The impact of the logistical process on food safety and quality for maize export in South Africa

Thesis submitted in fulfilment of the requirement for the degree

by

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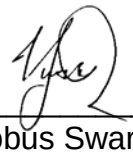
DECLARATION

I, Jacobus Swart, hereby declare that the contents of my thesis represent my own unaided work, and that it has not been partly or fully submitted in respect of this or any other subject and that the work of others has been adequately referenced. Furthermore, it represents my own opinions and not those of the Cape Peninsula University of Technology



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ABSTRACT

Over the last decades, due to the lack of safety concern and inadequate quality management in logistical process, it caused unsafe and poor quality of maize products. Thus, this study looks into the key factors that affect maize exports from South Africa in order to improve the logistical processes and reduce the risks involved in the process. The main risks associated with poor traceability and logistical chain management of maize export, as well as issues pertaining to non-conformance to the different food safety standards were explored.

Data were collected a group of food business operators (FBO) (n_1=127) and food business inspectors (n_2=20) through a number of interviews and a self-administered questionnaire. Data were then analysed by using the SPSS-V19 programme to generate descriptive statistical results to determine the specific needs and gaps within the current system as well as providing recommendations on the specific food safety changes pertaining to the maize export industry.

The results showed that there is a lack of understanding among role-players regarding FBO legislation. In the comparison of many large companies, there is only a few small role-players adhere to the legislation pertaining to food safety and traceability. This has impacted on the quality of maize products negatively. This strongly suggested that all role-players that handle maize for export must be registered for FBO codes with Department of Agriculture, Forestry and Fisheries. The study also recommended that the Perishable Products Export Control Board (PPECB) should inspect and confirm the legitimacy of the FBO codes that appears on the maize export documentation.

Keywords: Quality, food safety, food business operator, maize export, logistical processes, and traceability.

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GLOSSARY OF TERMS

Terms	Definition / Explanation
Assignee:	A person, undertaking, body, institution, association or board designated under section 2(3) of the Agricultural Product Standards Act, 1990 (Act No. 119 of 1990).
Codex Alimentarius:	Codex Alimentarius is Latin word for food code. CA is the mean results of the Commission's work: a set of international food standards, guidelines and codes of practice with the goal to protect the health of consumers and ensure fair practices in the food trade (Codex Alimentarius, 2012).
Consumer Protection Act (CPA, 2008):	Consumer Protection Act, 2008. Means act no. 68 of 2008. This act seeks to protect everyone from hazardous products and hidden risks and dangers (Melville, 2010:11).
Container or food container:	Includes anything in which or with which food is served, stored, displayed, packed, wrapped, kept or transported and with which food is in direct contact (Act No. 119 of 1990).
Food:	Means a foodstuff intended for human consumption as defined in section 1 of the Foodstuffs, Cosmetics and Disinfectants Act, 1972 (Act No. 54 of 1972), excluding food referred to in regulation 14 (Government Gazette, 2003).

Food Business Operator (FBO):	FBO is the person(s) that is responsible for insuring that prescribed requirements of export standards are met within the food business under his/her control and include both the management of the food business as well as the person with overall authority on site or in a specific establishment, primary production and on farm facilities, off-farm depots and silo's (Act No. 119 of 1990).
Food handler:	A person who in the course of his or her normal routine work on food premises comes into contact with food not intended for his or her personal use (Government Gazette, 2003).
Food handling organization:	Business, which during its operations, processes, manufactures, stores, transports, distributes or sells foodstuffs or is engaged in any activity which may impact on the safety of foodstuffs (SANS10330:2007).
Foodstuffs Cosmetics and Disinfectants Act No.54 of 1972 and the Health Act No 61 of 2003:	These acts form the legislative framework governing food safety and describe the official activities and tasks of the Department of Health (DoH). Regulations Governing Tolerance for Fungus-produced Toxins in Foodstuffs (R1145/2004) establish the legal limits for aflatoxin in maize for the domestic market both for foodstuffs ready for human consumption (Government Gazette, 2008)
Food Suitability:	Means assurance that a food product is acceptable for human consumption according to its intended use (Act No. 119 of 1990).

Good agricultural practices (GAP):	Refer to widely varying elements, of recommendations that can help to improve the quality and safety of the produce grown, to more encompassing aspects of primary production and post-production systems, such as environmental impact assessments et cetera (FAO, 2003:1).
Hazard Analysis and Critical Control Point (HACCP):	It consists of seven principles which identify specific food safety hazards such as biological, chemical, physical and allergens that can adversely affect the safety of food and specific preventative measures for their control (SANS10330, 2007:1).
Hazardous:	Means dangerous, fraught with danger, risky and unsafe (Collins, 1997:293).
Health Hazard:	A biological, chemical or physical agent in, or condition of, food with the potential to cause an adverse health effect (Government Gazette, 2003).
Logistics management:	Is that part of the supply chain process that plans, implements and control the efficient, effective flow and storage of goods, services and related information from the point-of-origin to the point-of-consumption in order to meet customer requirements and satisfies the requirements imposed by other stakeholders such as government and the retail community. Included within this definition are aspects such as customer service, transportation, storage, plant site selection, inventory control, order processing, distribution, procurement materials handling, return goods handling, and demand forecasting (Van der Vorst, 2005:10).

Perishable food:	Means any foodstuff which on account of its composition, ingredients, moisture content and/or pH value and of its lack of preservatives and suitable packaging is susceptible to an uninhibited increase in microbes thereon or therein if the foodstuff is kept within the temperature spectrum of 4 to 65^{o}C, and includes the perishable foodstuffs listed in Government Notice No. R.1183 of 1 June 1990, as amended, excluding fruit and vegetables (Government Gazette, 2003).
Phytosanitary plant and health certificate:	The importation of any plant products need to be accompanied by a plant health (phytosanitary) certificate. In most countries the importation of certain plant products or by-products included is pathogens detrimental for human health, is prohibited to enter another country, depending on the legislative conditions of that country, the export country must supply this certificate (Government Gazette, 2012).
Perishable products export control board (PPECB):	The assignee of DoA, the company operate under two laws: the Agricultural Products Standards Act, 1990 (Act No. 119 of 1990). The Perishable Products Export Control Act, 1983 (Act No. 9 of 1983). In terms of the former act serves to assure trading partners of perishable produce regarding the quality of South African perishable produce, while the latter seeks to safeguard the cold chain for South African perishable products (PPECB, 2011:7).
Quality:	Means individual needs, expectations, perceptions, and experience of the customer, overall it is the fitness of use of the product (Levine et al., 2001:16).

Risk-management:	Means the process, distinct from risk assessment, of weighting policy alternatives in consultation with interested parties, considering risk assessment and other legitimate factors, and if need be, selecting appropriate prevention and control options (Codex Alimentarius, 2012).
Supply chain management (SCM):	Is for the integrated planning, co-ordination and control of all business processes and activities in the supply chain to deliver superior consumer value at less cost to the supply chain as a whole while satisfying the variable requirements of other stakeholders in the supply chain (e.g. Government and non-government organizations (Van der Vorst, 2005:2).
Traceability Standard Operating Procedure (T-SOP):	This is a guideline that supports checklists, compliance criteria and special market protocols issued by the Department of Agriculture. This document takes account of mandatory requirements for traceability and related information specified in relevant South African directives, export standards and phytosanitary agreements, Codex Alimentations principles and guidelines and support checklists and protocol documents (NDA, 2007:1).
Transport:	Means carry, haul, transportation vehicle and shipping (Collins, 1997:644).

CHAPTER ONE: ORIENTATION OF THE STUDY

1.1 INTRODUCTION AND MOTIVATION

Food safety and quality is always a major concern in countries worldwide, particularly to those countries that are involved in food import and export. In order to maintain good quality of food and keep it safe to consumers, many countries have issued various regulations and legislations. The South African National Standards (SANS) states that food safety is of a global concern and the international agreements advocate the protection of consumer health (SANS10330, 2007). These standards were accepted internationally as a means to reduce the risk, specific to food safety hazards (biological, chemical, physical and allergens) (SANS10330, 2007). These standards have also been published by the Codex Alimentarius in 2003, and they require that all FBO's (which includes transport operators) to implement food safety and traceability requirements. The transporters and farms are the two most critical control points in the export chain of maize that need a thorough food safety training of personnel. The standards explicitly state that FBO's shall ensure that at all stages of handling for which they are responsible for, from and including loading and off-loading of maize from primary production up to and including the export of food products are carried out in a hygienic way in accordance with the prescribed standards requirements of afore-mentioned standard (SANS10330, 2007).

Perishable products export control board (PPECB) is mandated by the Department of Agriculture Forestry and Fisheries (DAFF), under the Agricultural Products Standards (APS) Act 119 of 1990, to ensure compliance with the food safety standard by conducting food safety audits on all registered FBO's. PPECB also audits the use of legislated pesticides on a regular basis, by sampling consignments of FBO's destined for export, according to a maximum residue levels (MRL) of the Standard Operating Procedure of South Africa (SOP) that all maize exporters must adhere too. This forms part of the risk

based approach of the total PPECB mandated functions, which will be studied in this research.

Over the past years, traceability of maize products destined for exports has become increasingly important for the quality and safety fresh products globally. Due to the fact that maize logistical processes are not measured and monitored effectively, the key factors affecting the product quality after harvest have not been clearly addressed to all role-players in the industry.

