal Disease Act. Act 35 of 1984.
- The Fertilizer. Farm Feeds, Agriculture Remedies and Stock Remedies Act. Act 36 of 1947.
- The Plant Breeders Act. Act 15 of 1976.
- The Agricultural Pests Act. Act 36 of 1983.
- The Plant Improvement Act. Act 53 of 1976.
- The Genetic Modified Organisms Act 25 of 1997
- Microbiological Standards for foodstuff Act 1207 of 2008

2.10 GENERAL OVERVIEW OF SOUTH AFRICAN FOOD INDUSTRIES AND ORGANISATIONS

The transformation in the country since the inception of the new democratic South Africa in 1994 has systematically changed the political, social, cultural, international, economic and agricultural perceptions of South Africans. The transition to democracy has allowed South Africa to return to the international arena. Denton and Vloeberghts (2003:84) state that, in the last decades, during

the Apartheid period, South Africa was isolated and had to provide for itself since there was no economic growth for the government to provide food to the people.

According to Denton and Vloeberghts (2003:87), the isolation of South Africa from the rest of the world has drastically influenced the ability of local industries to deliver world class output food products. Organisations relied mostly on government support rather than using quality management system methodologies to optimise their operations in order to be more profitable and meet up with the demand of quality food products. Nonetheless, the exposure of South Africa to global competition has forced local organisations to change business practice, in order to cope with the international demand, as well as to protect local markets against challenges such as: meeting consumer's demands and expectation.

The return of South Africa to the international scene implies export goods and services that meet international standards and that satisfy global consumers. The shift towards best practice was a must to ensure success. Denton and Vloeberghts (2003:96) suggest that industries in South Africa have opportunities for growth, but the challenge is to drive to change. The transformation of food industries in South Africa could not be done without the impact of challenges given the diversity of South African society. Roodt (1996:17) identifies the following as some challenges that occur in the South African food manufacturing establishment environment: lack of resources, lack of competent staff to manage the food safety system, lack of training programs, lack of government commitment towards the systems.

Top management positions are for the most part still mainly white whereas the general labour force is principally black and unqualified. There is a gap between the poor and the wealthy. Illiteracy prevails amongst a greater portion of the labour force despite there being a greater demand for skill and technology. Establishments need to implement affirmative action and follow the regulations of the Employment Equity Acts No. 55 of 1998 to avoid fines for non-compliance.

The strong Foreign Direct Investment (FDI) in South Africa has contributed to reduce some of these challenges. For example, some of the multinational firms often force local counterparts to adopt quality management system practices which require a culture change and bring people to work together to achieve

common goals. The strong FDI in South Africa is one contributor that puts local industries in a very competitive position and therefore provides an opportunity to catch up with developed countries that have been striving for excellence for centuries.

2.11 PERCEPTION OF EXPORTING GOOD QUALITY PRODUCTS

Quality is a degree of satisfaction of someone's needs. It is a set of features and characteristics that has satisfied a specific requirement. Many definitions can be applied to quality. However, Madu and Madu (2002:249) provide a comprehensive definition of quality in terms of eight dimensions or attributes that a product or service must have in order to be considered of high quality. These dimensions in terms of product quality are listed below:

- Performance: a product's operating characteristics or how well a product achieves its objective. Features: a supplement to a product's basic function;
- Reliability: a probability that a product does not fail for at least a specific period of time under normal conditions;
- Durability: measures the useful life of a product or services;
- Serviceability: ease of servicing a product;
- Conformance: refers to how a product or services satisfy customers' expectations;
- Perceived quality: deals with the reputations of products;
- Aesthetics: personal judgment of how a product looks, sounds, smells, or tastes.

Quality is widely used as a measure of excellence, to gain a deep understanding of how customers around the world perceive product quality.

2.12 CONCLUSION

The Global food Safety initiative scheme has released a number of food safety standards which are applicable to the food industries to implement and in order to deliver safe products. GMP is the pre-requisite which needs to be in place before

the implementation of those schemes. Though South Africa has the standards in place such as: HACCP, International Organisation for Standardisation, Safe Quality Food, British Retail Consortium's Global Food Safety Standard, International Food Standard and Quality Management System with no regulatory body enforcing the implementation of the systems. This chapter provides an over view of GMP in the food industry, the various regulatory bodies that are governing the food industry in South Africa as well as general overview of South Africa food industry. In the next chapter, a literature review in support of the research problem will be described.

CHAPTER 3: LITERATURE REVIEW: GOOD MANUFACTURING PRACTICES

3.1 INTRODUCTION AND BACKGROUND

A literature review is a critical examination and analysis of a published body of knowledge that has been theorised and conceptualised by many scholars (Mouton, 2001:88). Watkins (2011:130) describes a literature review as a focus on a very specific problem that needs to be mitigated. In this chapter, the literature was reviewed in order to support and answer the research problem which reads as follows:

"GMP is currently perceived as minimal food safety measures by most food manufacturers. Therefore, the lack of enforcement of approved standards within the food manufacturing establishment in South Africa may result in the food product quality being questioned by consumers".

In the last years, the quality and safety of food has become more of a public concern than ever before (Trienekens & Zuurbier, 2008:108). Manufacturers are now more aware of the importance of producing a product that is of high quality and safe for its end users. Government has therefore placed pressure on food manufacturers to ensure that the production of food is safe by means of implementing acceptable standards or systems. Taking a systems approach to food safety involves looking at all the parts of the handling and preparation processes. This is achieved by appointing qualified and competent individuals to ensure that all the processes within the system are synchronized.

3.2 GLOBAL PERSPECTIVE ON FOOD SAFETY

Food Safety Development (FSD) strives to reduce the consequential negative impact of food-borne diseases worldwide (Gessner, Beller, Middaugh & Whitford, 1994:95-97). The leading cause of illnesses and death in developing countries is food and waterborne diarrhea, and are responsible for affecting 1.8 million people annually. Recently, statistics have shown trends of food-borne diseases in food production, processing, distribution and preparation as an increased demand for food safety measures in order to ensure a safer global food supply to consumers. WHO works closely with FAO (2002) to address food safety issues in the food

supply chain through the use of HACCP system (SCV, 2008).The methods of food safety such as recall procedure, traceability, rework, non-conformance investigation, customer complaint, are efficient science-based tools to enhance food safety measures, thereby benefit both the health of the public and economic development by providing safe and quality products.

To improve food safety and strengthen consumers' confidence, concerns over safety and quality for governments, food producers, industrial traders and consumer are increasing. The negative impact of food-borne diseases is significant to the whole world. In the European region, some food safety and quality problems have endangered consumer health hence the implementation of food safety systems are very important as these consist of control measures to eliminate any potential risk associated with the product (Traoré, Héma & Ilboudo, 1998).

3.3 GOOD MANUFACTURING PRACTICES IN THE FOOD INDUSTRY

The food manufacturing industry is one of the most important industries in South Africa as it covers everything from food processing plants to its relationship with the consumers. It is not generally known how basic this industry is to most people's lives. This is why it is critical that the products of the industry are of the highest quality and free from harmful bacteria. There should be safeguards for the consumers against any ill health consequences from the products and to ensure that the company is not sued for faulty products (Willbur, 1992 and Goode, 1999). GMP plays a role in promising these results and achieving them.

GMP are widely used by most food manufacturing industries for the control of the manufacturing process, especially in the areas of the type of premises, equipment, sanitation, documentation and handling of food (Mayes & Motimore, 2001). The control starts with the selection of good quality raw material and continues through all the steps of the manufacturing process. Using GMP as a guideline for the South African food manufacturing industry would help build quality and reliability. It would also keep up with international market standards so that local manufacturing will be of export value.

Every aspect of food manufacturing should be controlled according to the defined managerial and technical standards. GMP standards document management's responsibility for the production of the foods that meet quality and safety requirements (Sirisaong, Semanochang & Busayawong, 2000). GMP integrates with HACCP systems and provides a framework for the existence and implementation of the food safety system that can subsequently be registered to ISO 90001(Mangelsdorf, 1999). GMP standards define requirements for the management and control of activities and operations which are involved in the manufacture, storage and distribution of foods.

Gilling, Taylor, Kane and Taylor (2001:711-13) describe GMP as a component of quality assurance systems focused on ensuring that the end product is fit for human consumption and meets food safety standards and requirements. GMP aim to eliminate, prevent and control any potential risks which might affect the finished product during the production, processing, storage and transportation process (Matthew, Christopher & Adrian, 2003).

3.4 REQUIREMENTS OF GOOD MANUFACTURING PRACTICES IN SOUTH AFRICAN FOOD INDUSTRIES

The principle of GMP should primarily concern quality management, personnel, premises, equipment, documentation, production, quality control, complaints, and product recall and self-inspection. GMP stresses the primary principle relating to manufacturing and quality control practices, properly designed premises, validated processes, trained personnel, effective storage and distribution and overlying all of these and orderly system of working and documentary procedures. GMP system focuses on product production, preventive measures and the necessary controls to be implemented (Mangelsdolf, 1999; Payne, 1999; Rohitratanan, 2001).

3.4.1 Personnel

A satisfactory system of GMP depends on personnel. Therefore, GMP is concerned with personnel and it is the duty and responsibility of the respective personnel to the know GMP the system and the requirements of the system. All personnel involved with GMP should be appropriately qualified for achieving pharmaceutical quality assurance objectives and furthermore, the personnel

should be efficient to carry out the task assigned to them without any failure. They should all be involved in training and refresher training to increase competence for the task with understanding of the requirements of the system. Furthermore, it is essential to access GMP practical compliance periodically (Thompson, 1979:527).

The implementation and management of a competent system of quality assurance and it's components in the manufacturing of food products in South Africa depend upon expert personnel. GMP contains specific requirements for employee training that must form the foundation of a training programme (Cruz, Cenci & Maia, 2006:408-409). According to Hathaway (1993), the training must continually be updated and must be focused more on quality rather than quantity.

3.4.2 Premises and equipment

The building and maintenance of equipment and premises should be suitable for the proper functioning of the operation intended for. The equipment and premises should be made of materials that will be easy to clean, maintain, service and that will not pose any risk to the products. The method of cleaning the equipment should be well defined and to prevent the build-up of dirt and mould. The equipment and premises should not affect the safety and quality of the products (Shaikh & Sial, 2007:63). There should be suitable, lightening, good ventilation, proper temperature control that does not affect the proper functioning and operation of the equipment as well as cleaning and maintenance. The operation of the equipment should be carried out by trained personnel and the instruction manual of the equipment on how to use, maintain and store the equipment should be followed accordingly to prevent any damage to the equipment. There should be documented records to verify the frequency of cleaning, calibration, verification as well maintenance. All damaged equipment should be taken out of the production areas clearly identified as faulty and sent for repairs (Ketpibun, 2001).

3.4.3 Documentation

Proper record keeping and control constitutes an important part of the GMP system. Proper record keeping should be free from legibility errors and be based on specifications. It is important that documentation is established. Documents

should be kept and updated accordingly. The legibility of the documents is important as proper documentation eliminates mistakes that may arise from verbal communication (Gravenmier, Wilson & Steffenson, 1997).

Quality systems need to be documented with records kept to ensure that everyone in the organisation is implementing the procedures and aware of the importance of the requirement. GMP is an important section of quality assurance which relates to all its aspects (Gravenmier, *et al.,* 1997). The aim of keeping documentation and specifications for material and manufacturing methods is to make sure that employees involved with manufacturing know what is expected of them, when to do it, how to do it and the reason for doing it.

Documentation should be well controlled and maintained with revision number and date as well as the frequency of review. Hand written documentation should be prevented except for date that will be written and the document should be signed off and verified as required. The content and title of the document should be clearly defined (Patel & Chotai, 2011:142-143).

3.4.4 Production

The activities of production must be followed properly with well-defined procedures and requirements that should be implemented only by trained personnel who are competent enough to perform the task. The operation of production should be carried out according to the defined procedures and instructions to conform to the standards (Sirisaong, Semanochang & Busayawong, 2000). To prevent deviation in the products there should be quality checks from the receiving of the raw materials to the finished product. Production operations must follow clearly defined procedures. There should be GMP compliance in all stages of production in order to achieve a stipulated product quality (Patel & Chotai, 2011:142-143).

All products should be properly stored and packaged to enforce a proper segregation and rotation system to avoid any expired products that might pose risks to human health once the product is consumed. During the production stage, all products should be properly controlled and protected to prevent any source of contamination such as foreign objects chemical spillage and cross contamination (Shaikh & Sial, 2007).

Any changes in the production process have to be approved in writing by top management and with the involvement of the quality assurance team to ensure compliance with GMP requirements. The changes usually include changes in supplier, changes in raw material, changes in production process as well as changes in the type of equipment used. Hence all such changes need to be verified and validated to make sure that successful results will be achieved as expected by the consumers and as per the GMP (Baş, Yüksel & Çavuşoğlu, 2007).

3.4.5 Quality control

Quality control is mostly concerned with the quality of the product which starts from the introduction stage until the final delivery of the product to consumers. Quality consists of aspects such as testing, sampling and meeting specifications. Quality control also deals with documentation to verify the processes and procedures to make sure that the necessary checks and controls are conducted (Ilbery & Kneafsey, 2000)

Quality checks on products should be carried out frequently to ensure that any non-conformance is identified and immediate action taken to prevent any cross contamination to the entire production batch (Shaikh & Sial, 2007:63).

3.4.6 Contract manufacturing and analysis

Contract manufacturing and analysis is a component of GMP which is directly involved with the agreement between the manufacturer and the customer in making sure that the finished product meets the consumer standard and satisfaction. Usually there are rules and regulations that bind the contract and each party signs the contract agreeing to the code binding that contract to control any misunderstanding and poor satisfaction with the product (Wilmott, 2013).

3.4.7 Complaints and product recall

All non-compliant products should be properly investigated with root cause analysis as well as measures to prevent the reoccurrence of the same complaint in future. Complaints should have documented procedures and the duration within which feedback needs to be provided (Siomkos & Shrivastava, 1993:74-75). The recall procedure and frequency should be documented. The recall

should be done within the time provided. Competent individuals should handle the complaints as well as the recall.

3.4.8 Self- inspection

Self-inspection should be carried out at regular intervals so as to observe the implementation of GMP and to propose the necessary corrective measures. Competent persons from the company should be made responsible for the self-inspection. A quality audit is a formal review of products, manufacturing processes, equipment facilities or systems conformity with quality standards (Ratnatunga, 1995). It is management's responsibility and commitment to provide the quality department with the tools they need to perform the quality functions properly and produce a high quality product. Mossel (1995) proposed that quality is dependent on the tools employed in managing the company. The quality audit plays an important role in evaluating conformity with defined procedures, especially the procedures specified by GMP. Quality audits may be of varying types and performed in various ways.

The ultimate objective of an audit is to provide valuable information about the manufacturing operation within the company that affects the quality and items being manufactured. This need is critical in the South African food processing industry as the implication of unsatisfactory quality production can lead to ill health. According to Cabrita and Frade (2016), these quality and self-audits are intended mostly to evaluate the validity of the procedures and to monitor compliance of the GMP system.

3.4.9 Quality assurance

Quality assurance is the process of introducing some control measures in a system to make sure that the final product meets the customer expectations and requirements. Quality assurance is built into the product during manufacturing and processing so as to prevent any non-conforming product (Sirisaong, Semanochang & Busayawong, 2000).

With quality assurance in place, it identifies all the hazards in the manufacturing process and provides controls to eliminate the hazards that are identified. There are controls in each stage of manufacturing to ensure that the finished products

comply with the food safety measures. Personnel involved with quality checks should be properly trained on the requirements and expectations (Muller, Jones, Kawagishi, Aizawa & Macnab, 1996). The advantages of having control checks in place include: fewer non-conforming products, less wastage, less re-work, it eliminates hazards and instils consumer trust that the product is safe and free from any risks and hazards.

3.5 BENEFITS OF GMP IMPLEMENTATION

Development, implementation, integration and improvement of GMP have many associated benefits. Extensive research on the benefits and motivations for GMP implementation has been conducted (Mensah, Mwamakamba, Mohamed & Nsue-Milang, 2012:6322). Mensah *et al*. (2012:6322) and Fotopoulos, Kafetzopoulos and Gotzamani (2011:592) concede that the benefits of GMP compliance lead to increased customer satisfaction; reduced customer complaints; improved internal procedures and competence and improved product quality. Further benefits are compliance with regulatory and legal requirements and an increase in the reputation of the company. In addition, compliance can enhance the prospect of trading in other countries, reduce operating costs and improve profit margins. According to Mensah *et al*. (2012:6318), compliance may also improve employee morale and improve the food safety system.

Fotopoulos *et al. (*2011:588) suggest that other motives for implementing GMP are to gain third party accreditations to avoid media pressure and to reduce waste and acknowledgement of competitors and to avoid potential export barriers.

3.6 CHALLENGES OF GMP IMPLEMENTATION

There are challenges related to the implementation of GMP. These challenges usually occur at the implementation stage, but are not restricted to it. Mensah *et al*. (2012:6325) note that the challenges for GMP compliance are employee resistance to change and lack of interest as GMP are not always a priority for all employees. Therefore, employees seem to show no interest in GMP implementation (Yapp & Fairman, 2006:43). Others may lack awareness of the requirements, lack technical knowledge and skills or lack access to adequate information. Information is not always communicated to all the organisation's

employees (Yapp & Fairman, 2006:43). Mensah *et al*. (2012:6319) and Yapp and Fairman (2006:47) mention lack of time for system implementation, regulation and maintenance of the equipment is always as problem as well.

Literature has revealed that the majority of the workforce in food organisations do not understand what hazard analysis is. They do not know what is expected, how to implement it in their business or how to evaluate and monitor the steps taken (Yapp & Fairman, 2006:45).

According to research conducted by Baş *et al.* (2007:127-128), the barriers identified by management to implement food safety management systems are: lack of prerequisite programmes, ignorance about the system to be implemented, cost, time, staff turnover, lack of management, lack of suitable physical conditions, lack of employee motivation to perform their task, difficult terminology, too much documentation, poor training systems, and the lack of support from authorities.

Fotopoulos *et al*. (2011:592) view barriers related to the implementation of GMP as poor production technology and design layout, the type of product, the size of companies, the lack of government support and authorities, challenges in verification and validation, insufficient planning, poor design of the building, and expensive certification processes from the certification bodies.

In addition to the above challenges, there are studies that suggest that language barriers could impede implementation. Dewanti-Hariyadi (2010:32) noted that in non-English speaking countries such as China, language can be a barrier for understanding GMP if the standard has not been translated into the country's language. People are sometimes unwilling to adapt to GMP implementation because the food safety hazards are not apparent to them. Due to a lack of knowledge, people working in direct contact with food are sometimes hesitant to adapt to GMP implementation. Hence in South Africa language barriers is not the problem.

In many cases, the cost implication of implementing food safety is related to GMP programmes for HACCP (Dewanti-Hariyadi, 2010:32-33). Financial barriers to implementation such as the high cost of development, education and training, and equipment are cited by Mensah *et al*., (2012:6320-6321), Yapp and Fairman

(2006:42) and Dewanti-Hariyadi (2010:32-33). The pre-requisites for food safety that have the most significant financial impact are buildings, hygiene and sanitation, pest control, personnel training, calibration and verification, micro analysis of products and maintenance of equipment.

3.7 THE IMPACT OF GMP ON THE FOOD MANUFACTURING INDUSTRY

Louw and Van Schoor (2011:2) assert that no food manufacturing industry, either a small manufacturer or a large manufacturer, can be silent to the fact that important requirements around legal, regulatory, social and environmental factors need to be adhered to. Safety and quality standards of the food manufacturing processes should be met to be able to compete on the international market.

The senior management of an organization should identify the GMP that is most relevant and applicable to their business. Louw and Van Schoor (2011:4) provide GMP implementation guidelines for companies to consider in determining the feasibility thereof. Aspects to consider are that the standards should assist the business values and should be appropriate for the food industry in the local or international market. The scope that is necessary and suitable for the food manufacturing industry should be determined as well as what relevant retailers and customers, as well as targeted future customers want.

According to Aggeloginnopoulos, Drosinos and Athanasopoulos (2007:1078), there is more benefit in implementing the HACCP system with ISO standards as it covers all the safety procedures and measures rather than implementing just a single system alone. The end result of a combined food safety system is usually more effective and satisfactory than just a single standard implemented.

3.8 MEASUREMENT OF GMP IMPLEMENTATION

The analysis of the effectiveness of GMP in food manufacturing industries always relates to validation and verification activities. To understand the contributing factors that influence GMP performance. The measuring and monitoring of GMP includes the analysis of data, customer satisfaction, internal audit results, control of non-conforming products, continual improvement, corrective action, root analysis and preventive measures.

Analysis of data

According to ISO 9001, the analysis of data should provide information relating to:

- customer satisfaction;
- conformity to product requirement;
- characteristics and trends of processes and products including opportunities for preventive action; and
- suppliers

The analysis of data is derived from measuring the performance of the FSMS, customer satisfaction, number of nonconforming products, customer complaints and from rejects and reworks.

Consumer satisfaction

As one of the measurements of the performance of the QMS, the organisation should monitor information relating to customer perception to establish whether the organisation has met customer requirements (ISO 9001). High or low customer satisfaction can be measured by the number of compliments or complaints received. However, a more proactive approach is to develop some key performance indicators and measures with the customer (ISO 15161, 2003:27).

Continual improvement

The organisation should continually improve the effectiveness of the QMS through the use of the quality policy, quality objectives, audit results, analysis of data corrective and preventive actions as well as management reviews (ISO 2008).

Corrective action

The organisation should take action to eliminate the cause of nonconformities in order to prevent recurrence. Corrective actions should be appropriate to the effects of the nonconformities encountered (ISO 2008).

Internal audits

The organisation should conduct internal audits at planned intervals to determine whether the QMS conforms to quality objectives and is effectively managed. Internal audits are to be conducted at planned intervals.

Control of nonconforming product

The organisation should ensure that product which does not conform to product requirements is identified and controlled to prevent its unintended use or delivery. Nonconforming products can be identified by inspection at various stages of the processes, internal quality audits or as a result of any other audit result derived from any type of audit (ISO 15161, 2003:29).

3.9 QUALITY MANAGEMENT SYSTEMS USED IN THE FOOD MANUFACTURING INDUSTRY

3.9.1 ISO 9001 Concepts for South African food manufacturing Industry

ISO 9001 is a quality management system that is implemented in industries to meet the quality requirement as per the international standard to prevent any deviation. The implementation of this standard in any organisation guarantees that the finished product will meet the final specifications. Companies that are ISO certified are considered by consumers as companies that are capable of delivering good quality products to meet their requirements (Lamprecht, 1993).

Companies with ISO 9001 have several benefits over companies who have not yet implemented those systems. Such benefits include improving the quality of the product, there is customer satisfaction with the product, reduction in wastage, prevention of recall, product quality and reliability, increased customer satisfaction, increase in company income, and continual improvement of the system through monitoring **(**SANS, 2003). ISO 9001 is used by companies wishing to develop a quality management system that covers product development, customer services, product recall, product testing, nature of the building, equipment used and customer requirements.

3.9.2 The Importance of ISO 9001 in the South African food manufacturing industry

The standard ISO 9001 sets out the methods that can be implemented in an organisation to guarantee that customer expectations and demands are met. This is the result of the efficiency utilisation of the available resources, both human and technological. The main reason why companies implement ISO 9001 is to reduce first time failure, to reduce the costs of customer claims, to get things right the first time, to improve services to the customer and to increase competitiveness (SANS, 2003).

Amongst those indicated earlier, ISO 9001 benefits also include the following:

- To improve awareness of quality and have a standard for the South African food manufacturing products.
- To open markets by ensuring that ISO 9001 is compatible with international standards **(**SANS, 2003)**.**

3.9.3 Total Quality Management (TQM)

Many South African food manufacturing industries are currently trading on the international market and are involved in exporting products to different parts of the world. The implementation of quality management systems and Total Quality Management (TQM) are the main standards which have a high level of quality performance and monitoring processes (Fisher, 1992:44). There has been effective implementation of TQM by manufacturers in South Africa to continuously improve the quality of products (Tannock & Krasachol, 2000).

TQM is a quality system aimed at continuously improving the quality and safety of products and the production process through a holistic approach that integrates the technical system with the cultural system within an organisation to achieve customer satisfaction (Fisher, 1992:44). TQM is also based on the premise that the customer is the focus of all the activities of an organisation and all improvements in quality must be directed toward customer satisfaction (Fisher, 1992:44).

According to Kirkman and Shapiro (2001), the main features of TQM are customer satisfaction, continuous improvement of products, process improvement and monitoring, process and product improvement, top management involvement in quality processes, and proper verification of data to improve on product quality and safety. TQM also includes a number of processes that are used for problem solving, proper recording of documents by the organisation, incorporate a number of tools and techniques that are designed to permit problem solving by groups of employees and to use data for continuous improvement.

The application of TQM tools will vary according to the nature and type of organisation where the required system will be implemented. Wilkinson, Marchington, Goodman and Ackers (1992:231) describe TQM as a continuous improvement process that is used in an organisation to achieve a high level of quality. It aims to provide customers with good quality and safety products to meet the requirements and satisfaction of the customers.

TQM provides guidelines to a company through the processes of improving its productivity and service to the level that the customer expects. The TQM programme will result in meaningful accomplishments today and for the future. It is the right way to achieve excellence and customer satisfaction. It will help the company to meet its competition (Wilkinson *et al.,* 1992). Moreover, TQM results in significant productivity gains, unit cost reduction and elimination of much absenteeism, lowering of worker compensation rates, reduction of accidents, elimination of consumer complaints and winning the consumers over by always giving them what they expect.

3.9.4 Lean and Six Sigma as a Quality tool

George and George (2003) published a book called *Lean Six Sigma* which is made up of Six Sigma "quality" with Lean "speed", where they point out that Lean and Six Sigma should be integrated to “Maximize manufacturer’s value by achieving the prompt rate of quality improvement in meeting customer satisfaction, cost and quality improvement of processes”. George and George, (2003:19-22) supports the fact that Lean alone cannot achieve statistical control to improve quality, while Six Sigma alone cannot improve process speed

dramatically. Therefore, the combination of Lean Six Sigma is the union of quality and speed, which represents a successful business model.

3.9.5 The application of Lean Six Sigma in the food industry

Successful stories of Lean Six Sigma implementation are common in the food manufacturing industry in general. Unfortunately, the development process of Lean Six Sigma in the food manufacturing industry is still limited in some countries such as South Africa and other developing countries. However, the application of Lean Six Sigma shows continuous quality improvement in the food manufacturing industry and customer satisfaction (Kwak & Anbari, 2006:2006-714).

3.10 SOUTH AFRICAN FOOD MANUFACTURING STRATEGIES

Manufacturing strategies are used in particular to minimize and reduce production cost in the food manufacturing industry. According to McCalman (1998:97), the right processes in manufacturing organisations can have considerable operational and competitive benefits. Adam, Flores and Macias (2001:43) state that, the benefit of implementing Lean Six Sigma in a food manufacturing industry includes improvement in quality, stock control, customer feedback times, machinery use and efficiency, staff efficiency and morale.

Gelders, Mailllaeits and Males (1994:799) define manufacturing strategies as part of quality requirements by achieving manufacturing objectives such as low production costs, quality and customer satisfaction. Manufacturing strategies lead to significant advantages and focus on continual decision making within key food manufacturing industries. Manufacturing strategies are also considered important in determining the reliability of a supplier since supply dependability is an important operational issue based on reliability.

3.11 THE APPLICATION OF QUALITY TOOLS AND TECHNIQUES RELATED TO GMP

Quality tools are usually used to solve quality problems that occur in an organisation. Table 3.1 below shows the importance of most used tools in any GMP establishment. These tools are used for continual improvement of the

process and for the implementation of GMP in new food manufacturing industries. The degree of importance ranges from very important to important.

Table 3.1: Importance of tools used most frequently **(Own source, 2016)**

Tools and techniques	Degree of importance
➢ Hazard analysis	➢ Very important
➢ Transport control	➢ Very important
➢ Pest control	➢ Very important
➢ Environment control	➢ Very important
➢ Personal hygiene	➢ Very important
➢ Product recall	➢ Very important
➢ Product instruction to customer	➢ Very important
➢ Loss control and safety management	➢ Very important
➢ Plant layout	➢ Important
➢ Measurement equipment control	➢ Important
➢ Calibration	➢ Important
➢ Standardization of parts, products and processes	➢ Important
➢ Waste management	➢ Important
➢ Preventive maintenance	➢ Important
➢ Material control	➢ Important
➢ Packaging and storage	➢ Important
➢ Production control	➢ Important
➢ Process control	➢ Important

3.12 CONSUMER INFORMATION AND DEMAND

The implementation of food safety principles should not be confined to developed countries only, but also be expanded to developing countries as factors that lead to the destructive eventualities of potential health incidents can be avoided by

food safety principles (WHO, 2002:87). Consumers who are well informed will be able to fight for their rights and ensure that they are provided with safe and good quality products and services.

Countries without effective food control systems cannot ensure safe foods. The range of foods eaten may affect individual's health in the long term as food safety discussions usually focus on the more immediate effects that arise from consuming foods contaminated with some undesirable biological or chemical agents. Food quality control is a science that deals with the basic standards of food safety maintenance to be accepted by the consumers (WHO, 2002:163).

The importance of quality control measures in the prevention of diseases and health remains unrecognized in public health establishments and they are thought to be causes of food-borne diseases (WHO, 2002:163). The role of food technologies in the life and health of people is wide and important in improving the nutritional quality of food and ensuring safety and preventing food-borne diseases. There are socio-economic implications of food safety and quality that facilitate and promote trade in food, provide employment and assist women in family food preparation, thus participating fully in social life.

3.13 THE SAFETY OF FOOD AS AN ECONOMIC OPPORTUNITY OF GROWTH

With the population growth in the world, food safety has become one of the major focuses and concerns of consumers by making sure that the food they consume is safe and will not pose any risk to human health. Many countries have implemented food safety systems as a means of safe-guarding consumer's health and as extra benefit of exporting food products out of the country. Government in many countries have therefore, enforced certain rules and regulations such as the global food safety initiative scheme binding food manufacturers to comply so as to meet international standards for exportation (Wayhan, Khumawala, & Balderson, 2010:761).

Improvements in finished product quality lead to customer satisfaction, lower cost in rework, reduction in wastage, international demand of products, increase in business turn-over and thereby increasing the revenue of the country (Wayhan, Khumawala, & Balderson, 2010:761-762). There is emphasis on continuous

improvement of processes in the production chain and the improvement of this food safety system should be measurable with expected targets and results. Effective implementation of processes and targets achieved will result in less wastage, less rework, less reject, more request of the product from consumers and customer satisfaction.