This, study looks into the key factors that affect the logistical process for maize export in order to manage maize export process effectively. This will assist food export companies to identify the shortcomings and ensure the quality and safety of maize product in the logistical process for maize export.

This chapter provides a general orientation of the study. It includes introduction and motivation, background to the study, research problem statement, research questions and objectives, research design and methodology, ethical considerations, significance of the study, and an overview of the thesis structure.

1.2 BACKGROUND TO THE RESEARCH PROBLEM

A number of regulations and legislations associated with logistical management and food safety management systems are in place for food product export in South Africa. These include Agricultural Product Standards (APS Act No. 119 of 1990); Codex Alimentarius Commission, Foodstuffs Cosmetics and Disinfectants (FCD) Act No.54 of 1972; the Health Act No 61 of 2003; Food Safety Checklists; Consumer Protection Act (CPA, 2008) and Compliance Criteria; Good Agricultural Practices (GAPs); Hazard Analysis and Critical Control Point (HACCP); Traceability Standard Operating Procedure (T-SOP); Phytosanitary plant and health certificate, et cetera .

Among these regulations, legislations, and management systems, the APS Act provides for control over the sale and export of certain agricultural products and

other related products, with a view to the maintenance of certain standards regarding the quality of products and the packing, marking and labelling thereof, as well as describing the official activities and tasks of the officials of the Department of Agriculture Forestry and Fisheries (DAFF), in particular Notice R.707 of this act (Act No. 119 of 1990).

CAC was created by Food and Agricultural Organization (FAO) and World Health Organization (WHO) to develop food standards, guidelines and related texts such as codes of practice under the joint of the United Nations FAO/ WHO Food Standards (Codex Alimentarius, 2012). According to Codex Standard 153-1985, the standards contain codes of practices detailing general principles of food hygiene laid down by the International World Health Organization, the standards have the following criteria (NDA, 2007):

- It must identify the essential principles of food hygiene applicable throughout the food chain (including primary production through to the final consumer) to achieve the goal of assuring that food is safe and suitable for human consumption.
- It recommends a HACCP based approach to enhance food safety.
- Indicates how to implement those principles
- Provides guidance for specific codes which may be needed for sectors in the food chain; or commodities; to amplify the hygiene requirements specific to those areas legislative requirements for an export company.

FCD Act No.54 of 1972, is used for various types of FBO's including primary production and on-farm facilities, off-farm pack houses and cold stores, container depots, silos, transport operators, exporters, airport terminals (NDA, 2007).

GAPs refer to widely varying elements, of recommendations that can help to improve the quality and safety of the produce grown, to more encompassing aspects of primary production and post-production systems, such as environmental impact assessments et cetera (FAO, 2003).

With regards to the HACCP export chain, it has become clear that there are some areas for improvement. The main function of the HACCP system is help to reduce the food safety risk incidents. According to SANS10330:2007, the different food safety processes should be effective and suitable in each link of the supply chain.

Table 1.1 discusses the different physical risks from farm to port in the logistical export process. According to Act 119 (1990:14), in the standards and requirements, regarding control of the export of maize, as stipulated by government notice no. R. 1983 of 23 August 1991, provision must be made in National Legislation to recognise risk standards set by reputable bodies/ countries e.g. MRL's of Codex and EU, responding to information received from food industry representative bodies of other countries. It is important to analyse notifications received from International food safety alert systems related to exports from South Africa, as well as national food safety alerts, information made available by the media, internet, and consumer bodies et cetera (horizon scanning). Cargo owners should consider all these potential risks prior to making the decision of whether they can transport maize to the port, in accordance with the maize export regulations.

Table 1.1: Risks in logistical chain process for maize export

Growing and Harvesting	Grower
Farm or Exporter	Forwarder or Trucker
Transport 1 (Short distance transporter)	• Silo's • Warehouse Handling • Warehouse and/or Storage (Export)
Transport 2 (Long distance transporter)	Loading
Transport 3 (Short distance transporter)	Ramp or Harbour Handler
Shipping Line	Forwarder or Trucker
• Handling • Warehouse and / or Storage (Importer)	Importer/Wholesaler / Super Distribution to retailer terminal

The maize regulations are as follows:

- be free from insects;
- free from any material or substances that may change the original quality of maize at the time of inspection for export, which may include any foreign matter or substance which renders it unfit for human or

animal consumption, processing into or utilisation thereof as food or feed (includes material like water, flaked rust pieces et cetera.);

- be free from any other material or substances that may harbour insects.

It is clear that risk governance, embracing risk identification, assessment, management and communication, has become crucial, but often highly controversial. The risks for maize can be found on the farm, or at port. Some of these risks are as follows:

- Physical risks - the risks associated with premises, equipment, facilities, and contamination at storage or transport points for example: waste or mould, rancid, sour, objectionable of mouldy smell or taste, wet or caked patches, not be of an excessively high temperature, free of insects, free from poisonous chemical substances and moisture content.
- Chemical risks - the risks associated with maximum residue levels that exceed hazardous waste.
- Biological risks -the risks associated with aflatoxin, mycotoxins, and genetically modified maize (APS Act 119 of 1990:14).

These systems make a safety certificate necessary as it brings about the harmonisation of a supporting system (hygiene conditions, measurements, products and their control); HACCP system and hygiene training of the personnel. The food companies must have in place, a safety programme in a written format; and they must execute it, and keep a record of the measures taken pertaining to food safety (SANS10330: 2007).

According to DAFF, the South African food safety regulation, (T-SOP), T-SOP is a traceability operating guideline that supports checklists, compliance criteria and special market protocols issued by DAFF (NDA, 2007:1). This document takes account of mandatory requirements for traceability and related information specified in relevant South African directives, export standards and phytosanitary agreements, Codex Alimentations principles and guidelines and support checklists and protocol documents. However, the system has not been fully implemented to date (NDA, 2007:3).

Increasing demand from importing countries to guarantee food safety resulted in the publishing of the Standards regarding food hygiene and food safety of agricultural products of plant origin intended for export (Notice No. R707 of 13 May 2005). This standard resides under the Agricultural Products Standards Act, 1990 (Act 119, 1990). Different countries use various organizations for example:

- Department of Agriculture, Forestry and Fisheries in South Africa use the APS Act 119 of 1990.
- Federal Government of the USA use the 2007 Grain standards Act of the USA.
- Australian Department of Agriculture use the 2010 Imports and Exports Act of Australia.
- In the European Nations they use Standards laid down by the Codex Alimentarius for food hygiene of 1985.

Due to worldwide recognisance of standardised systems and processes pertaining to food safety, there is a need to standardise the South African export processes, and to integrate it to the requirements of the consumer needs worldwide. In recently years, there is a common sense that technology plays a minor role in food processes and the human factor is to blame for bad exporting practises. Although many organizations have food safety systems in place for maize export, however, are these systems being implemented effectively?

1.3 PROBLEM STATEMENT

Based on the research background, the maize export market in South Africa pertaining to maize handling, quality and traceability are not being followed appropriately, Act, 1990 (Act 119, 1990). In this regard, the statement of the research problem is read as: “Lack of safety concern and inadequate quality management in the logistical process for maize export result in unsafe and poor quality of maize product”.

1.4 THE RESEARCH PROCESS

According to Badenhorst (2008:51), the fundamental stages in the research process to all scientific based investigation are listed below:

- 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 – A culmination and a beginning, a thread carried through the entire project.
- Write up the dissertation.

Collis and Hussey (2003:16) also indicated that the following six fundamental stages in the research process, namely:

- 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.

Based on the above, the following research process was implemented in this study:

- Identify a research topic regarding a quality problem experienced in maize export processes.
- Building up a theoretical framework regarding quality, risk-management and tools of improving maize export processes.
- Formalising the research question.
- Define research design and methodology.
- Collect evidence and analyse data.
- Develop conclusions.

1.5 RESEARCH QUESTION AND OBJECTIVES

Due to the fact that the logistical management of maize is seldom measured and monitored, the quality thereof is seen by role-players in the industry as just another export hurdle to overcome. The primary research objectives for the aim of this research are to:

- Identify the roles and responsibilities of role-players.
- Identify whether maize producers follow food safety systems in their production processes.
- Identify the key factors that affect the quality and safety of maize product in the logistical process for maize export.
- Identify the universal logistical supply chain management processes.
- Determine an effective approach that can be used to improve the maize export processes.

In order to deal with the research problem, the primary research question to be researched within the ambit of this report is read as: “How to maintain the quality and safety of maize product through logistical management, food safety management and traceability in the maize export processes in South Africa”

Based on the primary research question, the following investigative questions of this research are formulated:

- What are the roles and responsibilities of role-players?
- Do maize producers know that they must follow food safety systems in their production processes?
- What are the key factors that affect the quality and safety of maize product in the logistical process for maize export?
- What are the universal logistical supply chain management processes?
- Which approach can be used to improve the maize export processes?

1.6 ETHICAL CONSIDERATIONS

According to Leedy and Ormrod (2010: 101), ethics mean:

- Protection from harm: In cases where the nature of a study involves creating a small amount of psychological discomfort, participants should know about it ahead of time, and any necessary debriefing or counselling should follow immediately after their participation.
- Informed consent: Participants should in advance be told about the nature of the study to be conducted, and be given the choice of either participating or not participating. Furthermore, they should be given the right to withdraw from the study at any time, as participation in a study should be strictly voluntary. It is suggested that an informed consent form that describes the nature of research as well as the nature of the required participation be presented to participants in a research study.