To continuously improve the health of a nation and for the manufacturers to make profit in their businesses, there is a high demand and need for the implementation of food safety management systems so as to produce safe and quality end products that will not cause any harm to human health. Hence, food safety should be considered as a quality improvement process to assist organisations to meet with safety requirements (Wayhan, Khumawala & Balderson, 2010:763).

3.14 COMMON CHALLENGES IN THE FOOD ESTABLISHMENT RESULTING FROM IMPROPER FOOD SAFETY CONTROL

Food safety and quality still remain a public health concern especially in developing countries as there is a high outbreak of food-illnesses and sudden death resulting in substantial costs to individuals (Käferstein, Motarjemi & Bettcher, 1997:504). Improper quality control of food, incorrect cooking temperatures, poor storage conditions and mishandling of food results in the occurrence of foodborne illnesses and even death (Howes, McEwen, Griffiths & Harris, 1996).

There are factors that lead to the increase in the number of incidences of some foodborne diseases such as: the preparation method of the food, storage conditions, cleanliness of food equipment, handling of food, increase in food establishments, population growth, rapid urbanisation, lack of knowledge on food safety and control (Bryan, 1988).

3.14.1 Cross-contamination

Food contamination implies the effect exerted by an external agent on food such as contaminated hands which cause food to be unfit for human consumption. The most common way for food to be contaminated is through contact with food handlers who carry food-borne micro-pathogens (CDC, 2005:1201). Improper

food handling and storage lead to the growth of disease-causing germs which might cause harm to human health and even death. The CDC (cited in Ayçiçek, Aydoğan, Küçükkaraaslan, Baysallar, and Başustaoğlu, 2004:254) points out that the most common bacterium identified in food poisoning, comprising 70% of cases is *Staphylococcus aureus.*

According to Lues and Van Tonder (2007:327), *Staphylococcus aureus* has been indicated as the bacteria predominantly involved in food-borne illnesses, the consequence of consuming contaminated food. Cross-contamination in food handling involves the transmission of pathogens through hands that are not clean to food, surfaces, sponges, towels, utensils, and ready-to-eat food. According to Todd (1996), people who do not maintain an appropriate degree of personal hygiene, or who have illnesses or other conditions, can contaminate food and surfaces through contact, transmitting food-borne illnesses to consumers.

In South Africa, just as in many other developing countries in the world, westernisation has created a revolution of fast-food production, with an accompanying increase in the health risks associated with poor hand hygiene (DoH, 2005:12). According to Todd (1996), there have been many changes in people's eating lifestyle in the past years. For this reason, effective hand and good surface hygiene practices are very important in the prevention of food-borne illnesses which might affect the consumer's health.

3.14.2 Food-borne Illness

Food-borne illness, also referred to as food poisoning or food-borne disease, is transmitted to a human through food that contains unsound material and is detrimental for human health. Unsound material implies unwholesome, sick, polluted, infected, contaminated, decayed or spoiled food, or food that is unfit for human consumption for any reason (DoH, 2005:1). Food-borne illnesses arise from eating food contaminated by bacteria, viruses, environmental or food toxins (Todd, Greig, Bartleson & Michaels, 2007). Some of the pathogenic micro-organisms are identified in food as the culprits of food-borne illnesses, either because of the severity of the sickness or the number of cases of illness they cause, including the *Escherichia coli* group (Todd, Greig, Bartleson & Michaels, 2007).

Food-borne diseases is very common (Todd, Greig, Bartleson & Michaels, 2007), and majority of reported cases are mostly from food establishments such as hotels, restaurants, airline catering and hospitals as the food safety systems are not implemented and there is insufficient monitoring and controls in place (Käferstein, Motarjemi & Bettcher, 1997:504). The contributing factors to food-borne diseases in service industries are related to improper hand hygiene practices, poor cleanliness of the equipment, poor storage conditions of food and poor preparation methods (Sivapalasingam, Friedman, Cohen & Tauxe, 2004).

The consumption of contaminated food and water results in food food-borne diseases (Reilly & Käferstein, 1997:735). There have been reported cases of food-borne diseases which occur daily throughout the world, from the most to the least developed countries (Todd, Greig, Bartleson & Michaels, 2007). It is difficult to obtain an accurate number of incidences of microbiological food-borne diseases. However, in developed countries, the percentage of people suffering from microbiological food-borne diseases each year has been reported to be up to 30%, while the problem is likely to be even more widespread in developing countries as a result of improper food safety systems in place (WHO, 2002: 33-37). In 2005, 1.8 million people died from diarrhoeal diseases as a result of consuming contaminated food caused by improper food poor food hygiene practices as well insufficient cooking and storage control of food (Howes, McEwen, Griffiths & Harris, 1996:734-736).

The South African Department of Health has recognized that food-borne disease outbreaks are not properly reported and documented (South Africa. Department of Health, 2011:25). Most diarrhoeal illness resolve within 24 to 48 hours without any medical attention required. Many food-related illnesses are not diagnosed and associated foodborne disease outbreaks are often not recognized (South Africa. Department of Health, 2011:25). The Department of Health postulates that health workers are less likely to report this less severe condition even when people seek medical attention. This poses a challenge to the health care system to maintain the knowledge and resources to identify and respond to these outbreaks (South Africa. Department of Health, 2011:2).

3.15 CHAPTER SUMMARY

Over the last two decades, GMP has emerged as a key element for any establishment which produces any type of food product. GMP aims to mitigate the risk associated with food production and are also perceived as an establishment licences to trade. This chapter provided a comprehensive literature review of the various GMP components, requirement of GMP, global perspective on food safety, benefit of GMP, the challenges of implementing GMP, the impact of GMP in the food industry as well as customer information and demand applicable to this study,

Based on literature review, GMP is the main fundamental system to Food Safety Management system in the food manufacturing industry. The most internationally recognised Food Safety Management Systems (FSMS) that are of importance to the food industry are BRC, IFS and ISO 22000, HACCP and ISO 9001. Many of these FSMS are implemented in the food manufacturing industries to continuously improve their business, to conform to customer requirements and to gain market share therefore without GMP in place, the implementation of these systems might not be successful.

CHAPTER 4: RESEARCH DESIGN AND METHODOLOGY

4.1 INTRODUCTION

This chapter provides detailed information on the research design and methodology of the study. The research population and sampling methods, the data collection instrument, its validity and statistical method of analysis are discussed. Chapter 5 will explain the data analysis and findings of the study in order to solve the research problem.

4.2 METHODOLOGY AND RESEARCH DESIGN

Research methodology refers to the overall approach and perspective to the research process in general and the nature of data collection and the way data will be analysed (Collis & Hussey, 2003:55). The research method for this study is quantitative nature. Questionnaires were used to capture the data and individual face-to-face interviews also used to supplement the questionnaires. Quantitative research is described as studies expressing quantities and refers to research in which data is analysed statistically (Badenhorst, 2008:92). The research design is survey research whereby questionnaires were used to collect data and individual face-to-face interviews were conducted to gain participant's feedback on GMP and its implementation in the food manufacturing establishments.

4.3 THE AIM OF THIS CHAPTER

The aim of this chapter is to determine the factors that hinder South African food manufacturing establishments from implementing GMP effectively with the main objective is to resolve the research problem as stated in Chapter 1, paragraph 1.4, which reads as follows:

"*GMP is currently perceived as minimal food safety measures by most food manufacturers. Therefore, the lack of enforcement of approved standards within the food manufacturing establishments in Western Cape Province, South Africa may result in the food product quality being questioned by consumers".*

4.4 THE TARGET POPULATION

A target population is defined as the total number of people who represent the main subject of research interest (Watkins, 2011:59). The target population for this study was fresh food produce manufacturing establishment in the Western Cape South Africa that work according to GMP guidelines and who have implemented GMP systems in their food manufacturing establishments.

The fresh food produce manufacturing establishment were identified from various sources:

- The food industry South Africa website were:

http://www.reportlinker.com/d0116070156/Food-Industry-in-South-Africa.html?pos=1

http://www.wcfinefood.co.za/food-industry-overview

- Personal investigations across the Cape Town fresh food produce establishments.

The questionnaires were distributed by physically and by means of an email by the student researcher.

4.5 CHOICE OF SAMPLING

A sample is a portion of population under consideration for the purpose of research (Collis & Hussey, 2003:155-160). The selected sample should have similar characteristics to the population under study, to make the derivation of the results that will represent the population possible (Walker, 2005:571-573).

4.5.1 Sampling method

The sampling method in this study was probability sampling, and specifically random sampling for the questionnaires (Babbie & Mounton, 2005:166). This is when members of a population have an equal chance of being selected. In this study, fresh food produce participants were selected by unsystematic or random distribution of questionnaires. The names of all possible participants were

allocated a number before the questionnaires were been sent to them for easy reference.

For the individual interviews, participants were selected purposively for their ability to answer the research question and their availability (Teddlie & Yu, 2007:77-100).

In this study, 52 respondents responded to the questionnaires and 6 food manufacturing establishments were selected from the 52 respondents who participated in the questionnaires to participate in the individual face-to-face interviews.

4.6 DATA COLLECTION

Data collection is a technique that allows the researcher to systematically collect information about their object of study (people, objects, phenomena) (Aina, 2004). Data was collected by questionnaires and individual face-to-face interview to supplement the questionnaires.

4.7 RESEARCH DESIGN

Leedy & Ormrod (2010:87) point out that, planning the research design is particularly important for the researcher not only to choose a practical research problem, but also to think about the kinds of data that an investigation of the problem will require, as well as logical ways of collecting and interpreting this data.

According to Badenhorst (2008:92), qualitative research means data of words. This research method seeks meaning in human action. It is believed that there is information that everyone can gain insight into, and the research must be in context, with all its complexity with more than one meaning, truth and interpretation. There is a single reality “out there” that everyone can see with one meaning, truth and interpretation.

In terms of quantitative research, Badenhorst (2008:92) it means expressing quantities, refers to research that is of a statistical design that relies on the use of quantitative data, which is data that is expressed in quantity or amount that is a specific method of data collection.

There is a major philosophical difference between qualitative and quantitative research. These differences overlap with modernism and postmodernism since quantitative research has its roots in modernist positivism. For this research the quantitative method approach was used.

4.7.1 Case study method

A case study method was used in this research study. According to Yin (1994), case study research can be used in many situations, such as organisational and management studies. It is an empirical enquiry that investigates a contemporary phenomenon within its real-life context. Case study research aims not only to explore certain phenomena, but also to understand them in a particular context.

Yin (1994) further describes some of the more salient aspects of case study research as listed below for ease of reference:

- "How" and "why" type questions are explanatory, and likely to be used in case study research.
- A case study illuminates a decision or set of decisions, why they were taken, and how they were implemented, and with what result.
- The case study as a research strategy comprises an all-encompassing method with the logic of design incorporating specific approaches to data collection and data analysis. Collection tactic or merely a design feature alone, but a comprehensive research strategy.
- The case study as a research strategy comprises an all-encompassing method with the logic of design incorporating specific approaches to data collection and data analysis. Collection tactic or merely a design feature alone, but a comprehensive research strategy.
- Case study research uses multiple methods for collecting data, which may be both qualitative and quantitative.
- A case study is typically used when contextual conditions are the subject of research (Yin, 1994).

In terms of types of case studies, Collis & Hussey (2003) listed the following main types of case studies:

- **Descriptive case study**: Where the objective is restricted to describing current practice.
- **Illustrative case study:** Where the research attempts to illustrate new and possible innovative practices adopted by particular companies.
- **Explanatory case study**: Where existing theory is used to understand and explain what is happening.
- **Experimental case study**: Where the research examines the difficulties in implementing new procedures and techniques in an organisation and evaluating the benefits.

Experimental case study was used in this study so as to find out the difficulties and challenges of implementing GMP in the food establishment.

4.8 MEASUREMENT SCALES

The Likert scale is by far the most common type of survey analysis used for questionnaires. Likert proposed a summated scale for the assessment of respondent's attitudes in questionnaires (Gliem & Gliem, 2003:82). Individual items in Likert's sample scale had five response alternatives:

- **5**-strongly agree;
- **4**-agree;
- **3**-undecided;
- **2**-disagree and
- **1**-strongly disagree.

Academics and scholars have a rule of thumb that there must be a certain minimum number of classes of responses. Cooper and Schindler (2003:253-256) describe the advantages of the Likert scales as:

- Responses are gathered in a standardised way;
- It is a relatively quick method of collecting information;

- It gives participants a wide range of choice form 1-5, which may make them feel more comfortable in responding to questions.

In this study, the Likert five-point scale was used. Likert suggested that a scale of less than five points would be inappropriate, but other studies have insisted on a seven-point scale or more (Levine, Ramsey & Smidt, 2001). The five-point scale was used in the study.

4.9 RESEARCH INSTRUMENT

Watkins (2011:140) is of the opinion that survey design research is the prevailing method used in the food industry. Leedy and Ormrod (2001:196) state that a survey is a set of questionnaires which is administered to the participants with a series of questions for them to provide feedback and the results of the feedback is summarised with percentage, frequency and more statistical analysis is done to answer the research question generated in the research as shown in Appendix D (Table 5.1) and Appendix E (Table 5.2).

A survey is defined as a collection of a large quantity of evidence data, usually numeric, or evidence that the data will be converted to numbers, normally by means or questionnaires (Remenyi *et al*., 2002:290).

4.9.1 Questionnaire based on survey design

Questionnaires were designed to obtain information regarding the implementation of GMP in the food manufacturing establishments. The questions were based on a review of the literature used in this study, which centred on an assessment of the application of GMP and related concepts of GMP. Furthermore, the literature on GMP on food industry codes, frameworks, standards and best practices that can be used in the food manufacturing establishments in the Western Cape were reviewed. In addition, questions were designed after a critical evaluation of the research title and questions, the research investigation sub-questions, and the key research objectives.

The following principles were kept in mind in designing the questions:

- Avoidance of prestige bia;

- The assumption of prior knowledge and of leading question avoidance of double-negative;

- Double-barrelled questions.

The questionnaires in Appendix B in Table 4.1 were accompanied with a consent letter as shown in Appendix A, to give the participants a guide of how to go about the questions. The questionnaires consist of four sections with five questions under each section, making a total of twenty questions in the questionnaires containing the following:

- **Section A:** The reason for implementing GMP in a food establishment.

1. To improve the product quality.
2. To improve establishment reputation.
3. To improve customer satisfaction.
4. To identify problems within the production process.
5. To meet customer requirement.

- **Section B:** The importance of GMP awareness in a food establishment.

6. Non-conforming products are investigated with root cause analysis by the establishment.
7. Improvement tools are used by the establishment to solve quality problems.
8. Employees in your facility are allowed to contribute ideas that might affect the food safety system positively for continuous improvement.
9. Are there barriers in your establishment that prevent you from achieving world class manufactured products?
10. Corrective actions are closely monitored and followed up to prevent the recurrence of the same issues in your establishment.

- **Section C**: Training on GMP and the benefit it has on the establishment.

11. All employees are trained on the basis of GMP and the advantage within the establishment.

12. There is an established communication channel put in place to ensure general awareness of GMP principles in your establishment to achieve world class manufacturer practices.

13. There are training programmes in place that will help your facility to achieve world class manufacturer practices.

14. The employees in your establishment are aware of the importance of GMP in the work place.

15. The implementation of GMP will benefit the establishment positively.

- **Section D:** GMP quality tools used for process improvement**.**

16. We often rely on quality tools to solve quality problems.

17. We have been trained in the use of basic quality control tools.

18. GMP aids or helps cleanliness in the manufacturing industry.

19. The monitoring of GMP is not seen as an additional responsibility.

20. Audits are conducted to verify the effectiveness of GMP system in your establishment.

4.9.2 Individual face-to-face interview

Information obtained from the questionnaire was supplemented by additional information obtained through individual face-to-face interviews. The rationale for adding interviews was that the questions in the questionnaire were structured to elicit a response that was scaled. This information added an additional view of how food manufacturing establishments use GMP.

In a quantitative approach, interviews are frequently used in survey research to complement questionnaire results. According to Babbie and Mouton (2005:249), survey interview is a qualitative interaction that involves norms and expectations and has an explicit purpose to obtain data by means of pre-arranged questions. It

is important that the interviewer adopts a neutral stance during the interview to be a neutral medium through which questions and answers are transmitted (Babbie & Mouton, 2005:251).

The individual face-to-face interview was conducted based on the availability of the participants and their willingness to share more information about their establishments. Each interview took forty-five minutes as the questions were well structured. The interview was conducted with food safety team leaders since they are the ones responsible for the maintenance of GMP compliance and implementation with six well-structured questions. The interview answers were recorded by transcribing which is a means of taking notes during the interview process and the results analysed by inductive reasoning. The interview took place in the interviewee establishment. Below are the six questions that were asked during the interview process to food safety team leaders in each food manufacturing establishment that participated in the interview and are reference in Appendix C (Table 4.2).

1. How many years has your establishment been using GMP?

2. How many years of experience do you have as a food safety team leader in a GMP establishment?

3. How often is your establishment audited on GMP compliance?

4. Does your establishment have quality management review meetings and how often?

5. Do your establishment have food safety objectives which are communicated to everyone?

6. Does your establishment have measurement tools to measure quality objectives?

4.10 VALIDATION OF SURVEY QUESTIONS

To ensure validity of the questions, the researcher ensured that they reflected the research problem which has already been established. Greener (2008:37) suggests that validity of an instrument refers to the issue that the instrument must measure what it is projected to measure. In order to achieve content validity

during the survey, the questions were derived from a literature review on GMP, which underpinned the area under investigation. The questionnaires were also reviewed and approved by the co- supervisor.

4.11 RESPONDENT BRIEFING

Prior to the collection of data, the student researcher clearly explained the purpose of the study to each participant. Each participant was given the choice to participate or not and the matter of voluntary participation was emphasised. The nature and quality of each of the participants performance was guaranteed to be kept confidential. Finally, participants were told that data would not be fabricated to support a particular conclusion. Therefore, their honest contributions would be critical to ensure that their assistance became useful in answering the research questions.

4.12 CONCLUSION

In this chapter, the target population was defined, and the type of sampling method was discussed. Data collection and analysis methods were described. An overview of the survey design was provided as well as a description of the Likert Scale. Finally, briefing for the respondents was discussed.

In Chapter 5, the analysis and interpretation of the data is described and results are discussed.

CHAPTER 5: ANALYSIS AND INTERPRETATION OF DATA

5.1 INTRODUCTION

Date analysis is the process of systematically applying statistical and/or logical techniques to describe and illustrate, condense and recap, and evaluate data. According to Shamoo and Resnik (2003), various analytic procedures “provide a way of drawing inductive inferences from data and distinguishing the signal from the noise present in the data”.

This chapter focuses on the analysis of the questionnaire responses and interview questions conducted among various food manufacturing establishment in the Western Cape Province of South Africa. The participants who participated in this study were all food safety team leaders in the establishments where GMP is implemented or consider the implementation of GMP. The sample size of this research was based on manufacturers who are currently using GMP or those who consider the implementation of GMP. Only fresh food produce manufacturing establishment in the Western Cape were contacted to participants in this study and the recommendations from the study will benefit the various establishments in the Western Cape.

5.2 VALIDATION OF SURVEY RESULTS

The results of the survey questionnaire were analysed by means of descriptive analysis. The responses obtained from the questionnaire were indicated in table format and specific frequency tables were used for ease of reference See Appendix D. The reliability of the data is further discussed in points 5.3.1, point 5.6 below and also reference in Appendix F.

5.2.1 Data format

The data was provided in the original format of questionnaires, which was then captured on a Microsoft Access database. The data was then imported into a SPSS format through the SPSS ACCESS module. The information derived from the survey results were then analysed and interpreted.

5.2.2 Assistance to the researcher

All the conclusions and findings made by the researcher were validated by means of this statistical report. The final report written by the researcher was validated by a qualified statistician to eliminate any misleading interpretations.

5.2.3 Sample

The target population consisted of fresh food produce manufacturing establishments in the Western Cape, South Africa. The establishments were randomly selected with a prerequisite: they should already have GMP implemented or consider the implementation of GMP. From the fresh food produce manufacturers in the Western Cape South Africa 52 responded to the questionnaires.

5.2.4 Interferential statistics

The following interferential statistics were used in this research study:

Cronbach's Alpha: Cronbach's Alpha is an index of reliability which deals with the variation accounted for by the true score of the "underlying construct". Construct is the hypothetical variables that are being measured (Cooper & Schindler, 2001:216-217). Furthermore, Cronbach's Alpha measures how well a set of items (or variables) measures a single uni-dimensional latent construct. When data has a multidimensional structure, Cronbach's Alpha will usually be low.

5.3 ANALYSIS

For this research study, data were analysed by means of Statistical Package for Social Science (SPSS) version 19 software. For analysis purposes, the participants were asked to rank their questionnaire responses in the form of Likert scale ratings 1-5. These were captured on a Microsoft Access database. The information derived from the survey results were then analysed and interpreted. The researcher wanted to do more than describe the sample with descriptive statistics as shown in Appendix D (Table 5.1) and Appendix E (Table 5.2), but also make inferences by means of inferential statistics (Cochran-Smith, 2004:2).

5.3.1 Reliability testing

Kothari (2004:73-74) defines reliability as “the extent to which results are consistent over time and an accurate representation of the total population under study”. Furthermore, results of a study should be reproducible under the same circumstance. The research instrument is considered to be reliable if these factors can be established. Kirk and Miller (1986) describe reliability in quantitative research as the degree to which a measurement remains the same and the stability of a measurement remains the same over time.

A high degree of stability indicates a higher degree of reliability, which means the results of the data are repeated. Another method of determining reliability is the test-retest method. Kothari (2004:74) determined issues with the test-retest system which usually lead to an unreliable instrument. This explains that the test-retest system may sensitize the respondent to the subject matter and hence influence the responses given. Similarly, Crocker and Algina (1986) note that when a respondent answers a set of test items, the score obtained represents only a limited sample of behaviour.

Reliability tests (Cronbach’s Alpha Coefficient) were conducted on the questions/statements (which is the measuring instrument in this case) posed to the food manufacturing establishments in the Western Cape who are implementing GMP or consider the implementation of GMP. The Cronbach’s Alpha Coefficients for each item are more than 0.70 the acceptable level according to Peterson (1994:181-191), and thus these items (statements) in the questionnaire, prove to be reliable and consistent for all the items in the scale.

5.4 DESCRIPTIVE STATISTICS

Descriptive statistics were used for each variable and only the respondents, who completed the entire questionnaire.

Appendix D (Table 5.1) shows the descriptive statistics for all the variables as well as the variables measuring the effective implementation of GMP with frequencies in each category and the percentage out of the total number of questionnaires.

Appendix E (Table 5.2) shows the descriptive statistics for all the variables in terms of the mean, median, standard deviation and range. The individual frequency tables are also found under Appendix D in table formats from Table 5.3 to Table 5.22.

5.5 INTERPRETATION OF RESULTS

Since the data for this research was collected through structured questionnaires and individual face-to-face interviews to supplement the questionnaires, the results are interpreted separately as follows:

5.5.1 Results of the questionnaire

The results for this study were discussed in terms of the four sections of the questionnaire with each section having 5 questions.

5.5.1.1: Results for Section A: Reason for implementing GMP in food establishments

Results for each question, frequencies and percentages are illustrated in Figure 5.1 below and with ease of reference to Appendix D.

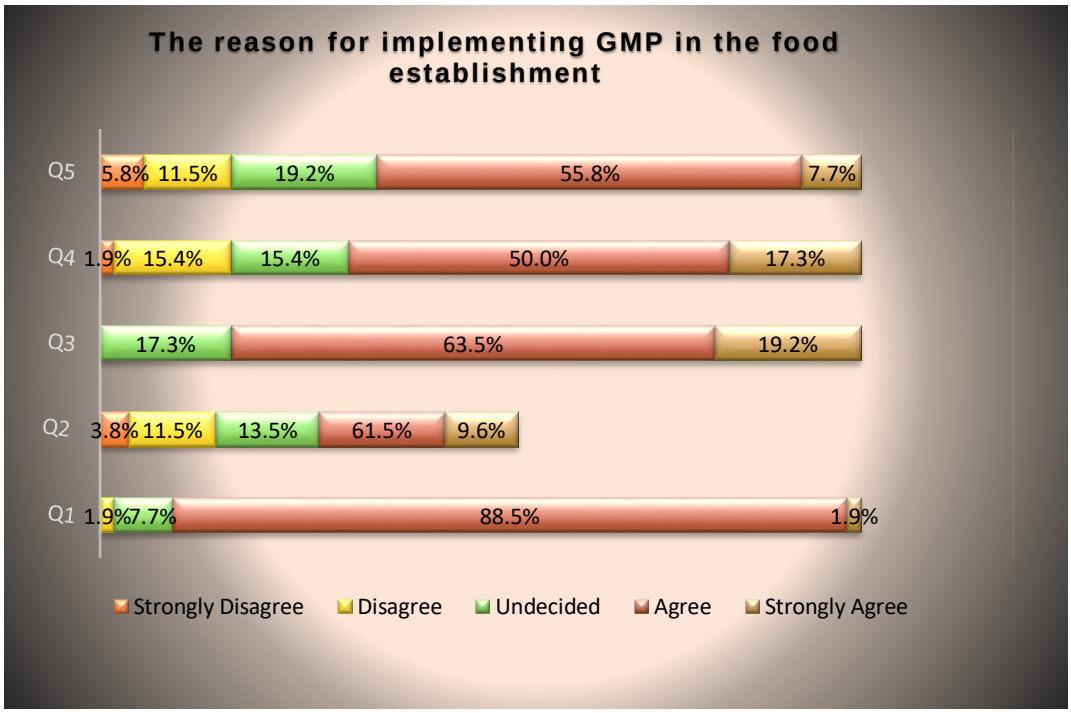

Figure 5.1: Reason for implementing GMP's in the food establishment

As indicated in Figure 5.1 above with ease of reference to Appendix D (Table 5.3 to Table 5.7) 88.5% of participants agreed that the reasons for the implementation of GMP were to improve the product quality, 61.5% agree that the reason for GMP implementation is to build the establishments reputation and 63.5% agree it was to improve customer satisfaction. 50% of the participants agree that GMP is considered a problem-solving tool in their establishment. 55.8% of the participant considered GMP as a method to meet customer satisfaction.

5.5.1.2: Results for Section B: The importance of GMP awareness in food manufacturing establishment

Results for each question, frequencies and percentages are illustrated in Figure 5.2 below and with ease of reference to Appendix D (Table 5.8 to Table 5.12).

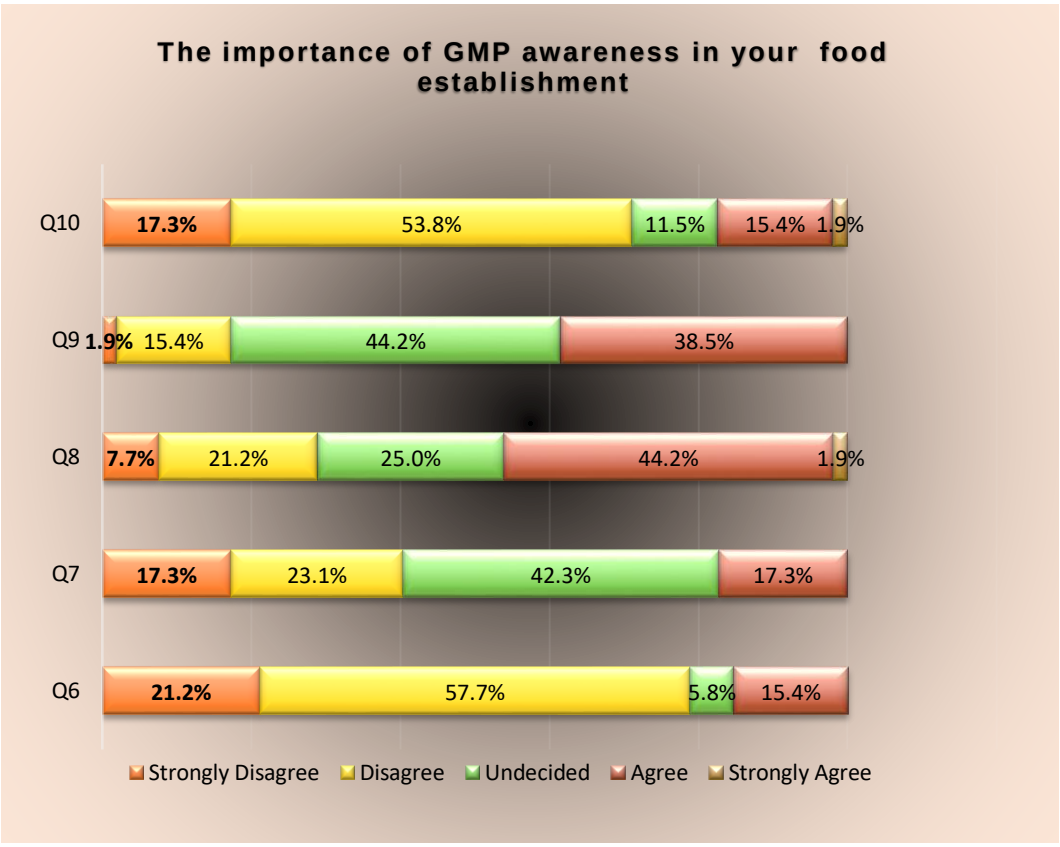

Figure 5.2: The Importance of GMP awareness in food manufacturing establishments

As shown in Figure 5.2 above, (Table 5.8) 57.7% disagree to strongly disagree with the statement that those non-conforming products are investigated with root

cause analysis. As seen in (Table 5.9), 42.3% where undecided with the statement that improvement tools are used by the company to solve quality problems and 23.1% disagree with the statement that improvement tools were not used to solve quality problems. (Table 5.10) shows that employees are allowed to contribute ideas which might affect the food safety system positively in their establishment, 44.2% agree and 25% were undecided. In (Table 5.11), 44.2% of the participants were undecided or confirmed that that there were barriers in their establishments that prevent them from achieving world class manufacturing processes and 38.5% agreed. 53.8% participants strongly disagree and 17.3% disagree that corrective actions were closely monitored and follow up to prevent the re-occurrence with reference to (Table 5.12).