Leedy and Ormrod (2010:101-102) further indicated that such a form of consent should contain the following information:

- A brief description of the nature of the study.
- A description of what participation will involve in terms of activities and duration.
- A statement indicating that participation is voluntary and can be terminated at any time without penalty.
- A list of potential risk and/or discomfort that participants may encounter.
- The guarantee that all responses will remain confidential and anonymous.
- The researcher's name, plus information about how the researcher can be contacted.
- An individual or office that participants can contact, should they have questions or concerns about the study.
- An offer to provide detailed information about the study (e.g. a summary of findings) due date for its completion.
- A place for participants to sign and date the consent form, indicating agreement to participate.
- Right to privacy: Any research study should respect participants' right to privacy. In general, a researcher must keep the nature and quality of participants' performance strictly confidential.

- Honesty with professional colleagues: Researchers must report their findings in a complete and honest fashion, without misrepresenting what they have done or intentionally misleading others as to the nature of their findings. Under no circumstances should a researcher fabricate data to support a particular conclusion, no matter how seemingly 'noble' that conclusion may be.

Collis and Hussey (2003:38-39), expand on the above and add 'confidentiality/anonymity', 'dignity' and 'publications to the list.

- Confidentiality/anonymity: It is good research practice to offer confidentiality or anonymity to participants in a research project. This would encourage them to give more open and honest responses.
- Dignity: In research, it would not be ethical to embarrass or ridicule participants.
- Publications: The success of a research student is achieved through the acceptance of the thesis or dissertation. More often than not, research and research findings are falsified in order to achieve publication success. While this is highly unethical, it is also unethical to exaggerate or omit results in order to present research in a more favourable light. A more complex situation arises when a publication casts a bad light on an individual, group or organisation.

Collis and Hussey (2003:39), provided the following checklist to ensure that research is conducted in an ethical manner:

- Will the research process harm participants or those about whom information is gathered (indirect participants)?
- Are the findings of the research likely to cause harm to others not involved in the research?
- Is accepted research practice violated in conducting the research, the data analysis, and drawing conclusions?
- Is community standards of conduct violated? (Collis et al, 2003:39)?

Badenhorst (2008:189) stated that: The data ethics and integrity means respect for the respondents, their response should be valued and the researcher should act with honesty and integrity.

This study has adopted the above principles and prepared a consent letter (Appendix A) between the researcher and the management of PPECB for data collection. The researcher also made sure that the data were presented by not concealing any evidence, or falsify data. The process of data collection was informed in advance and with consent. All the responses were fairly and accurately saved and entered appropriately. In order to protect all role players from possible repercussions, their names and identities were kept strictly confidential and anonymity. There were no adjustments made from the conclusions and no evidences were misrepresented. In addition, this research focuses on the 'right of privacy'. All the participants were allowed to continue or withdraw their participation at any time.

1.7 THE RESEARCH ASSUMPTIONS AND CONSTRAINS

1.7.1 Research assumptions

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

- There is a lack of concern in the export of maize regarding risk management and traceability.
- The role-players, who were responded to the study, would be able to provide correct, complete and timely information.
- It is assumed that all the role-players have the basic understanding on quality of maize product regulations, food safety systems and risks of non-conformance in maize export process.

1.7.2 Research constraints

Constraints identify limitations of research weaknesses, and identify the areas that cannot be in the research scope (Badenhorst, 2008:149). In this research, limitations related to all the role players in the maize chain from production until consumption that identified are enemies, and some are allied to the problems with maize for the export market. This research was concentrated mainly on emails and questionnaires from farmers and role players from the northern parts of South Africa. This study listed the following criteria as constrains in this research that:

- The export companies being investigated has a large staff compliment situated at various locations in South Africa. It is for this reason, that the assessments will only involve staff from nominated export companies and will not include any design function.
- As Natal, Gauteng, Limpopo, Free State and Mpumalanga provinces are the main provinces that have regular maize export in South Africa. Hence, this research is restricted to the maize export companies in these provinces.
- Due to lack of information from previous studies within the maize export industry in South African perspective, the researcher only looks into the common aspects of logistical process and following the various Acts and regulations for maize export to determine the conformance / non-conformance of role-players.

1.8 CONTRIBUTION OF THE RESEARCH

PPECB is mandated by the DOA to ensure compliance with the food safety standard by conducting food safety audits on all registered FBO's. This study contributes the following significance to the maize export industry of South Africa:

- Provides valuable guidelines to PPECB management to consolidate and improve the existing policy for maize export in South Africa.
- Enhancing the credibility of the South African Export Certificate.
- Supporting the export competitiveness of the South African perishable products industries.

- Strengthening PPECB's capacity as a credible source of strategic information for serving industries and stakeholders.
- Supporting government in ensuring confidence in the quality assurance and food safety systems for local perishable product markets.
- Supporting government in building systems to ensure compliance to South African quality and food safety standards for exported perishable products, from farm to export harbour.

In essence, this study also contributes to the existing body of knowledge by delivering a generic and workable framework, which will address the specific governance requirements of FBOs in the maize export processes and make all role-players aware of their responsibilities pertaining to food safety and traceability.

1.9 OVERVIEW OF THE THESIS STRUCTURE

This thesis 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 has been defined:

Chapter 1: Orientation of the study

This chapter presents the structure of the thesis. It includes the scope of the research environment and the significance of the topic to be conducted within the ambit of this thesis. Finally, it describes the research questions, aims and objectives as well as how the research was delineated.

Chapter 2: Holistic perspective of the research environment

In this chapter the details will be provided of the creation of a risk process by maize export companies and the various impacts it has. The key areas, namely logistical chain management food safety and HACCP for export maize will be elaborated further. This leads to a conceptual framework at the end of the chapter, which will guide the process of the research.

Chapter 3: Literature review

This chapter describes the literature review that will be conducted on risk-management and traceability of maize in order to gain a better understanding of the research field and establish a suitable theoretical framework. This is done against the background of other possible methodologies that were discussed from other literature findings.

Chapter 4: Research design and methodology

In this chapter, the research design and methodology will be discussed in detail. The outcomes of other possible methodologies and data collection methods will also be discussed.

Chapter 5: Results and discussion

This chapter provided detailed results through a comprehensive data analysis. Based these results, the discussion of all the key variables were carried out. These will lead to answer the research questions raised earlier, in relation to the findings to the conceptual framework which will also be discussed.

Chapter 6: Conclusion and recommendations

In this chapter, the conclusion will be made based on the research findings. Recommendation and further areas of possible future research will be identified and highlighted.

1.10 CONCLUSION

This chapter has provided an overall structure of the thesis. It leads a distinct direction to the study to be conducted, in order to build up a solid understanding of the logistical process for maize export. The steps and methods to be followed to achieve the objectives of this study are briefly described above. The next chapter will provide a holistic overview of the maize export processes worldwide and in particular in the South African context.

CHAPTER 2: OVERVIEW OF MAIZE PRODUCTION AND EXPORT ENVIRONMENT

2.1 INTRODUCTION

This chapter firstly presented a holistic overview of maize export worldwide. It includes some countries (e.g. United Kingdom, United States, New Zealand, and South Africa) and international organisations (e.g. European Commission, Food Agricultural Organization and the World Health Organization) that deal with the policies for food safety and traceability, and the general development of the supply chain management (SCM) in the South African context. It provided an overview of exports of maize from different areas and how it could impact on the country's economy. It also consists of maize export contribution to country's food safety legislations and secondly, the main problems facing South African was discussed. Thirdly, the key factors such as lack of food safety concerns expressed by some role players in the export of maize and knowledge of food safety processes, and poor general performance pertaining to maize exports, was established This chapter provides an assessment of the application of the holistic and practical underpinning to the research environment. Finally, a conclusion of whole chapter was carried out.

2.2 MAIZE SECTOR POLICIES IN COUNTRIES WORLDWIDE

2.2.1 WHO/FAO: Food Safety Concern

According to Codex Alimentarius (2012), the Codex Alimentarius Commission (CAC) was established in 1963 by two organizations from United Nations, the Food Agricultural Organization (FAO) and the World Health Organization (WHO). Both organizations seek to protect the health of consumers and the implementation of fair practices. According to the WHO/FAO (2009), the WHO Global Environment Monitoring System (GEMS/Food) informs the CAC and governments on levels, trends and significance of chemical contaminants in

food. WHO also expands the scope of GEMS/Food to include food borne pathogens and other food contaminants of concern. WHO Global Salm-Surv (WHO GSS) promotes integrated, laboratory-based surveillance and fosters inter-sectoral collaboration and communication among microbiologists and epidemiologists in human health, veterinary, and food-related disciplines (WHO/FAO, 2009:2). This indicates that a global strategy for the surveillance of food borne illnesses has been linked to the incorrect food handling, and thus caused by human error at some point in the food chain. Knowledge, education, and training do not ensure safe food handling practises, although training can play a big part to eliminate the contamination of food. The main problem shows that the lack of technical and financial expertise to follow food safety practises, and addressing these motivating factors is essential to assure the safety of foods.

WHO/FAO (2009:2) further stated that the following food safety issues that need to be addressed to reduce the risk of food borne diseases:

- Microbiological hazards like mycotoxins and aflatoxin in maize, for the food borne diseases it cause.
- Chemical hazards which does cause a lot of food borne diseases because of the chemical contaminants the environmental contaminants like lead and mercury in maize and other food.
- Building capacity with food safety especially in developing countries, where the negative and positive experiences can be used for improving food safety systems globally.

According to the FAO/WHO Food standards program (2000:3-10), the general principles of food import and export standards for food hygiene are to:

- Identify the essential principles of food hygiene applicable throughout the food chain (including primary production till the final consumer), to achieve the goal to ensure that food is safe and suitable for human consumption.
- Recommend HACCP-based approaches are a means to enhance food safety. The HACCP system will provide assurance that food is suitable for

human consumption and maintain confidence in internationally traded food; and

- Provide health education programmes which will effectively communicate the principles of food hygiene to the industry and the consumers.
- Provide food which is safe and suitable for consumption.
- Ensure that consumers have clear and easily understood information, by way of labelling and other appropriate means, to enable them to protect their food from contamination and growth/survival of food borne pathogens by storing, handling and preparing it correctly.
- Maintain confidence in internationally traded food. Consumers should recognize their role by following relevant instructions and applying appropriate food hygiene measures.
- Indicate how to implement those principles.
- Provide guidance for specific codes which may be needed for - sectors of the food chain, processes or commodities, to amplify the hygiene requirements specific to those areas (FAO/WHO food standards program, 2000: 3-10).

2.2.2 The European Commission (EC): Food Safety Regulations

According to the European Parliament and the Council of the European Union, Regulation (European Commission, No 852/2004) of the European Parliament and of the Council of 29 April 2004 on the hygiene of foodstuffs, the following regulations are in particular for food safety (EU, 2004):

- To public health, these rules and procedures contain common principles, in relation to the manufacturers 'and competent authorities' responsibilities, structural, operational and hygiene requirements for establishments, procedures for the approval of establishments, requirements for storage and transport and health marks.

- Food hazards should be identified and adequately controlled during the initial stages such as production and exporting process, this will ensure the achievement of the objectives of this Regulation. However, in the case of the direct supply of small quantities of primary products, by the food business operator producing them, to the final consumer or to a

local retail establishment, it is appropriate to protect public health through national law, in particular because of the close relationship between the producer and the consumer.

- The application of hazard analysis and critical control point (HACCP) principles to primary production is not yet generally feasible. However, guides to good practice should encourage the use of appropriate hygiene practices at farm level, where necessary, specific hygiene rules for primary production should supplement these guides. It is appropriate for the hygiene requirements applicable to primary production and associated operations to differ from those for other operations.

- Food safety is a result of several factors: Legislation should lay down minimum hygiene requirements; official controls should be in place to check food business operators; compliance and food business operators should establish and operate food safety programmes and; procedures based on the HACCP principles (EU, 2004).

According to the EC Regulation No. 178/2002 of the European Parliament and the Council, the commission laid down procedures in food safety laws at their meeting on 28 January 2002 (EU, 2002). The following food safety issues regarding the risk of food borne diseases are:

- A high level of protection of human life and health can only be assured if there is an adequate procedure for food safety processes in member countries for the import and export processes of food and foodstuffs.
- Water for production of food was identified as a serious risk because it is ingested directly or indirectly, thereby contributing to the exposure of the consumer to ingested substances which affect the food safety of the product.
- Measures must be adopted to ensure food safety in all the stages from production to consumption. Each component of the value chain can cause serious impacts on food safety.

- Relevant risks must also be based on whether it is society, traditional, economical, ethical and environmental factors influencing food safety.
- Food safety laws must be able to install confidence and safety internationally and nationally to all the consumers. It must support free trade in the safe feed and safe wholesome food in a non-discriminatory manner.
- All the imports and exports of food must meet the minimum safety processes of the importing country.
- Food or feed businesses must be able to identify the food in all stages from production to consumption. It must be traceable if an investigation would follow when not complying with food safety standards (EU, 2002:1).

2.2.3 Food Safety Management Systems: Finnish Food Authority

The Finnish Food Safety Authority stated that their drive is to secure risk-based food safety management systems and control of all food. The safety procedures that they follow are (EU, 2002:18-20):

- All consumed food must have a basis for a risk-based food safety management system to achieve an appropriate level of protection (ALOP) to human or animal health.
- On the plant level all food must be regulated through quality assurance systems and a hazard analysis and critical control point (HACCP) programme.
- All consumed food must have a quantitative microbiological risk assessment (QMRA) done, in order to test the specific risk along the food chain to be established.

Beside the above food safety issues, concerns, there were certain countries in the worldwide also have different approaches to food safety and traceability.

2.2.4 Food Safety Standards in United Kingdom

According to Shears et al. (2004:336), increased media attention to food safety issues, consumer studies and the establishment of new regulatory bodies such

as the European Food Safety Authority and the national food safety agencies, demonstrate that food safety has emerged as and continues to be an important issues in society in the United Kingdom. Due to this heightened attention to food safety, consumer perceptions may be negatively influenced or unnecessarily raise their concerns (de Jonge et al., 2004:839). Thus, Shears *et al.* (2004:336) insisted that building and maintaining consumer confidence is the job of the politicians, their decisions however should be based on scientific applications, but the scientists should at all times to be independent of politics. Indeed, scientific results and recommendations must be public, open, transparent and trustworthy.

In the European Union (EU), the countries work according to the Codex Alimentarius Food standards programs (EU, 2004:1).This system helps with the facilitation of all imports and exports. It is very strict on food safety as it is believed that foods can become contaminated at any link of the food chain, from production to service. The majority of food borne illnesses have been linked to foods incorrect handling, and thus caused by human error at some point in the food chain. Knowledge, education, and training do not ensure safe food handling practises, although training can play a big part to eliminate the contamination of food. According to EU (2004), the major problem reflected that the motivation of employees to follow food safety practises, and addressing these motivating factors is essential to assure the safety of foods. In order to eliminate this risk there needs to be official inspection and certification systems which are fundamentally important and very widely used to control the unsafe handling of products for export or import (EU, 2004). This will help to create confidence in consumers in the quality (including safety) of their food supply. This inspection may include every process from harvesting, processing, storage, transport, and other handling of products. This will be the most appropriate means of ensuring food safety till consumption.

2.2.5 Food Safety of Grain Export in United States

According to Yee, Yeung and Morris, (2005:841), the U.S. Food and Drug Administration (FDA) and U.S. Department of Agriculture (USDA), both federal

agencies charged with ensuring the safety of the food supply, it is an important issue facing consumers, the food industry and the governments. Yee *et al.* (2005:841) further indicated that due to the fact that most consumers are not able to determine food safety risks, their perception of food safety is in part of matter of trust in the food chain. According to de Jonge *et al*. (2004:837), it is assumed that public trust in the food industry, government and public policy is on the decline and that most consumers are extremely worried about the safety of the food they eat.

According to De Waal and Plunkett (2009), the food safety system in America is ‘broken' and due to this fact. Many Americans are hospitalized and fewer may die from preventable food borne illnesses. Furthermore even foods regulated by the Food and Drug Administration (FDA) have caused a number of recent national outbreaks and recalls resulting in the consumer confidence in the safety of their food supply. Sometimes outbreaks have adversely impacted upon (De Waal & Plunkett, 2009). In addition, they also indicate that it is the responsibility of the American Congress to act timely in order to create a solid food safety system, with adequate resources and authority to meet the demands of a modem and globalized food system. More importantly to restore the public's confidence before another outbreak occurs.

It classifies an effective preventive food safety strategy or system to work, it needs the following attributes. A protective food safety system should be:

- systematic (i.e., from farm to table);
- risk-based (i.e., with set priorities and established risk management practices);
- Transparent and participatory; cost-effective; and
- Minimally disruptive of trade (which is an obligation of all countries regardless, as per the SPS Agreement).

2.2.6 Legislation of Maize Import/Export in New Zealand

According to MAF Biosecurity New Zealand (2011), the New Zealand Ministry of Agriculture and Fisheries (MAF), have health standard import requirements for the importation of grains/seeds for consumption, feed or processing There are

three import requirements for maize, and all three will be inspected on arrival for regulated insect pests and seeds:

- It must be heat treated to sterilize any pests or seeds it may contain that can enter the country. It must have a phytosanitary certificate issued by the National Plant Protection institute (NPPO). The certificate must stipulate that the maize has been heat treated and the consignment contains no viable plant seeds.
- It may only enter the country at MAF approved transitional facilities by organizations operating MAF-approved grain importation systems. The Phytosanitary certificate must certify that the maize was inspected according to appropriate official procedures, and examined for regulated weed seeds as per specified by MAF schedules of regulated weed seeds. The weed seeds are specified in the grain for processing; import system requirements. This importation requires that the maize must be free from regulated pests, and has undergone pest control activities like fumigation that are effective against pests in accordance with MAF approved methods. It also stipulates that the maize that was imported must be sourced from a “pest free area” or “pest free” place of production. The MAF must also be satisfied that the pre-shipment activities have been undertaken, and that the exporting country National Plant protection Agency (NPPO) must confirm this by providing the following additional requirements on the phytosanitary certificate. For example, a bio-security certificate, this means that the Ministry of Agriculture and Forestry is charged with leadership of the New Zealand biosecurity system. This encompasses facilitating international trade, protecting the health of New Zealanders and ensuring the welfare of the environment, flora and fauna, marine life and Maori resources. Maize may also only be imported by MAF approved importing organizations; these organizations may also apply to store or process the maize.