In summary, questionnaire results for Section B indicated that there were gaps in the food manufacturing establishments. The following gaps were: root cause analysis of non-conforming products were not properly investigated, quality improvement tools not used, employees not allow to contribute ideas which might affect food safety positively, there were barriers that prevented the production of excellent products and that corrective actions to improve quality were not monitored

5.5.1.3: Results Section C: Training on GMP and the benefit it has on your establishment

Results for each question, frequencies and percentages are illustrated in Figure 5.3 below with reference to Appendix D (Table 13 to Table17).

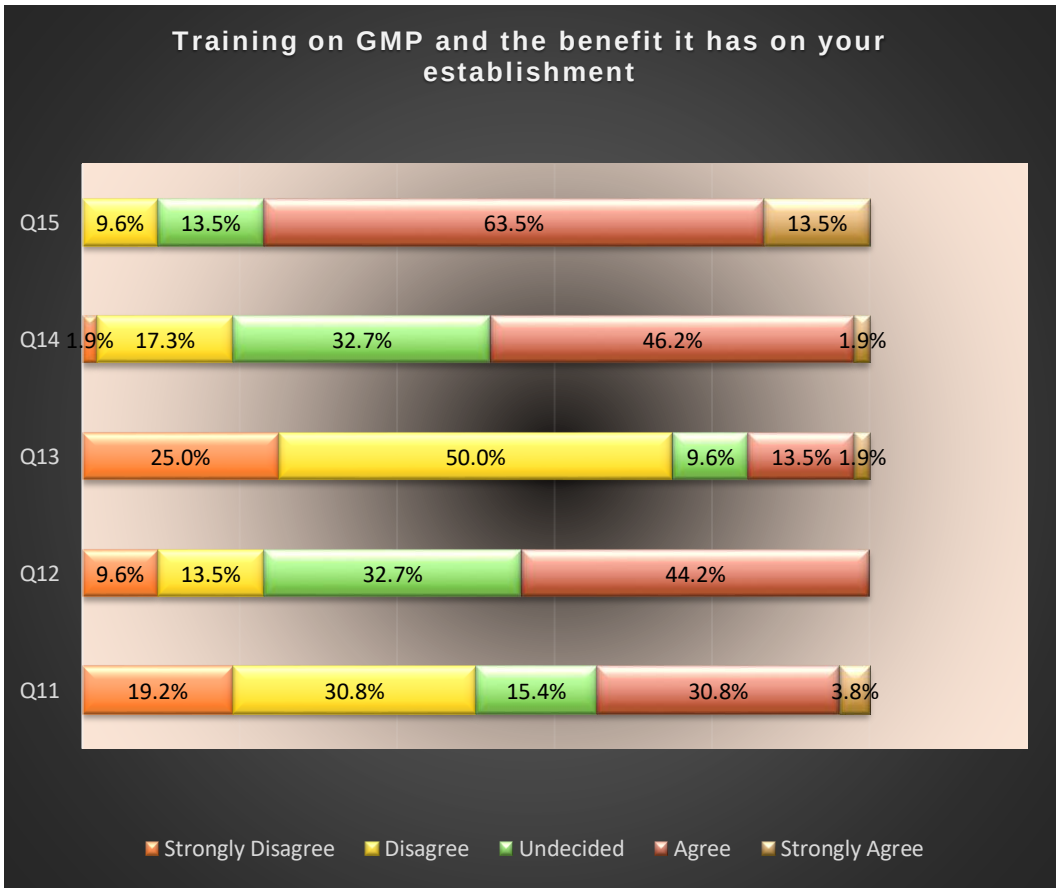

Figure 5.3: Training on GMP and the benefit it has on your establishment

Results in Figure 5.3 above shows that 30.8% of the participants disagree that employees are trained on the basis of GMP and 30.8% agree to this statement as seen in (Table 5.13). As seen in (Table 5.14), out of the participants 44.2% agree with that statement that communication channel is in place for awareness of GMP and 32.7% were undecided with the statement. 50% disagree with the statement that there are training programmes in place as reference to (Table 5.15). 46.2% of the participants agree that employees were aware of the importance of GMP and 32.7% were undecided with the statement as shown in (Table 5.16). 63.5% of the participants agrees with the statement that the implementation of the GMP system would have a positive impact on their establishment as seen in (Table 5.17).

Results of Section C indicated that there was insufficient training and training programmes in the surveyed food manufacturing establishments and that communication channel was one of the areas that were affected negatively.

5.5.1.4: Results of Section D: The quality techniques used for process improvement in your establishment

Results for each question, frequencies and percentages are illustrated in Figure 5.4 below with reference to Appendix D (Table 18 to Table 22).

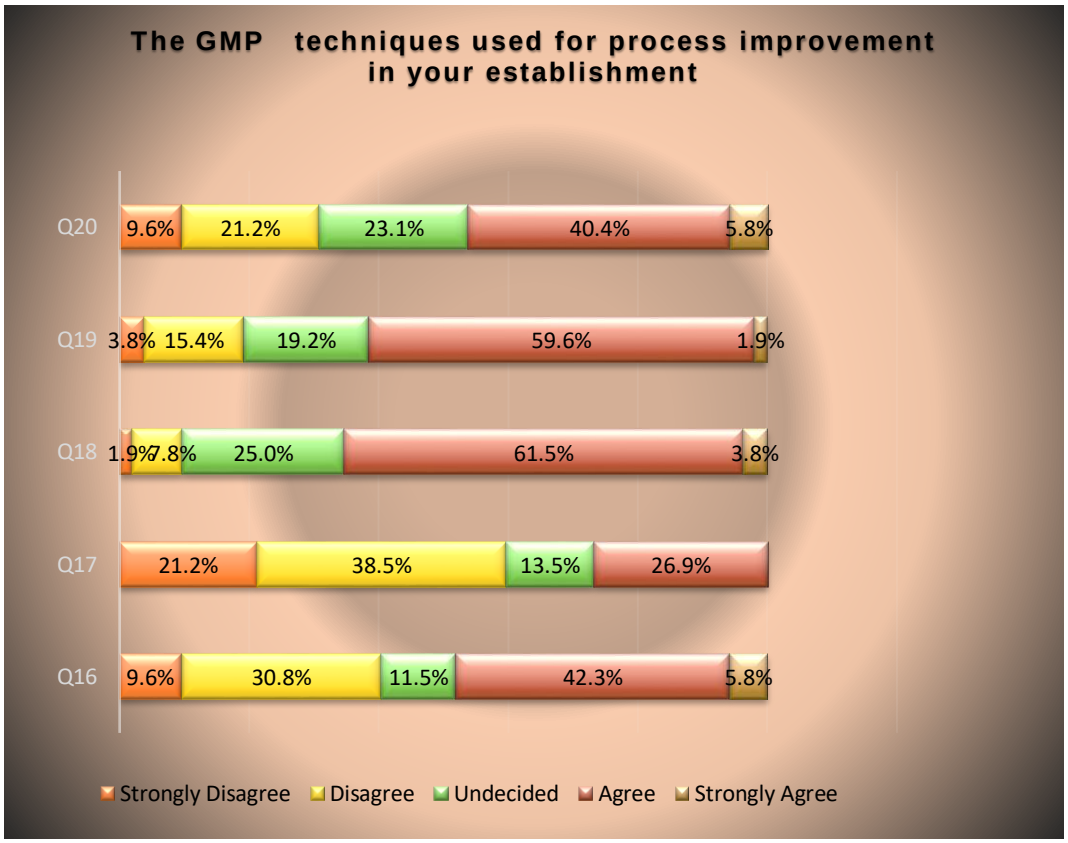

Figure 5.4: GMP techniques used for process improvement

Figure 5.4 above shows that, 42.3% participants agree that their establishment did not rely on quality tools to solve problems and 30.8% disagrees with the statement with reference to (Table 5.18). In question 17 of the questionnaire, 38.5% of the participants disagree that they have been trained on basic quality tools to improve the food safety system as seen in (Table 5.19). 61.5% of the participants agree that GMP aids in cleanliness of the establishment with reference to (Table 5.19) and 59.6% agree that the monitoring of GMP was not seen as an additional responsibility reference in (Table 5.21). 40.4% of the participants agree that audits are conducted to verify the effectiveness of GMP system in their establishment's reference in (Table 5.22).

The results shown in Figure 5.4 indicate that there is a need for training on the use of quality improvement tools in the establishment. Results also show that not enough audits were in place to monitor GMP compliance in most of the establishments that participated in this study.

5.6 RELIABILITY OF THE SURVEY RESULT

Analysis for the reliability of the results indicated that the Cronbach's Alpha is 0.782 for selected questions in the questionnaire, thus the data was within acceptable limit for the selected questions with reference to Appendix F and all the questions were further tested for reliability and the Cronbach's Alpha was poor as shown in Appendix F.

5.7 RESULTS OF INDIVIDUAL FACE-TO-FACE INTERVIEWS

Results of individual face-to-face interviews with the six selected fresh food produce manufacturing establishment in the Western Cape South Africa are described below.

5.7.1 Duration of an establishment operation on GMP

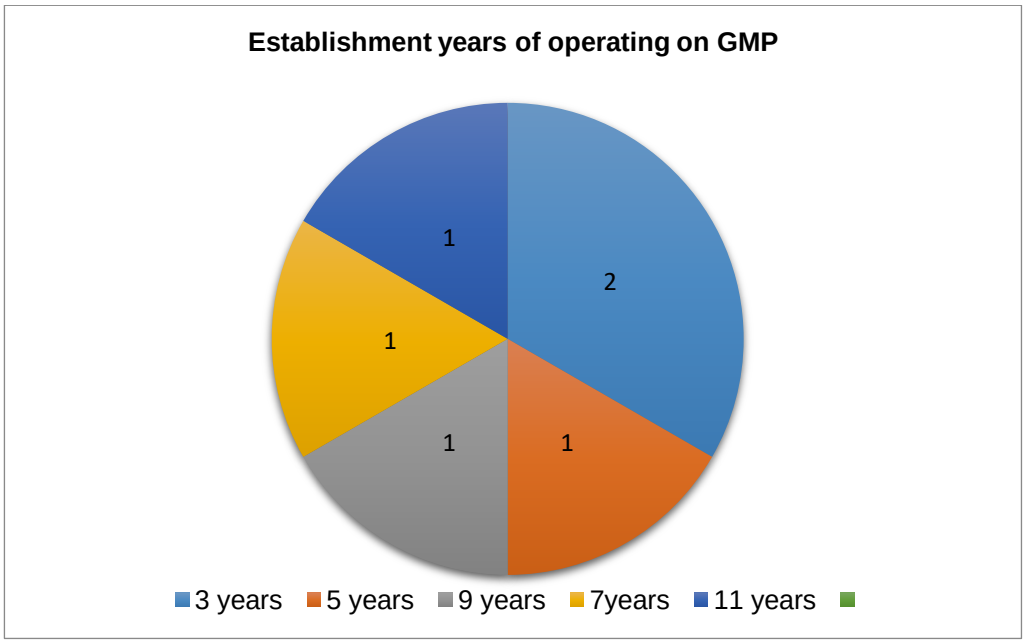

Figure 5.5: Establishment years of operating on GMP

Results in Figure 5.5 above indicate the duration of which each fresh food produce manufacturing establishments that was interviewed have been operating

on GMP. The duration were as follows: 2 establishment have been operating on GMP for 3 years, 1 for 5 years,1 for 9 years, 1 for seven years and 1 for 11 years.

5.7.2 Food safety team leader's experiences

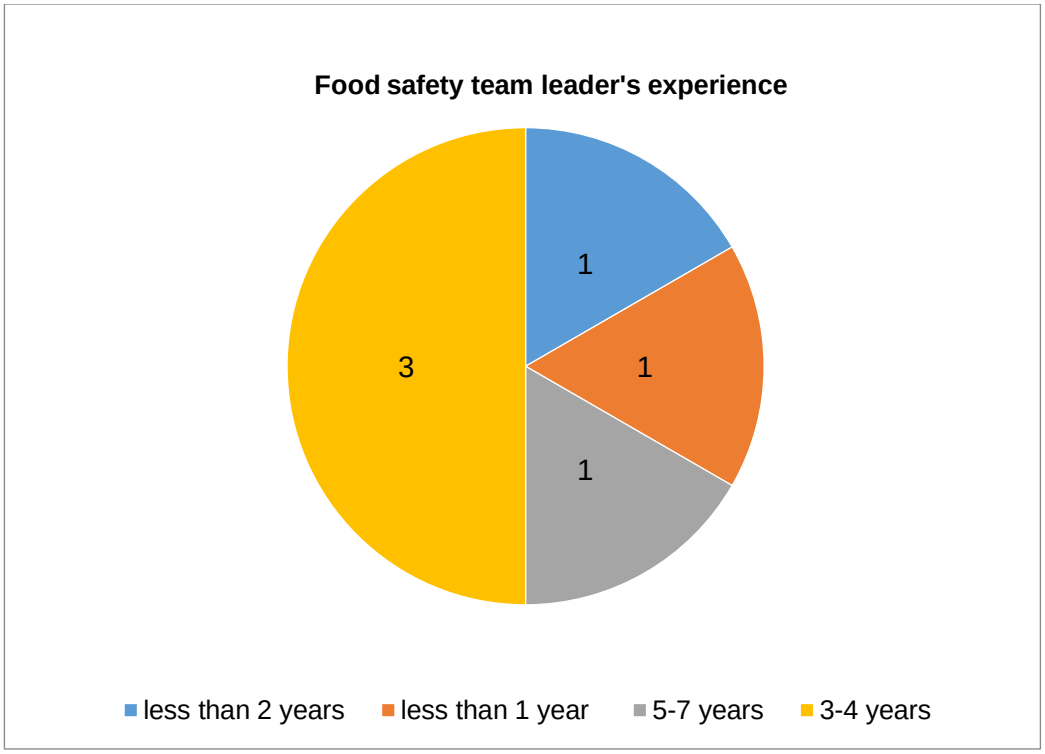

Figure 5.6: Food safety team leader's experience

As illustrated in Figure 5.6 above, 3 of the food safety team leaders had between 3 and 4 years' experience of using GMP. 1 had between 5 and 7 years' experience. 1 have less than 1 year experience and 1 had less than 2 years' experience.

5.7.3 Auditing of an establishment on GMP compliance

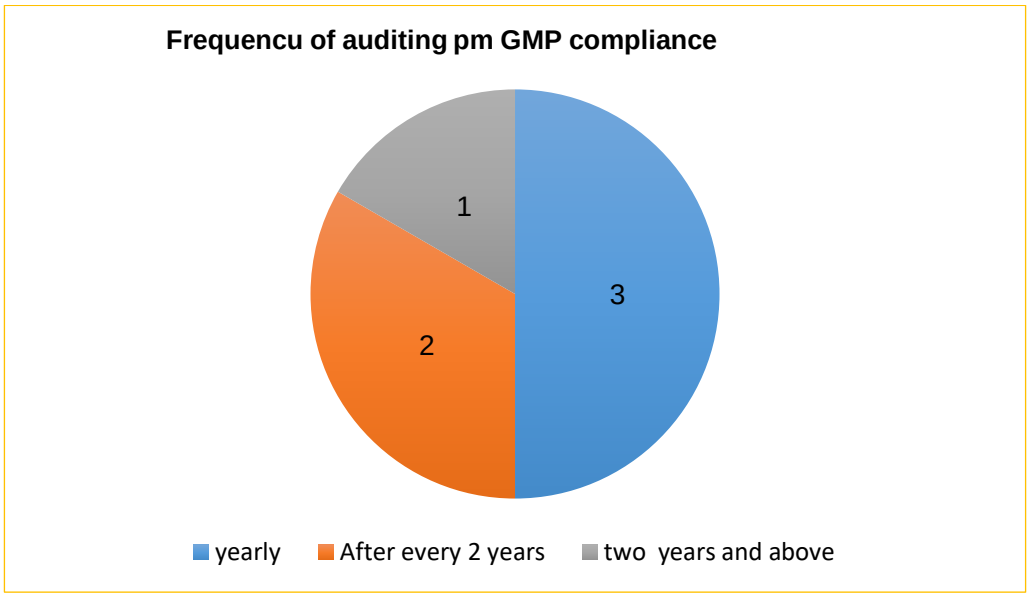

Figure 5.7: Auditing an establishment on GMP compliance

Figure 5.7 shows that 3 of these 6 interviewed establishments are audited for GMP compliance yearly. 2 are audited by every 2 years and 1 are audited after 2 years and above.