- Maize may enter New Zealand for heat treatment on arrival, as specified by MAF documents. This treatment may only be carried out in a MAF approved transitional facility and treatment operator or under MAF supervision.

New Zealand MAF reserves the right to validate all phytosanitary measures, testing methods used to meet MAF import requirements. Consignments must be held in such a manner as to avoid contamination or re-infestation with regulated pests after treatment or inspection, all tests will be for the account of the importing organization (MAF Biosecurity New Zealand, 2011).

2.3 BACKGROUND OF THE MAIZE EXPORT IN AFRICA

2.3.1 Overview of Maize Production in Africa

The potential for expanding maize production in Sub-Saharan Africa is huge.
In South Africa, about 1.3 million smallholdings use about 14 percent of the farmland surface (NDA, 2011). They are mostly subsistence oriented, with low production levels due to traditional land tenure, lack of physical infrastructure and credit facilities, poor access to input markets and a high level of urban migration (Perret et al., 2005:18).

Even after excluding protected and forested areas, an estimated 88 M ha of land that is not yet planted to maize is suited to the crop. Worldwide, this amount is equivalent to four times the area now planted to maize and over half of the additional land area that is suitable for maize (Deininger & Byerlee, 2011). By far the largest proportion of this area is found in Sudan. Other areas with considerable potential for expansion are in Eastern and Southern Africa, including Mozambique, Angola, Zambia, Madagascar and Tanzania.

Beside the areas of production, maize price has been fluctuated over the last decades. According to OECD/FAO (2010:57), Figure 2.1 showed the price volatility from 1957 to 2009. Although the periods of high price volatility are not new to agriculture, but there are fears that price volatility may be increasing. The figure shows the coefficient of variation of prices after the predictable component has been removed from the observed values (OECD/FAO, 2010:57). Values close to zero indicate low volatility, higher values denote greater volatility.

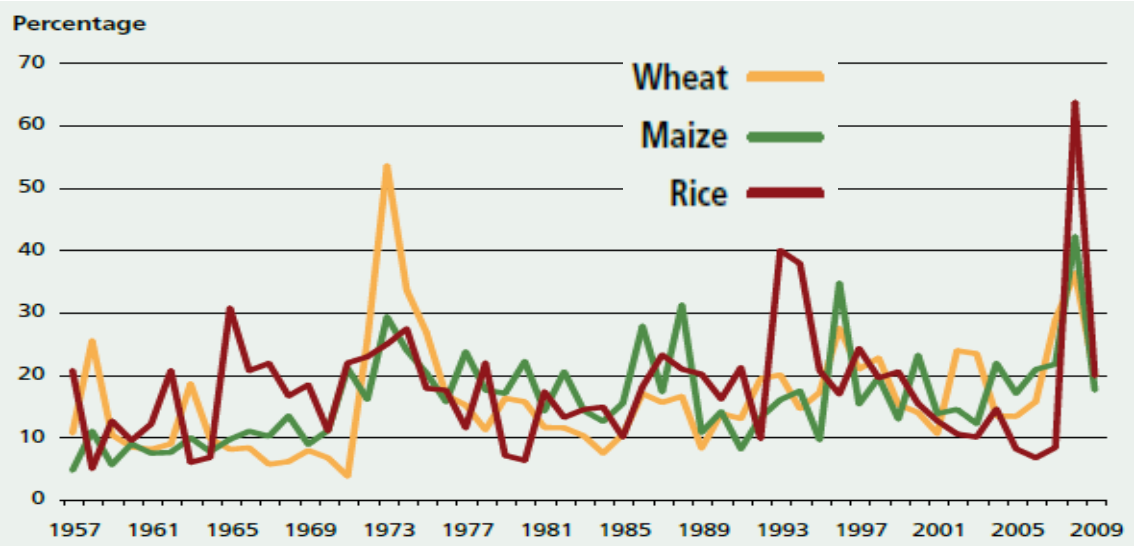


Figure 2.1: Historic annualised volatility of international grain prices
(Source: OECD/FAO, 2010: 78)

Maize remains the most important food crop in Sub-Saharan Africa, Latin America and a key feed crop in Asia. According to Smale et al. (2011:3), from 2005 to 2008, maize represented an average of 27 per cent of cereal area, 34 per cent of cereal production and 8 per cent of the value of all primary crop production. This includes estimated area and production of green maize, which is highly valued as the harvest approaches at the end of the —hungry season. From 1961-2008, maize dropped slightly as a share of total area in primary crops, but not as a share of area of production of cereals, which has fluctuated between 32 and 45 percent over that time period.

2.3.2 Maize Export Industry in South Africa

In South Africa, maize is the cornerstone to both food security and feed for livestock population. It is the most important grain crop in South Africa, very commonly grown by smallholders (NDA, 2009:15). According to Nel and Steyn (2002), maize is the major staple food for most South Africans, with up to 95 per cent of rural and 80 per cent of urban consumers consuming it on a regular basis. The maize industry parallels the South African agricultural sector's duality, with a commercial sector mainly based on centralised procurement systems developed at national level and a small informal subsistence-oriented

sector where local small millers operate at a very local level (Biénabe & Vermeulen, 2011:494). Maize represents about 66 per cent of the daily energy intake of very poor nutritionally vulnerable consumers (Oldewage-Theron et al., 2005:23); and expenditure for maize meal accounts for up to 20 per cent of low income consumers' monthly income (Watkinson & Makgetla, 2002:3).

However, notwithstanding bumper crops and increasing yield levels maize production remains at the mercy of high international stock levels and low commodity prices, both internationally and in South Africa. Ever increasing input costs further impacts negatively on the competitiveness of the crop. One of the few solutions to a competitive maize industry is to increase agricultural productivity through the dedicated application of new technology and the realisation of the genetic yield potential of all cultivated cultivars in commercial production.

According to Grant et al. (2012:7), as South Africa is the largest producer of maize in Africa with the most developed market, the South African value chain information may serve as a benchmark for other countries in the Southern African Development Community (SADC). Maize remains crucial for food security in Southern Africa, accounting for an average of 36% of all caloric intakes in the region. The predominance of the crop in farming systems and diets implies that yield gains have the potential to jump-start a significant improvement in nutrition which can be compared to those experienced in Asia for rice and wheat. In South Africa, maize is produced mainly in North West province, the Free State, the Mpumalanga Highveld and the KwaZulu-Natal Midlands.

According to EU (2010), despite declining maize prices during 2009, maize producers increased white maize plantings by 15% and yellow maize plantings by 9% in 2010 to reach a total area planted of 2.72 million hectares. This increase in the area planted in 2010 was driven by the generally strong cash flow position of farmers due to good profits in the previous two years. Another contributing factor was the significant decline in fertilizer prices towards the end of 2009. The most recent estimates pegged the 2010 maize crop at 13.3 million

tons, which is the second largest crop in the history of maize production in South Africa. This is also the third consecutive year in which supply will exceed domestic demand, which will boost the carry out stock levels.

The grain industry is one of the largest in South Africa, producing between 25% and 33% of the country's total gross agricultural production. The largest area of farmland is planted with maize, followed by wheat and, to a lesser extent, sugarcane and sunflowers. According to BFAP (Bureau for Food and Agricultural Policy) (2012), although South Africa's export market for white maize to neighbouring countries has diminished considerably over the past two seasons due to maize surpluses produced in a number of countries in Africa, the sustainability of surplus production in southern Africa remains uncertain as government policies play a decisive role in providing incentives to small- and large-scale producers, and there are doubts about the fiscal sustainability of such support. Furthermore, SA has successfully exported large volumes of white maize to premium markets in Mexico and more recently Venezuela and possible China (BFAP, 2012). In 2013, SA will reach its highest area under production of field crops since 2004 by expanding production by almost 300 000 ha on the back of increases in commodity prices that are expected to exceed the increase in input costs by a significant margin in the 2012/13 season (BFAP, 2012).

Figure 2.2 below showed that the disaggregated percentage share of total cereal export values from the Department of Trade and Industry (DTI). When disaggregated, the maize subsector, between 2007 and 2009 contributed approximately 83 per cent to the total value of cereal exports, where wheat and meslin count 14 per cent, and rice was only 3 per cent.

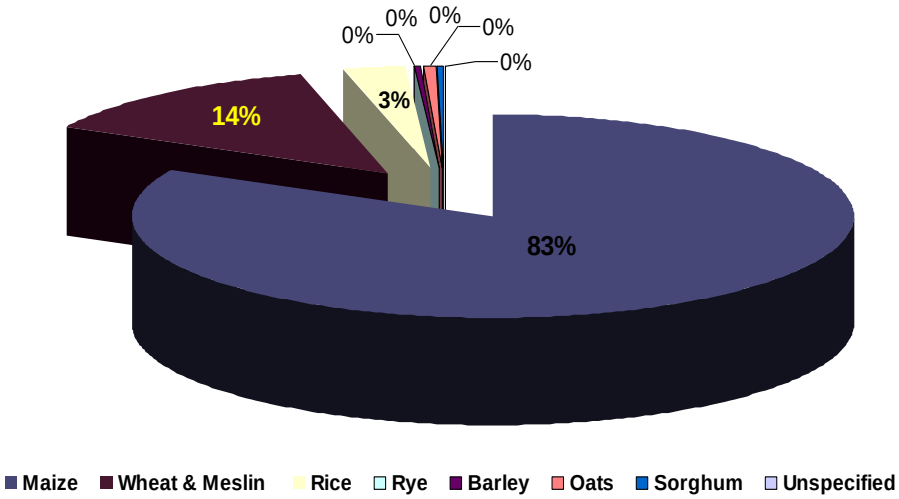


Figure 2.2: Maize grain contribution to total cereal export values: 2007-2009
(Source: Department of Trade and Industry, http://www.thedti.gov.za)

2.3.3 The Role of FBO and the Function of PPECB

According to APS Act No. 119 of 1990, Food Business Operator (FBO), is the person(s) that is responsible for insuring that prescribed requirements of export standards are met within the food business under his/her control and include both the management of the food business as well as the person with overall authority on site or in a specific establishment, primary production and on farm facilities, off-farm depots and silo's (Act No. 119 of 1990). According to Act No. 119 of 1990, FBO's need to register their businesses to comply with South African legislation in order, this enables maize products can become fully traceable and that food safety regulations are adhered too, to achieve high perception value of exported products.

Table 2.1 below include the person or persons that is responsible for insuring that prescribed requirements of export standards are met within the food business under his/her control and include both the management of the food business as well as the person with overall authority on site or in a specific establishment, primary production and on farm facilities, off-farm depots and silos (NDA, 2007:16).

Table 2.1: The roles and responsibilities of role-players pertaining to FBO codes

NO.	Key Business Process	Key Performance Measure	Objectives	Input	Output	Resp.	Doc Req.
1.	**Allocation process**						
1.1	All new FBO's must register with the DoA	Exporting producers identified during export certification	100% of all exporting FBO's to register.	FBO allocation	Allocated FBO's	FBO	FBO application form
1.2	Completing of the application form and supply of supporting documentation	No of returned applications to the FBO	100% accurately completed applications		No delays in the allocation process	FBO	FBO application form
1.3	Processing new application for FBO codes within 10 working days from receipt of information	Processing time: Once per fortnight	All applications processed within measure		Uniquely allocated code communicated to the applicant	DoA: FSQA	FBO application form
1.4	Verification of the application detail	No wrongly allocated codes	No duplication of codes & no allocation errors		Accurate database	DoA	n/a
1.5	Update of the FBO database with new allocations	5 working days	All applications updated within the 5 working days		Updated database to be used by FBO's & assignee	DoA	n/a
1.6	Verification of FBO detail on site	Verification of FBO detail whilst conducting food safety audits	All accurate information on database	FBO Database	Accurate database	PPECB, APIS	n/a
1.7	Copy of all new applications to PPECB	100% updates according to the DoA FBO database have been received	All applications and updates copied to PPECB	FBO allocations and updates	All updates received by PPECB	DoA: FSQA	Completed & approved new applications received

NO.	Key Business Process	Key Performance Measure	Objectives	Input	Output	Resp.	Doc Req.
2.	**Update and maintenance of FBO database**						
2.1	Call for mandatory yearly updates of all FBO information	All FBO's to update or confirm their information within the indicated time slot	100% updated information	Update of FBO information	Accurate database	DoA	n/a
2.2	FBO's that have not updated information will be made in-active on the database	Unauthorised FBO's isolated with the Export certification process	100% updated information	Updates re-ceived from the manda-tory updates	Updated FBO database	DoA	n/a
2.3	Verification of FBO detail on site	Verification of FBO detail whilst conducting food safety audits	100% accurate information on database	FBO Database	Accurate database	PPECB, APIS	n/a
3.	**Use of FBO Codes**						
3.1	All outer containers of produce destined for export must comply with the product standards and requirements	PPECB EPI and inland rejections	100% Compliance	FBO Database	Traceable containers/products	FBO / PPECB / DoA	Product stan-dards and re-quirements. Non com-pliance FBO's

(Source: NDA, 2009).

PPECB (Perishable products export control board), the assignee of DoA, the company operate under two laws: the Agricultural Products Standards Act, 1990 (Act No. 119 of 1990) and the Perishable Products Export Control Act, 1983 (Act No. 9 of 1983). In terms of the former act serves to assure trading partners of perishable produce regarding the quality of South African perishable produce, while the latter seeks to safeguard the cold chain for South African perishable products (PPECB, 2011:7).

According to de Beer, Paterson and Olivier (2010:123), the emphasis in perishable exports (maize) has shifted over the years as production volumes and varieties increased, technology improved and markets changed. One of the most important environmental changes in South Africa impacting on maize exports was the deregulation of the marketing environment in 1997. Deregulation was the single most important event in recent years to create a shift in responding to market demands, as we know it today. Never will the exports of grain produce from South Africa again be controlled from the production side - market conditions and consumer preferences have now become the dominant driving forces behind the grain trade. The new millennium challenges will differ significantly from the past.

Although the South African economy in global terms is relatively small, the role that the perishable products play in the markets of the world is significant and growing. World food markets and consumers today require compliance to very high standards of quality, reliability and consistency in supply, and above all, food safety assurances. Human health, combined with animal and plant health as well as social and economic requirements by everyone involved in the process from "farm to port" are criteria that will drive the actions and behaviour of role players in the supply chain of grain produce in future. This will not only be required for food products, but will impact on every process, all equipment and every human involvement in the food supply process.

The future challenges in food supply will therefore require that role players and service providers like the PPECB must be able to prove that they are internationally credible, can offer services of high professional standards over

the total supply chain and understand and respond effectively to the very dynamic and competitive market conditions which will prevail. This will require business partnerships with customers and suppliers, based on sustainable relationships to develop integrated business solutions that will create value and ensure long-term growth and profitability. Ultimately, all South Africans need to contribute to the development of trade at global level, to the benefit of South Africa and its people.

Figure 2.3: Hazardous maize transporter at Durban port

In summary, this incident in Figure 2.3 indicates that if there was proper control of all stages from production to consumption. The removal of the toxic waste sticker indicates that the driver knew he was in the wrong, as his bulk carrier can only transport general cargo and not maize for human consumption. The legislation is in place, but is not being implemented by the maize export industry. If the importer found any radiation in the cargo, then the ship with all its cargo would be rejected, and dumped into the sea. This can result in being banned from export of maize again to anywhere in the world because food safety is such an important matter worldwide.

Role players described below in Figure 2.4 must believe they have the capacity, the will and the drive to become part of a new solution to international trade in food supply, and that companies like PPECB will play a significant role in the years to come. 180 years of exports by PPECB (de Beer et al., 2010:123). The function of the role-players in South Africa is as follows:

- Department of Agriculture: Promulgating of the Act, Regulations and standards and requirements, the department also negotiates between countries and governments and does the phytosanitary requirements of the importing country
- PPECB is the assignee of the Department of Agriculture
- Producers do the crop estimations and the crop delivery at the port
- Grain forum does the revision of the grading regulations and requirements
- Exporters do the planning, booking and reporting of the export process.

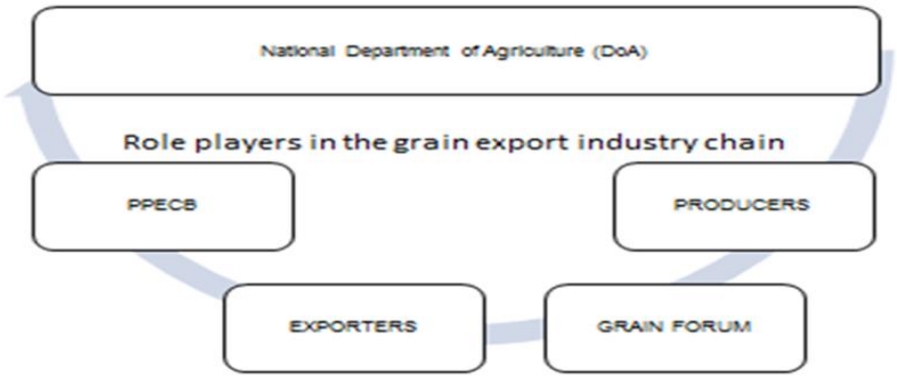


Figure 2.4: Diagram indicates the role-players in the maize export process

South African quality, quality perfection, quality standards of the APS Act (Agricultural Products Standards), are maintained quality as per PPECB Act, MRL regulations (Maximum Residual Levels), food safety requirements, export markets insist on Quality Management System (QMS), to have market access to all foreign countries. Why and how do this risks pertaining to food safety occur? This is not a new question but should always be considered by all the export role players. Conformance to the various food safety standards is held in

high regard by some role players and is one of the key performance areas of some businesses. In a broad perspective, many businesses can fail due to lack of finance, poor management skills and improper food safety standards.
PPECB must make sure that all FBO's comply with South African minimum food safety and traceability standards

The total tons of exported maize for the 2011/2012 season was 2 442 493 ton (Senwes Grainlink, 2012). According to Figure 2.3, the white maize was exported to 12 countries such as Mexico, Botswana, Lesotho, Italy, et cetera. Particularly, Mexico (67.1%) counts the largest maize importing country in comparing to other countries.