5.7.4 Frequency of management quality review

Figure 5.8: Frequency of management quality review meetings

Figure 5.8 indicates the frequency that management quality review meetings are conducted. 3 establishment interviewed reported that they never had quality review meetings, 1 met every two years and 2 of the establishments met on a yearly basis.

5.7.5 Quality objectives

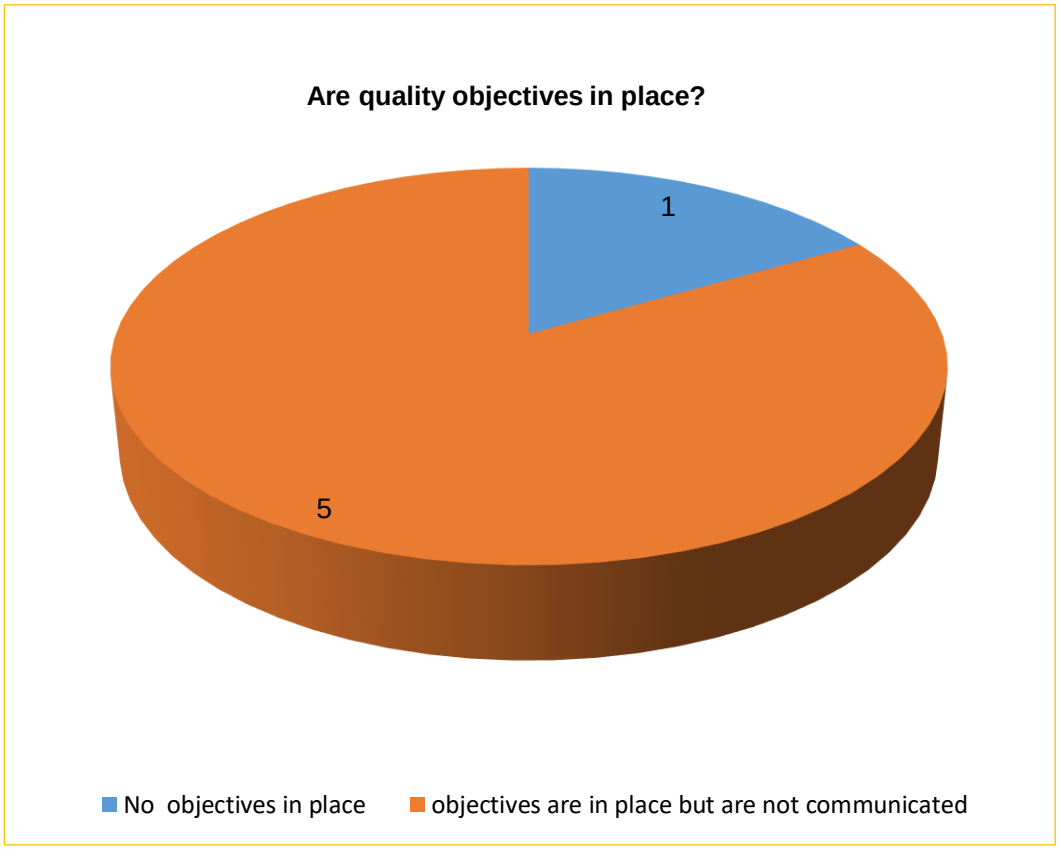

Figure 5.9: whether quality objectives are in place

Figure 5.9 shows that 5 of the establishments agree that there are quality objectives in place, but that the objectives were not communicated to staff, while 1 establishment reported that there are no quality objectives in place.

5.7.6 Use of quality objective measurement tools

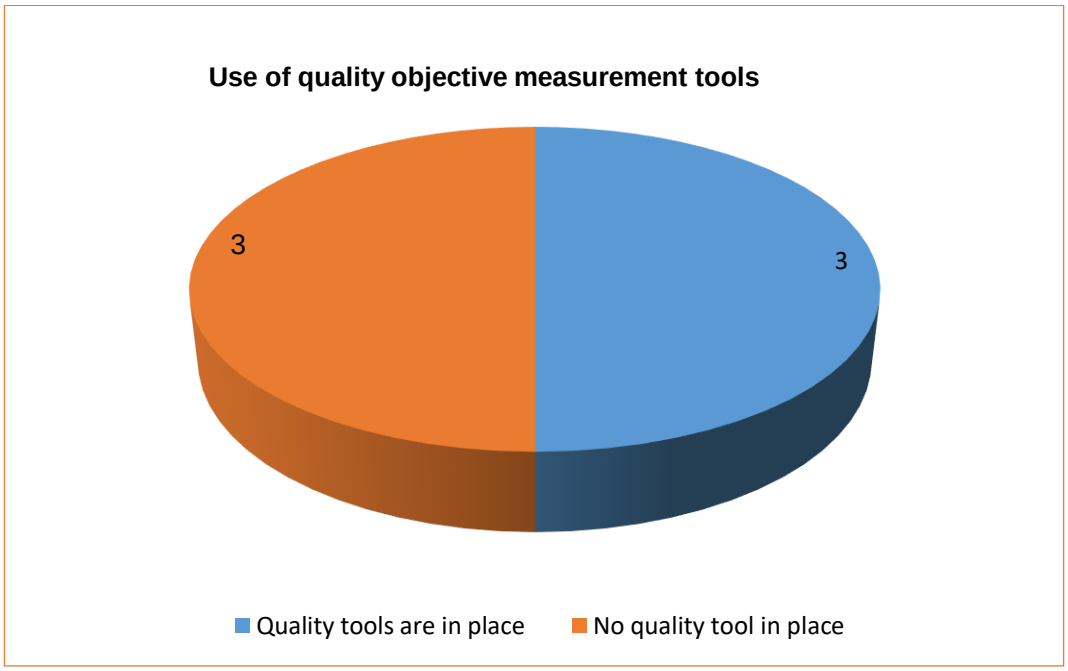

Figure 5.10: Use of quality objective measurement tools

As shown in Figure 5.10 above, 3 of the establishments used quality objective measurement tools and 3 did not use quality objective measures in their establishments.

5.8 DISCUSSION OF INDIVIDUAL FACE-TO-FACE INTERVIEW RESULTS

Based on the results of the individual face-to-face interviews, all 6 establishments interviewed had GMP in place. The duration that GMP had been in place varies from 3 to 11 years. Of the food safety team leaders interviewed, two-thirds had between 3 and 7 years' experience with GMP whereas one-third had less than two years' experience therefore, GMP was in place and food safety team leaders had experience of GMP in all establishments that were interviewed. Annual meetings where establishments were audited for GMP compliance happened yearly for 3 establishments that was interviewed. Two establishments were audited after every 2 years and 1 establishment audited after 2 years and above. Auditing occurring intervals of more than 2 years may not ensure food safety.

There is a need for more frequent management quality review meetings as 3 out of the 6 establishments interviewed never had regular quality review meetings to detect problems with the system which can then be resolved. One establishment have quality review meetings after every 2 years and 2 of the establishments yearly. Quality objectives for the establishment were absent for 1 out of the 6 establishments that were interviewed and of those establishments that had quality objectives in place. It was reported that the objectives were not communicated well to all staff members. This is thus an area of concern as well defined quality objectives enhance the establishment's ability to ensure safe food products. By not having well-defined and universally understood food safety objectives, the establishment is not following GMP system. Regarding the use of tools to measure quality objectives 3 out of the 6 establishment were using such tools. In terms of GMP compliance, it suggests establishment are missing out on opportunities to monitor and evaluate their progress towards the production of safe food.

In conclusion, the interview data suggested that three aspects regarding GMP compliance appear to have gaps; the frequency of auditing for GMP compliance; to ensure that quality objectives are in place and communicated to all staff and understood by all. Food manufacturing establishment to implement and use quality tools to measure quality improvement objectives.

5.9 DISCUSSION OF QUESTIONNAIRE DATA RESULTS

The questionnaire data suggest five key points of concern regarding compliance of GMP awareness in the food manufacturing establishment. It is evident that non-conforming products are not investigated with root because analysis, as it is very important to investigate any non-conformance that is observed to prevent the re-occurrence. Corrective actions should be properly monitored and followed up and communicated to all staff. There is training programmes in place. Hence, some employees have not received training. As it is only through training that the employees will became more aware of GMP in their establishments, this matter is urgent. Participants from the 52 fresh food produce establishments who responded to the questionnaires agrees that there are insufficient quality improvement tools in place to solve quality problems or to regularly measure the performance of their processes. Finally, more audits should be conducted as it is

only through auditing that an establishment can evaluate whether they are complying with food safety standards or not.

5.10 CONCLUSION

From the interpreted results of the individual face-to-face interviews that were used as a means to supplement information from the questionnaires and the results of the questionnaires it is evident that, GMP systems are not fully implemented in the fresh food produce establishments. There is a lack of awareness on training in the establishments that were surveyed through questionnaires. The use of quality objectives and auditing was found to be an area of concern in the establishments that were interviewed as there was lack of compliance. Hence, in Chapter 6, which is the concluding chapter, suggestions and recommendations that might benefit the surveyed establishments positively and those who might consider the implementation of these systems in future.

CHAPTER 6: CONCLUSION AND RECOMMENDATIONS

6.1 INTRODUCTION

The South African food manufacturing establishment plays a major role in the economy as mentioned in Chapter 2. The food manufacturing industry offers economic advantages to South Africa such as adding value to agricultural products, reducing the number of imported products, providing employment in local areas and gaining income from export products. The entire food manufacturing establishment needs to implement basic good manufacturing practices which conform to international standards to ensure product quality and meet customer requirements and satisfaction.

From the questionnaire results, it is evident that there is a lack of GMP awareness in the surveyed establishments as 17.2% of the participants agree to this. One of the establishment that were interviewed state that, there were no quality objectives in their establishment's, which brings doubt whether their end product is safe as monitoring of quality objectives ensures that the expected quality standard is achieved. Also, 75% of the participants indicated that there were no training programmes for employees in their establishments to create awareness of the food safety system. If employees are not trained they would not be able to perform their task due to lack of knowledge on the expected task. Quality improvement tools was an area of concern as 40.4% of the participants were not using those tools to improve their food safety system and non-conforming products and corrective action were not investigated with root cause analysis and preventive action. However, there were some areas of compliance to GMP as 90.4% of the participants agreed that GMP was important in ensuring quality and safety of end products.

6.2 OVERVIEW OF THE RESEARCH PROCESS

In this study, quantitative methodology was utilised to collect the data for this study. The data collection method was structured questionnaires as well as individual face-to-face interviews of fresh food produce manufacturing establishments. Since this study only targeted the fresh food produce manufacturing establishments in the Western Cape Province, participants were randomly selected on their wiliness to implement GMP and those who are

already complying with GMP standards. The questionnaires were sent to the participants through emails and some were physically delivered to the participants by the student researcher. The questionnaires were accompanied by consent letters (See Appendixes A). Participants were given a month to complete the questionnaires and return them back to the researcher. Though most participants had returned their completed questionnaires within a month, some of the establishment did not reply. The response rate was more than 80% thus it contributed strongly to validity and reliability of the results.

Furthermore, individual face-to-face interviews were conducted with selected establishments based on their availability. The establishment were interviewed to get a deeper understanding of their current GMP awareness practices and to evaluate the effectiveness of this system. The participants of the interviewed food establishments were all food safety team leaders from the fresh food manufacturing establishment who participated in the questionnaires. However, they could only answer the questions that were asked since the questions were structured.

Both the results from the questionnaires and the face-to-face interviews were captured in Excel and verified by a statistician for accuracy before analysing. Finally the results were analysis, and discussed as seen in Chapter 5.

6.3 THE RESEARCH PROBLEM REVISITED

The research problem that is addressed in this study is that GMP is currently perceived as minimal food safety measures by most food manufacturers. Therefore, the lack of enforcement of approved standards within the food manufacturing establishments in Western Cape Province, South Africa may result in the food product quality being questioned by consumers.

Based on the results of this study, it is evident that partial implementation of GMP is used by food manufacturers and the results confirm a need for enforcement for establishments to meet GMP requirements, which is a prerequisite for the food manufacturing establishments.

6.4 THE RESEARCH QUESTION REVISITED

The primary research questions were: What are the measures that food manufacturers in the Western Cape Province of South Africa need to have in place in order to guarantee safe food products for customers? Are there any measures in place that will force the Western Cape food manufacturing establishments to adopt GMP in order to guarantee safe food products to the customers?

Results from both questionnaires and individual face-to-face interviews indicate that the food manufacturing establishments need to tighten their quality systems as there was clear evidence that quality improvement tools used for measuring GMP effectiveness were not implemented. There was lack of compliance in some establishments such as lack of food safety objectives, lack of training, lack of training programmes, lack of communication on GMP to employees, non-conforming products and corrective actions were not investigated and no food safety management review meetings were in place to address quality issues that arises.

6.4.1 The investigative questions revisited

Four investigative questions were examined in support of the primary research questions:

- What hinders effective implementation of GMP among food manufacturing establishments in the Western Cape?

According to Chapter 3, Paragraph 3.6 challenges of GMP implementation which often occurs such as: there is always lack of interest as employees do not consider GMP as a priority, lack of awareness of the requirement, lack of technical knowledge and skills, lack of proper communication among employee, and lack of training.

- What are the perceived barriers within food manufacturing environment to ensure compliance to GMP?

In the literature review, Chapter 3, Paragraph 3.6 some of the perceived barriers to ensure GMP compliance within the food manufacturing establishment are as

follows: lack of prerequisite programmes, too much documentation, lack of management, financial barrier, lack of suitable physical working conditions, poor training system and lack of support from authorities.

- Are food manufacturers aware that GMP will improve their confidence to manufacture and deliver products that conform to safety standard to their customers?

In Chapter 3, Paragraph 3.5 states the benefits of GMP implementation which will improve manufacturer's confidence to manufacture and deliver products that conform to safety standards to their customers as follows: increased in customer satisfaction, reduced customer complaints, improved products quality, increased in the reputation of the company, reduced waste and avoid potential export barriers.

- Which key factors measures performance of GMP within the food manufacturing establishments?

There are many factors that measures performance of the GMP in the food manufacturing establishments. In the literature review, Chapter 3, Paragraph 3.8 six components measures performance of GMP, namely analysis of data, customer satisfaction, internal audits, control of nonconforming product, Continual improvement and corrective action.