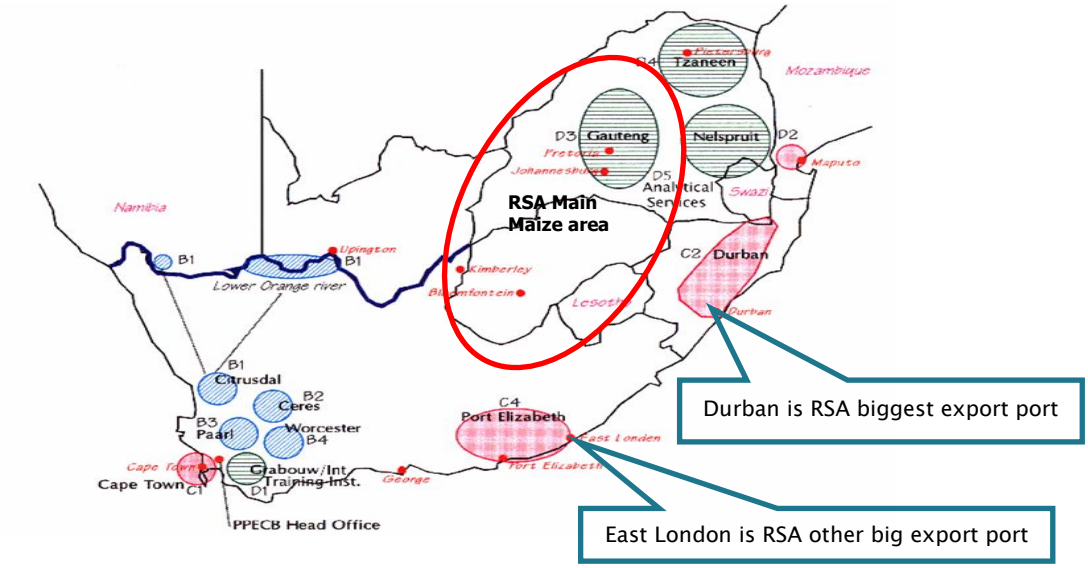


Figure 2.5: The main inspection areas and ports for maize export

(Source: PPECB export directory 2012:88).

Figure 2.5 indicates the main provinces where maize is produced, this include Free State, Gauteng and Mpumalanga. This indicate also that because of the long distances from this area to the port is transported by bulk transporters there is a risk that the maize can become contaminated by water or other grains.

The export of maize shown in Figure 2.6 below indicates that the exports of maize was 2 442 493 ton in the 2011/2012 season of which 69.55% went

through the 2 ports and 30.45% went through the border posts into African countries. The risks are not as great through the border posts as the distance from the place of production to the export border post is not so long. When it goes to the ports, the distance to Durban is more than a 1000 km and at the port it is off loaded into silos then loaded onto a vessel, and only then the voyage to the importing country takes another 3 – 6 weeks before it gets to the consumer.

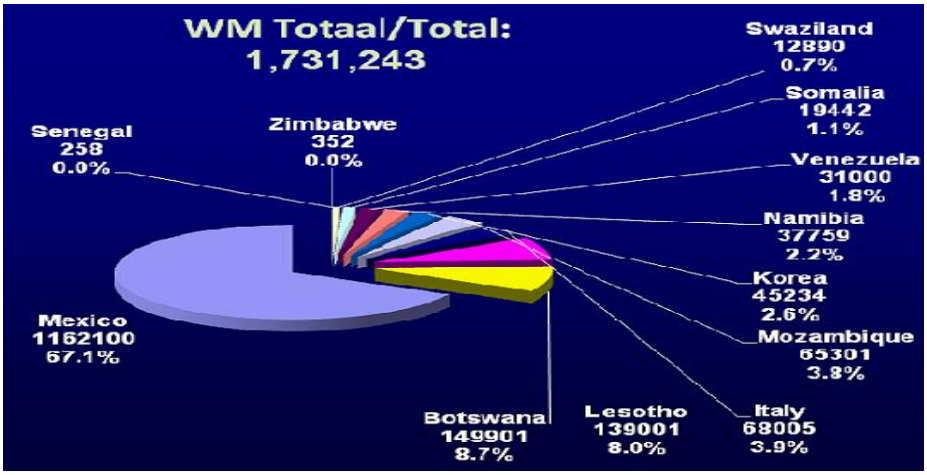


Figure 2.6: Maize exports in 2011/2012 season

(Source: Senwes Grainlink, 2012)

During the past five years, an average of 11.6 million tonnes of grain and oil seeds was exported. During the last maize export season, the grains were exported through our harbours and border posts indicated in Figure 2.7 were exported through South African border posts during the 2011/2012 season, the total was (30.45 per cent) or through South African harbours (66.55 per cent); (PPECB, 2012:89).

Figure 2.7: Maize exports in 2011/2012 through borders and harbours

(Source: PPECB export directory 2012:88).

According to Vink and Van Rooyen (2009:16-17), with the implementation of a new Agricultural Marketing Act, the marketing boards and single-channel marketing system were phased out and industry trusts established, with a significant impact on the various aspects of agricultural policy management. The maize industry plays a major role in the South African economy and sustainability of the industry is important for the economy, employment and food security. Growth and diversification of the maize industry has the potential to benefit the maize supply chain, the manufacturing sector and the South African economy. The deregulation of grain marketing in South Africa has suddenly exposed producers and other market participants to the free market environment and has consequently placed new demands on them in terms of the marketing of maize. To equip producers with the necessary skills to survive economically it is important that continuous training on grain marketing is provided. Although the price of maize is not determined by the cost of production, producers need this information in calculating their breakeven yields on soils with different yield potential.

The production of maize is a complicated process due to the wide diversity of maize cultivars, difficult conditions and areas located in South Africa. It is important that maize cultivars should be adapted to specific production conditions. The projected production costs in the various maize production areas, as well as the breakeven income at various yields that producers

should receive to cover their cost of production, are critical information in the decision-making process of producers before the next planting season. To create new markets for maize producers which can substantially expand maize production and increase the total income of the maize industry by increasing the total volume of maize at more stable prices over the long term in the interest of the whole maize industry and the enhancement of food security (Vink & Van Rooyen, 2009:16-17).

2.3.4 Food Traceability and Legislation for Maize Export

According to the APS Act, 1990 promulgated in notice Traceability Special Operational Procedure, pertaining to the operating guideline for traceability of regulated agricultural products of plant origin that are destined for export "Regulated food products of plant origin" are products that are destined for export and which are regulated under the APS Act, 1990 (APS Act 119 of 1990). Beside maize, it also includes fruit and vegetables, and specified oilseeds, grains and other processed products.

Jackson (2006:16) indicated that this legislation include examples of relevant standards would be product quality standards and the Food Hygiene and Food Safety system under the APS Act, and Standard Operating Procedures (SOPs) for maximum residue limits (MRL's) and Export Certificates. There are at least 14 legal documents governing the food safety industry in South Africa, but only three of these are concerned with law enforcement (Jackson, 2006:18).

South African legislation which is regulated under the Agricultural Product Standards Act, 1990 also referred to as the APS Act. Regarding the legislation for export, a FBO is the main legislation for export which means the person or persons responsible for ensuring that the prescribed requirements of these standards are met within the food business under his or her control and include both the management of the food business as well as the person with overall authority on site or in the specific establishment (APS Act 119 of 1990). The FBO will be accountable for third party arrangements, where responsibility for such operations is under the control of a third party food producer. The Health

Act of 1977 stated that: container" or "food container" includes anything in which or with which food is served, stored, displayed, packed, wrapped, kept or transported and with which food is in direct contact.

“Contaminate" means the effect exerted by an external agent on food so that it (Health Act, 63 of 1977):

- Does not meet a standard or requirement determined by any law;
- Does not meet acceptable food hygiene standards or consumer or standards
- If it is unfit for human consumption; and "contamination" has a corresponding meaning.

All over the world there is a policy and legislation to produce food that is wholesome and safe for human consumption. In terms of the WHO white paper on food safety (Brussels, 2000:3-6), most first world countries signed an SPS Agreement, which is the World Trade Organization (WTO) Agreement on the Application of Sanitary and Phytosanitary Measures, adopted in 1994, which allows members to take appropriate and scientifically based measures to protect public health as long as they do so in a manner that minimally disrupts trade. Recognise food safety as an essential public health function, with the goal of developing sustainable, integrated food-safety systems for the reduction of health risk along the entire food chain. The resolution also asked WHO to encourage evidence-based strategies for the control of food-borne diseases and to provide guidance in prioritizing such strategies. FAO has always given high priority to programmes and activities dealing with food quality, safety and consumer protection. WHO has also had a continuing commitment to the fundamental principle that ensuring food safety is an essential activity and an integral part of any public health.

The framework of this agreement has identified the following needs for a food safety system:

- The need for more transparent and effective communication among all stakeholders and the need for all farm-to-table stakeholders to participate in food safety management;
- The need to consider the global scope of the farm-to-table food production process; and
- The need for science-and data-based decision making when attempting to improve the safety and lower the risks of food production.
- The need to be cost-effectiveness and the obligation to minimally disrupt trading (Brussels, 2000:3-6).