All the investigative questions were addressed through questionnaires and individual face-to-face interviews to discover the research problem. There were factors and barriers which hinder the implementation of the GMP within the surveyed industries such as: lack of training, poor of GMP to staff, lack frequent audits to verify compliance with the system and quality improvement tools were not been used in all the companies. Section A of the questionnaires gave a clear indication on the benefit of GMP implementation in the various food establishments which were: to improve the product quality, to build establishment reputation, to improve customer satisfaction, to identify problems within the production process and to meet customer requirement.

6.5 KEY RESEARCH OBJECTIVES REVISITED

The identified primary research objectives of this research study are listed below:

- To explore the awareness and implementation of GMP among the food manufacturing establishment in the Western Cape.

In section A of the questionnaire which reads as follows: the reason for implementing GMP in the food establishment and section B, which stated the importance of GMP awareness in the food establishments were used to achieved this research objective reference to Appendix B.

- To determine the perceived barriers within the food manufacturing establishments with regards to adhering to GMP.

The perceived barriers were listed in Chapter 3, Paragraph 3.6.

- To suggest an effective approach to highlight the benefits of GMP for the boarder South Africa food manufacturing establishment.

In Chapter 3, Paragraph 3.5 the benefits of implementing GMP were discussed and also included in section A of the questionnaire as reason of implementing GMP.

- To determine the key factors that measures performance of GMP within the food manufacturing establishments.

The key factors that measures performance of GMP within the food manufacturing establishments are listed in Chapter 3, Paragraph 3.8.

Based on the results obtained from the questionnaires and individual face-to-face interviews, it was evident that the research objectives of this study were achieved as both methods of data collection methods gave a clear indication of the research objectives. Hence recommendations were suggested to improve GMP compliance, and to consider GMP as a prerequisite for all food manufacturing establishments as food safety and quality are the fundamental requirements of all food manufacturing to safeguard consumer health.

6.6 ANALOGIES DRAWN FROM THE DATA ANALYSED

The following analogies were drawn from the data analysed:

- Food manufacturing establishment should consider the investigation of non-conformance to be very important with root cause analysis as it is through the investigation that issues in the production chain could be solved.

- The barriers in the food establishment that hinder the industries to meet the expected standard should be identified and prevented such as training, frequent communication of the GMP system to employees.

- Training programmes should be provided and employees should be trained on GMP standards and compliance.

- Management review meetings on food safety should be conducted often as it will help the establishment to achieve its objectives.

6.7 RECOMMENDATIONS

The following recommendations suggested for this study:

- Training: food manufacturing industries should consider training as an important factor for all the employees in the establishment as it is through training that employees become aware of GMP requirements and requirements.

- Training programmes: the industry should provide training programmes for employees in the food manufacturing establishment such as GMP training and all other food safety training as it only through training that employees will know the procedures and the systems.

- Non-conformance of products: all the non-conformances should be properly investigated with root cause analysis so as to determine the source of the non-conformance and should be followed up with corrective and preventive measures.

- Quality tools: industries should be encouraged to use quality measurement tools as it will help to improve the GMP system and will result in a quality and safe end product for consumers.

- Management review meeting: there should be frequent management review meetings whereby the objectives of the system can be monitored for continual improvement.

- Auditing: food establishment should conduct audits yearly to verify compliance to GMP system.

6.8 LIMITATIONS OF THE STUDY

This study was conducted with a few limitations such as the number of establishments involved and data collection methods. Moreover, this study was conducted in a single province of South Africa. It will be more significant to gather data from other provinces of the country as well so as to have more in-depth understanding of GMP awareness and implementation in the entire country. Other limitations were that the target population for the questionnaires was only fresh food produce manufacturing establishment in the Western Cape as this could not allow for comparative statistics.

6.9 FINAL CONCLUSION

This chapter concluded the study and provided recommendations on how GMP can be effectively implemented within the food manufacturing establishments in the Western Cape Province. Attention was redirected to the research problem, investigative questions and the research objectives. This chapter ended with a set of recommendations to mitigate the research problem.

In the last decade, food manufacturers have put considerable effort into establishing and implementation of GMP systems to ensure the safety of their products. Most GMP requirements give flexibility for individual manufacturers to decide for themselves what the best methods are to meet the necessary control. This study led to some interesting findings: food manufacturers were not complying with GMP standards which are a problem and the quality and safety of the finished products were not guaranteed to be safe for human consumption. Though some establishments had GMP in place, it was not properly managed and the awareness of this system was not properly communicated to all staff. There is lack of enforcement for the GMP system to be used in the food establishment.

This research study was conducted with a number of boundaries such as the type of food industries involved, data collection methodology, and the target population. For further research, different types of food establishments and at least two data collection methodologies should be taken into account. The structured questions had a disadvantage in that respondents simply ticked an answer; the reasons for their choice were not clear. It would therefore be advantageous to use other data collection methodologies to gain a deeper understanding of the research question and sub-questions. Moreover, this research was conducted in a single province of South Africa; however, it is important to know how GMP implementations are tackled in the rest of the country.

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APPENDIXES

Appendix A: Consent letter

Cape Peninsula University of Technology

FACULTY OF ENGINEERING

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M-TECH: QUALITY STUDY CONSENT LETTER

Principal investigator: Macceline Ngwa

Dear Sir / Madam,

I am currently completing my Master's degree in Quality at the Cape Peninsula University of Technology, at Bellville campus. My research title is, **"**The application of Good Manufacturing Practices as a quality approach to food safety in a food manufacturing establishment in the Western Cape South Africa.

In order for me to conclude my research findings, I need your assistance. The survey is anonymous. Please do not write your name on the survey. Responses cannot be traced to any individual. The free and frank expression of your own opinion will be most helpful.

There are no right or wrong answers to any items in the questionnaire. It is your opinion on each statement made that matters.

The survey contains a number of statements on GMP awareness in the Western Cape South Africa. You are requested to respond to each of the statements by

placing a CIRCLE in the space which most accurately fits the extent to which you agree that the statement describing.

If you strongly disagree with the statement you would *CIRCLE* number **1**. If, on the other hand, if you strongly agree with the statement you would *CIRCLE* number **5**, disagree will be **2,** undecided **3** and agree **4**

After you have read each statement, please decide the degree to which the statement accurately describes your own situation in your company, using the five point scale.

Once you have completed the questionnaire email it to:maccelinengwa@yhaoo.com

Thank you for your participation.

Yours

Macceline Ngwa

Appendix B: Research questionnaire. (**Source:** Own source).

Table 4.1: Research questionnaire

Food Safety Knowledge. X= If you agree with the questions.	**1-Strongly disagree**	**2-Disagree**	**3-Undecided**	**-4Agree**	**5-Strongly agree**
Section A: The reason for implementing GMP in your food establishment.					
1. To improve the product quality.					
2. To improve establishment reputation.					
3. To improve customer satisfaction.					
4. To identify problems within the production process.					
5. To meet customer requirement.					
Section B: The importance of GMP awareness in your food establishment.					
6. Non-conforming products are investigated with root cause analysis by the establishment.					
7. Improvement tools are used by the establishment to solve quality problems.					
8. Employees in your facility are allowed to contribute ideas that might affect the food safety system positively for continuous improvement.					
9. Are there barriers in your establishment that prevent you from achieving world class manufacturing products?					
10. Corrective actions are closely monitored and followed up to prevent the recurrence of the same issues in your establishment.					
Section C: Training on GMP and the benefit it has on your establishment.					

11. All employees are trained on the basis of GMP and the advantage within the establishment.					
12. There is an established communication channel put in place to ensure general awareness of GMP principles in your facility.					
13. There are training programmes in place that will help your facility to achieve world class manufacturer practices.					
14. The employees in your establishment are aware of the importance of GMP in the work place.					
15. The implementation of GMP will benefit the company positively.					
Section D: GMP techniques used for process improvement in your establishment.					
16. We often rely on quality tools to solve quality problems.					
17. We have been trained in the use of basic quality control tools.					
18. GMP aids or helps cleanliness in the establishment.					
19. The monitoring of GMP is not seen as an additional responsibility.					
20. Audits are conducted to verify the effectiveness of GMP system in your establishment.					

Appendix C: Individual face-to-face interview question. (**Source:** Own source).

Table 4.2: Individual face-to-face interview question

List of questions
1. How many years has your establishment been using GMP?
2. How many years of experience do you have as a food safety team leader in a GMP establishment
3. How often is your establishment audited on GMP compliance?
4. Does your establishment have quality management review meetings and how often?
5. Do your establishment have food safety objectives which are communicated to everyone?
6. Does your establishment have measurement tools to measure quality objectives?

Appendix D: Descriptive statistics for all the variables

Table 5.1: Descriptive statistics for all the variables

Variables	Categories	Frequency	Percentage
Section A: The reason for implementing GMP in your food establishment.			
Q1 To improve the product quality	Disagree	1	1.9
	Undecided	4	7.7
	Agree	46	88.5
	Strongly Agree	1	1.9
Q2 To build improve company reputation	Strongly Disagree	2	3.8
	Disagree	6	11.5
	Undecided	7	13.5
	Agree	32	61.5
	Strongly Agree	5	9.6
Q3 To improve customer satisfaction	Undecided	9	17.3
	Agree	33	63.5
	Strongly Agree	10	19.2
Q4 To identify problems within the production process	Strongly Disagree	1	1.9
	Disagree	8	15.4
	Undecided	8	15.4
	Agree	26	50
	Strongly Agree	9	17.3
Q5 To meet the requirement of customer	Strongly Disagree	3	5.8
	Disagree	6	11.5
	Undecided	10	19.2
	Agree	29	55.8
	Strongly Agree	4	7.7
Section B: The importance of GMP awareness in your food establishment.			
Q6 Non-conforming products are investigated with root cause analysis by	Strongly Disagree	11	21.2
	Disagree	30	57.7
	Undecided	3	5.8

the company.	Agree	8	15.4
Q7 Improvement tools are used by the company to solve quality problems.	Strongly Disagree	9	17.3
	Disagree	12	23.1
	Undecided	22	42.3
	Agree	9	17.3
Q8 Employees in your facility are allowed to contribute ideas that might affect the food safety system positively for continuous improvement.	Strongly Disagree	4	7.7
	Disagree	11	21.2
	Undecided	13	25
	Agree	23	44.2
	Strongly Agree	1	1.9
Q9 Are there barriers in your establishment that prevent you from achieving world class manufacturing products.	Strongly Disagree	1	1.9
	Disagree	8	15.4
	Undecided	23	44.2
	Agree	20	38.5
Q10 Corrective actions are closely monitored and follow up to prevent the recurrence of the same issues in your establishment.	Strongly Disagree	9	17.3
	Disagree	28	53.8
	Undecided	6	11.5
	Agree	8	15.4
	Strongly Agree	1	1.9
Section C: Training on GMP and the benefit it has on your establishment.			
Q11 All employees are trained on the basis of GMP and the advantage within the establishment.	Strongly Disagree	10	19.2
	Disagree	16	30.8
	Undecided	8	15.4
	Agree	16	30.8
	Strongly Agree	2	3.8
Q12 There is an established communication channel put in place to ensure general awareness of GMP principles in your facility.	Strongly Disagree	5	9.6
	Disagree	7	13.5
	Undecided	17	32.7
	Agree	23	44.2
Q13 There are training programs in place that will help your facility to achieve	Strongly Disagree	13	25
	Disagree	26	50
	Undecided	5	9.6

world class manufacturing within the next 5 years	Agree	7	13.5
	Strongly Agree	1	1.9
Q14 The employees your establishment are aware of the importance of GMP in the work place.	Strongly Disagree	1	1.9
	Disagree	9	17.3
	Undecided	17	32.7
	Agree	24	46.2
	Strongly Agree	1	1.9
Q15 The implementation of GMP will benefit the company positively.	Disagree	5	9.6
	Undecided	7	13.5
	Agree	33	63.5
	Strongly Agree	7	13.5
Section D: GMP techniques used for process improvement in your establishment.			
Q16 We often rely on quality tools to solve quality problem.	Strongly Disagree	5	9.6
	Disagree	16	30.8
	Undecided	6	11.5
	Agree	22	42.3
	Strongly Agree	3	5.8
Q17 We have been trained on the use of basic quality control tools.	Strongly Disagree	11	21.2
	Disagree	20	38.5
	Undecided	7	13.5
	Agree	14	26.9
Q18 GMP's aid or helps cleanliness in the establishment.	Strongly Disagree	1	1.9
	Disagree	4	7.7
	Undecided	13	25
	Agree	32	61.5
	Strongly Agree	2	3.8
Q19 The monitoring of GMP's are not seen as an additional responsibility.	Strongly Disagree	2	3.8
	Disagree	8	15.4
	Undecided	10	19.2
	Agree	31	59.6
	Strongly Agree	1	1.9
Q20 Audits are conducted to verify the effectiveness of GMP system in your establishment.	Strongly Disagree	5	9.6
	Disagree	11	21.2
	Undecided	12	23.1
	Agree	21	40.4
	Strongly Agree	3	5.8

Appendix E: Descriptive statistics – Mean, Median, Standard Deviation, Range and frequency tables.

Table 5.2: Descriptive statistics – Mean, Median, Standard

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Section A: The reason for implementing GMP in your food establishment.					
1. To improve the product quality.	52	2	5	3.90	.409
2. To improve establishment reputation.	52	1	5	3.62	.953
3. To improve customer satisfaction.	52	3	5	4.02	.610
4. To identify problems within the production process.	52	1	5	3.65	1.008
5. To meet customer requirement.	52	1	5	3.48	1.000
Section B: The importance of GMP awareness in your food establishment.					
6. Non-conforming products are investigated with root cause analysis by the establishment.	52	1	4	2.15	.937
7. Improvement tools are used by the establishment to solve quality problems.	52	1	4	2.60	.975
8. Employees in your facility are allowed to contribute ideas that might affect the food safety system positively for continuous improvement.	52	1	5	3.12	1.022
9. Are there barriers in your establishment that prevent you from achieving world class	52	1	4	3.19	.768

manufacturing products?					
10. Corrective actions are closely monitored and followed up to prevent the recurrence of the same issues in your establishment.	52	1	5	2.31	1.001
Section C: Training on GMP and the benefit it has on your establishment.					
11. All employees are trained on the basis of GMP and the advantage within the establishment.	52	1	5	2.69	1.213
12. There is an established communication channel put in place to ensure general awareness of GMP principles in your facility.	52	1	4	3.12	.983
13. There are training programmes in place that will help your facility to achieve world class manufacturer practices.	52	1	5	2.17	1.024
14. The employees in your establishment are aware of the importance of GMP in the work place.	52	1	5	3.29	.848
15. The implementation of GMP will benefit the company positively.	52	2	5	3.81	.793
Section D: GMP techniques used for process improvement in your establishment.					

16. We often rely on quality tools to solve quality problems.	52	1	5	3.04	1.171
17. We have been trained in the use of basic quality control tools.	52	1	4	2.46	1.111
18. GMP aids or helps cleanliness in the establishment.	52	1	5	3.58	.776
19. The monitoring of GMP is not seen as an additional responsibility.	52	1	5	3.40	.913
20. Audits are conducted to verify the effectiveness of GMP system in your establishment.	52	1	5	3.12	1.114

Frequency Tables

Table 5.3: Q1To improve the product quality

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	1	1.9	1.9	1.9
	Undecided	4	7.7	7.7	9.6
	Agree	46	88.5	88.5	98.1
	Strongly Agree	1	1.9	1.9	100.0
	Total	52	100.0	100.0	

Table 5.4: To build improve establishment reputation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	2	3.8	3.8	3.8
	Disagree	6	11.5	11.5	15.4
	Undecided	7	13.5	13.5	28.8
	Agree	32	61.5	61.5	90.4
	Strongly Agree	5	9.6	9.6	100.0
	Total	52	100.0	100.0	

Table 5.5: Q3 To improve customer satisfaction

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Undecided	9	17.3	17.3	17.3
	Agree	33	63.5	63.5	80.8
	Strongly Agree	10	19.2	19.2	100.0
	Total	52	100.0	100.0	

Table 5.6: Q4 To identify problems within the production process

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	1	1.9	1.9	1.9
	Disagree	8	15.4	15.4	17.3
	Undecided	8	15.4	15.4	32.7
	Agree	26	50.0	50.0	82.7
	Strongly Agree	9	17.3	17.3	100.0
	Total	52	100.0	100.0	

Table 5.7: Q5 To meet the requirement of customer

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	3	5.8	5.8	5.8
	Disagree	6	11.5	11.5	17.3
	Undecided	10	19.2	19.2	36.5
	Agree	29	55.8	55.8	92.3
	Strongly Agree	4	7.7	7.7	100.0
	Total	52	100.0	100.0	

Table 5.8: Q6 Non-conforming products are investigated with root cause analysis by the establishment

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	11	21.2	21.2	21.2

	Disagree	30	57.7	57.7	78.8
	Undecided	3	5.8	5.8	84.6
	Agree	8	15.4	15.4	100.0
	Total	52	100.0	100.0	

Table 5.9: Q7 Improvement tools are used by the establishment to solve quality problems

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	9	17.3	17.3	17.3
	Disagree	12	23.1	23.1	40.4
	Undecided	22	42.3	42.3	82.7
	Agree	9	17.3	17.3	100.0
	Total	52	100.0	100.0	

Table 5.10: Q8 Employees in your facility are allowed to contribute ideas that might affect the food safety system positively for continuous improvement

		Frequency	Percent	Valid Percent	Cumulative Percent
Table 5 world cl	Strongly Disagree	4	7.7	7.7	7.7
	Disagree	11	21.2	21.2	28.8
	Undecided	13	25.0	25.0	53.8
Valid	Agree	23	44.2	44.2	98.1
	Strongly Agree	1	1.9	1.9	100.0
	Total	52	100.0	100.0	
Valid					

Table 5.11: Q9 Are there barriers in your establishment that prevent you from achieving world class manufacturing products

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	1	1.9	1.9	1.9
	Disagree	8	15.4	15.4	17.3
	Undecided	23	44.2	44.2	61.5
	Agree	20	38.5	38.5	100.0
	Total	52	100.0	100.0	

Table 5.12: Q10 Corrective actions are closely monitored and follow up to prevent the recurrence of the same issues in your establishment

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	9	17.3	17.3	17.3
	Disagree	28	53.8	53.8	71.2
	Undecided	6	11.5	11.5	82.7
	Agree	8	15.4	15.4	98.1
	Strongly Agree	1	1.9	1.9	100.0
	Total	52	100.0	100.0	

Table 5.13: Q11 All employees are trained on the basis of GMP and the advantage within the establishment

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	10	19.2	19.2	19.2
	Disagree	16	30.8	30.8	50.0
	Undecided	8	15.4	15.4	65.4
	Agree	16	30.8	30.8	96.2
	Strongly Agree	2	3.8	3.8	100.0
	Total	52	100.0	100.0	

Table 5.14: Q12 There is an established communication channel put in place to ensure general awareness of GMP principles in your facility

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	5	9.6	9.6	9.6
	Disagree	7	13.5	13.5	23.1
	Undecided	17	32.7	32.7	55.8
	Agree	23	44.2	44.2	100.0
	Total	52	100.0	100.0	

Table 5.15: Q13 There are training programmes in place that will help your facility to achieve world class manufacturing within the next 5 years

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	13	25.0	25.0	25.0

	Disagree	26	50.0	50.0	75.0
	Undecided	5	9.6	9.6	84.6
	Agree	7	13.5	13.5	98.1
	Strongly Agree	1	1.9	1.9	100.0
	Total	52	100.0	100.0	

Table 5.16: Q14 employees in your establishment are aware of the importance of GMP

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	1	1.9	1.9	1.9
	Disagree	9	17.3	17.3	19.2
	Undecided	17	32.7	32.7	51.9
	Agree	24	46.2	46.2	98.1
	Strongly Agree	1	1.9	1.9	100.0
	Total	52	100.0	100.0	

Table 5.17: Q15 The implementation of GMP will benefit the establishment positive

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	5	9.6	9.6	9.6
	Undecided	7	13.5	13.5	23.1
	Agree	33	63.5	63.5	86.5
	Strongly Agree	7	13.5	13.5	100.0
	Total	52	100.0	100.0	

Table 5.18: Q16 We often rely on quality tools to solve quality problem

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	5	9.6	9.6	9.6
	Disagree	16	30.8	30.8	40.4
	Undecided	6	11.5	11.5	51.9
	Agree	22	42.3	42.3	94.2
	Strongly Agree	3	5.8	5.8	100.0
	Total	52	100.0	100.0	

Table 5.19: Q17 We have been trained on the use of basic quality control tools

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	11	21.2	21.2	21.2
	Disagree	20	38.5	38.5	59.6
	Undecided	7	13.5	13.5	73.1
	Agree	14	26.9	26.9	100.0
	Total	52	100.0	100.0	

Table 5.20: Q18 GMP aid or helps cleanliness in the establishment

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	1	1.9	1.9	1.9
	Disagree	4	7.7	7.7	9.6
	Undecided	13	25.0	25.0	34.6
	Agree	32	61.5	61.5	96.2
	Strongly Agree	2	3.8	3.8	100.0
	Total	52	100.0	100.0	

Table 5.21: Q19 The monitoring of GMP are not seen as an additional responsibility

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	2	3.8	3.8	3.8
	Disagree	8	15.4	15.4	19.2
	Undecided	10	19.2	19.2	38.5
	Agree	31	59.6	59.6	98.1
	Strongly Agree	1	1.9	1.9	100.0
	Total	52	100.0	100.0	

Table 5.22: Q20 Audits are conducted to verify the effectiveness of GMP system in your establishment

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	5	9.6	9.6	9.6
	Disagree	11	21.2	21.2	30.8
	Undecided	12	23.1	23.1	53.8
	Agree	21	40.4	40.4	94.2
	Strongly Agree	3	5.8	5.8	100.0
	Total	52	100.0	100.0	

APPENDIX F: RELIABILITY

Case Processing Summary

		N	%
Cases	Valid	52	100.0
	Excluded[a]	0	.0
	Total	52	100.0

Reliability Statistics for selected questions

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.732	.731	11

Item Statistics

	Mean	Std. Deviation	N
Q12	3.12	.983	52
Q14	3.29	.848	52
Q15	3.81	.793	52
Q11	2.69	1.213	52
Q9	3.19	.768	52
Q13	2.17	1.024	52

Q1	3.90	.409	52
Q20	3.12	1.114	52
Q10	2.31	1.001	52
Q7	2.60	.975	52
Q6	2.15	.937	52

inter-Item Correlation Matrix

	Q12	Q14	Q15	Q11	Q9	Q13	Q1	Q20
Q12	1.000	.124	-.122	.030	.256	.175	.077	.220
Q14	.124	1.000	.055	.145	.184	.258	-.032	.047
Q15	-.122	.055	1.000	-.389	.062	-.103	.063	-.130
Q11	.030	.145	-.389	1.000	-.062	.233	.058	.041
Q9	.256	.184	.062	-.062	1.000	.131	.185	-.026
Q13	.175	.258	-.103	.233	.131	1.000	-.288	-.069
Q1	.077	-.032	.063	.058	.185	-.288	1.000	.111
Q20	.220	.047	-.130	.041	-.026	-.069	.111	1.000
Q10	.143	.148	-.048	-.066	-.002	.272	-.070	.073
Q7	-.053	.428	.075	-.041	.027	.248	-.050	-.065

Q6	.172	.215	-.065	.111	.122	.319	-.063	.001

Inter-Item Correlation Matrix

	Q10	Q7	Q6
Q12	.143	-.053	.172
Q14	.148	.428	.215
Q15	-.048	.075	-.065
Q11	-.066	-.041	.111
Q9	-.002	.027	.122
Q13	.272	.248	.319
Q1	-.070	-.050	-.063
Q20	.073	-.065	.001
Q10	1.000	.170	.262
Q7	.170	1.000	.069
Q6	.262	.069	1.000

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Q12	29.23	13.357	.260	.182	.388

Q14	29.06	12.840	.433	.291	.337
Q15	28.54	16.763	-.185	.205	.512
Q11	29.65	14.466	.027	.280	.482
Q9	29.15	14.525	.184	.171	.417
Q13	30.17	12.460	.371	.345	.343
Q1	28.44	16.055	-.009	.181	.454
Q20	29.23	14.573	.044	.097	.469
Q10	30.04	13.410	.243	.163	.393
Q7	29.75	13.799	.199	.255	.410
Q6	30.19	13.139	.320	.169	.368

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
32.35	16.192	4.024	11

Reliability Statistics for all questionnaire

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.411	.388	20

Item Statistics

	Mean	Std. Deviation	N
Q1	3.90	.409	52
Q2	3.62	.953	52
Q3	4.02	.610	52
Q4	3.65	1.008	52
Q5	3.48	1.000	52
Q6	2.15	.937	52
Q7	2.60	.975	52
Q8	3.12	1.022	52
Q9	3.19	.768	52

Q10	2.31	1.001	52
Q11	2.69	1.213	52
Q12	3.12	.983	52
Q13	2.17	1.024	52
Q14	3.29	.848	52
Q15	3.81	.793	52
Q16	3.04	1.171	52
Q17	2.46	1.111	52
Q18	3.58	.776	52
Q19	3.40	.913	52
Q20	3.12	1.114	52

Inter-Item Correlation Matrix

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Q1	1.000	.004	.243	.108	.019	-.063	-.050	-.114
Q2	.004	1.000	.114	-.039	.116	-.350	.062	.107
Q3	.243	.114	1.000	-.085	.274	-.005	.145	-.287
Q4	.108	-.039	-.085	1.000	.071	.037	.134	-.075
Q5	.019	.116	.274	.071	1.000	-.290	.183	-.036

Q6	-.063	-.350	-.005	.037	-.290	1.000	.069	-.060
Q7	-.050	.062	.145	.134	.183	.069	1.000	.284
Q8	-.114	.107	-.287	-.075	-.036	-.060	.284	1.000
Q9	.185	-.165	-.134	.138	-.148	.122	.027	-.004
Q10	-.070	-.079	-.299	.069	-.151	.262	.170	.271
Q11	.058	-.037	.194	.120	-.021	.111	-.041	-.081
Q12	.077	.090	-.233	.021	-.058	.172	-.053	.143
Q13	-.288	.110	-.068	.192	-.045	.319	.248	.168
Q14	-.032	.043	-.011	.395	-.121	.215	.428	-.017
Q15	.063	-.126	-.033	.111	.243	-.065	.075	.028
Q16	.131	-.162	-.083	.228	.068	.155	.409	.127
Q17	.013	-.088	-.187	.146	-.327	.345	.194	.090
Q18	-.069	-.198	.183	.110	.141	.010	-.023	-.283
Q19	-.104	.047	-.014	-.016	.170	-.166	.011	.054
Q20	.111	.006	-.292	.159	-.121	.001	-.065	.126

Inter-Item Correlation Matrix

	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16
Q1	.185	-.070	.058	.077	-.288	-.032	.063	.131
Q2	-.165	-.079	-.037	.090	.110	.043	-.126	-.162

Q3	-.134	-.299	.194	-.233	-.068	-.011	-.033	-.083
Q4	.138	.069	.120	.021	.192	.395	.111	.228
Q5	-.148	-.151	-.021	-.058	-.045	-.121	.243	.068
Q6	.122	.262	.111	.172	.319	.215	-.065	.155
Q7	.027	.170	-.041	-.053	.248	.428	.075	.409
Q8	-.004	.271	-.081	.143	.168	-.017	.028	.127
Q9	1.000	-.002	-.062	.256	.131	.184	.062	.013
Q10	-.002	1.000	-.066	.143	.272	.148	-.048	-.010
Q11	-.062	-.066	1.000	.030	.233	.145	-.389	.036
Q12	.256	.143	.030	1.000	.175	.124	-.122	-.055
Q13	.131	.272	.233	.175	1.000	.258	-.103	-.006
Q14	.184	.148	.145	.124	.258	1.000	.055	.285
Q15	.062	-.048	-.389	-.122	-.103	.055	1.000	.156
Q16	.013	-.010	.036	-.055	-.006	.285	.156	1.000
Q17	.009	.258	-.111	-.032	.222	.355	.080	.031
Q18	-.025	-.082	.026	-.089	.020	.100	-.071	-.046
Q19	-.113	.012	-.222	.100	-.097	.049	.326	-.217
Q20	-.026	.073	.041	.220	-.069	.047	-.130	-.049

Inter-Item Correlation Matrix

	Q17	Q18	Q19	Q20
Q1	.013	-.069	-.104	.111
Q2	-.088	-.198	.047	.006
Q3	-.187	.183	-.014	-.292
Q4	.146	.110	-.016	.159
Q5	-.327	.141	.170	-.121
Q6	.345	.010	-.166	.001
Q7	.194	-.023	.011	-.065
Q8	.090	-.283	.054	.126
Q9	.009	-.025	-.113	-.026
Q10	.258	-.082	.012	.073
Q11	-.111	.026	-.222	.041
Q12	-.032	-.089	.100	.220
Q13	.222	.020	-.097	-.069
Q14	.355	.100	.049	.047
Q15	.080	-.071	.326	-.130
Q16	.031	-.046	-.217	-.049
Q17	1.000	-.406	-.013	-.107
Q18	-.406	1.000	.135	.035

Q19	-.013	.135	1.000	-.085
Q20	-.107	.035	-.085	1.000

Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance
Item Means	3.136	2.154	4.019	1.865	1.866	.330
Item Variances	.902	.167	1.472	1.305	8.813	.104
Inter-Item Covariances	.030	-.374	.467	.841	-1.248	.020
Inter-Item Correlations	.031	-.406	.428	.834	-1.054	.024

Summary Item Statistics

	N of Items
Item Means	20
Item Variances	20
Inter-Item Covariances	20
Inter-Item Correlations	20

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Q1	58.81	29.335	.027	.402	.412
Q2	59.10	29.696	-.095	.400	.446
Q3	58.69	30.178	-.139	.533	.437
Q4	59.06	25.075	.350	.310	.339
Q5	59.23	29.083	-.043	.362	.437
Q6	60.56	26.997	.179	.471	.384
Q7	60.12	24.418	.441	.514	.317
Q8	59.60	27.147	.134	.338	.395
Q9	59.52	28.490	.066	.358	.409
Q10	60.40	26.520	.204	.304	.377
Q11	60.02	28.294	-.011	.406	.437
Q12	59.60	26.834	.179	.334	.384
Q13	60.54	24.763	.374	.471	.331
Q14	59.42	24.327	.547	.564	.304
Q15	58.90	28.991	.000	.404	.421
Q16	59.67	26.107	.179	.491	.381

Q17	60.25	27.250	.098	.615	.404
Q18	59.13	29.962	-.111	.474	.441
Q19	59.31	29.237	-.046	.331	.434
Q20	59.60	28.520	-.012	.312	.434

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
62.71	29.621	5.443	20