Cicerone (2008) emphasized that progress can be achieved and that even very difficult food safety problems are solvable, and that there are success stories out there. As an example, he told a story about some shipments of shrimp from Southeast Asia being refused entry into the United States and European Union (EU), a number of years ago because of the detection of unacceptable levels of chloramphenicol residue. The refused entries had a devastating effect on shrimp export throughout Southeast Asia. Over the last five years, however, the Vietnamese shrimp industry has made a terrific comeback, despite initial problems in educating the thousands of low-tech and largely illiterate shrimp farmers about what they needed to do to correct the problem. Largely through technical assistance provided from several European countries, the Vietnamese government has developed a surveillance, monitoring and analytical capacity that simply did not exist at any level five years ago. Today, the United States and EU account for almost half of all Vietnamese shrimp exports (Cicerone, 2008:25).

Many countries have discovered that there is a need for a harmonization of quality factors for food products, that they want the same or a better quality than that they have in their own country when they buy on the open market. According to the Codex the general principles for food hygiene is to:

- Identify the essential principles of food hygiene applicable throughout the food chain (including primary production through to the final consumer), to achieve the goal to ensure that food is safe and suitable for human consumption.

- Recommend HACCP-based approaches a means to enhance food safety. The HACCP System will provide assurance that food is suitable for human consumption and maintain confidence in internationally traded food, and
- Provide health education programmes which will effectively communicate the principles of food hygiene to the industry and the consumers.
- Provide food which is safe and suitable for consumption.
- Ensure that consumers have clear and easily understood information, by way of labelling and other appropriate means, to enable them to protect their food from contamination and growth/survival of food borne pathogens by storing, handling and preparing it correctly.
- Maintain confidence in internationally traded food. Consumers should recognize their role by following relevant instructions and applying appropriate food hygiene measures.
- Indicate how to implement those principles.
- Provide guidance for specific codes which may be needed for - sectors of the food chain, processes or commodities, to amplify the hygiene requirements specific to those areas.

2.3.5 The South African Maize Inspection Standards

In terms of the APS Act 119 of 1990, the South African perishable product export inspection standards. This Act includes mandatory quality, hygiene and operational standards. The conditions of the maize is prescribed and enforced to all producers/exporters of maize. It is based solely on inspection, sampling and analysis of the maize as per legislation by the South African government.

In terms of the APS Act 119 of 1990 South African maize inspection standards the Export Terminals delivery, ship inspection standards, South African inspection standards, Maize is mainly transported by truck from farm/farm storage to grain elevator at the port. Harvest and transport to the port is often performed by contractors who follow the season from inland to the coast. From the elevator it is Transnet’s responsibility to transport the maize cargo onto the

ship by skip, then crane or conveyor belt. These export terminals operate on a “just in time” principle with consolidated cargo moving from inland silo elevators just prior to the ship arrival at the port. The South African grain elevators have little excess storage space, so the time from leaving the inland elevator to the port is a critical process.

According to the South African inspection standards, shipping inspection standards (APS Act, 1990:1-21), the South African regulations only make live grain insect infestation inspection mandatory for the ship. According to United States Department of Agriculture (USDA), the USA Grain Commission Act (Pitchford, 1995:3), USA grain inspection services examine every hold for residues of previous cargoes, rust scale and paint scale, unsanitary conditions such as animal/rodent excreta or decaying matter, any unknown substances, standing water, objectionable foreign odours and infestations by rodents or insects.

Fit to load certificate, which includes ship inspection procedure and ship documentation Branch (2006:389-390), indicated that a nominated company facilitates with pre-shipment inspection, regulations of the importing country, quality and quantity inspections in accordance with regulations of the importing country, national and international standards et cetera. An increasing number of shippers and various organisations, authorities and governments in countries throughout the world are now insisting on inspection of goods. This embraces their quality, the quantity of the maize being exported, the loading conditions and cargo quality conditions, and the maize is delivered free on board (FOB) (Branch, 2006:389-390). According to APS Act, (1991:1-21), pre-shipment inspection of cargo and vessel as well as the physical inspection for pricing, quantity and quality, verification of export documentation and custom clearance certificates; if the vessel or shipment of maize was rejected for whatever reason, this nominated company will assist with the re-inspection as soon as possible, and facilitate the speedy release of the vessel for the export of the maize to the import port.

According to Branch (2006:538), pre-shipment inspection and a fit to load certificate is crucial in the export process, because of deregulation of shipping, road and rail transport. This has much potential to improve transport utilisation and in so doing, reduce cost and time for the producer and user. A pre-shipment and fit to load certificate includes the distributions systems, to plan a cheaper and quicker supply chain concept, also involving Just-in-Time (JIT) working system. The liberalisation of the South African transport business will facilitate a cheaper and more extensive transport infrastructure, to meet consumer demand pertaining to cargo safety and traceability for export of the maize.

2.3.6 The logistical process for maize export

According to PPECB (2007:9), the maize logistical process includes the following steps as shown in diagram 2.2.1.

1) It is harvested on field on the farm, where no official control tests been done at this level.
2) Stored in a silo or grain shed, in bulk bins or in hessian bags and outside under tarpaulins, where it loses it traceability and it will be dried to a moisture content of below 14%, and cleaned of any foreign matter to comply to export requirements..
3) Then it will be loaded on a transporter (transporter or train), at this point grading will take place with a sample of the contents. In some cases it will be transported on open trucks covered with a tarpaulin, the standard of the transport mode will depend on the choice of the exporter. It can also be loaded inside a standard general purpose container. There are no official hygiene tests on both means of transport; in this case the third party will be responsible for the stuffing and ensuring that the container is placed on a stack.
4) Then it will reach the port of choice (Durban or East London), here it will be stacked in warehouses or silos by consignment received, here it loses traceability again.
5) Then it will be loaded on a vessel for export.

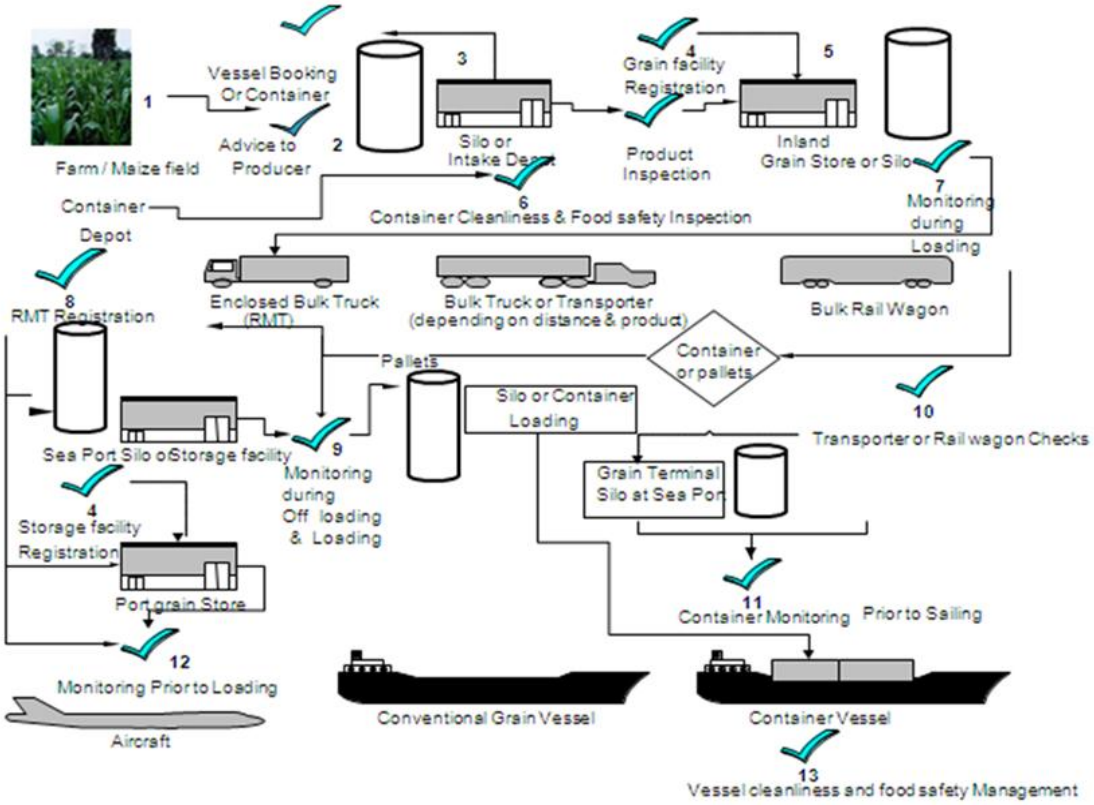


Figure 2.8: The South African logistical process for maize export

(Source: PPECB export directory, 2012:11)

A summary of the objectives of each component (refer to the illustration above) is listed below:

1. Advice to Producer;
   - Determination of harvest readiness / ripeness
   - Quality in field / pre-harvest grading
   - Field residue sample
2. Product Inspection (at Inland Pack-house or Intake Depot);
   - Sample product inspection of consignment (as per regulations of the Agricultural Products Standards Act)
   - Residue control samples of consignments (for Government Laboratories)
   - Information, training and guidance on farm or at silo
   - Audit of sorting accuracy
   - Reports on farm quality results / statistics
   - Determination of quality prior to loading

3. Export Notification;
    - Capture shipping (booking) details (quantities) and confirm with shipping line (for operational planning and control of exports)
    - Handle enquiries for information and advice on optimum post-harvest procedures
4. Store Registration;
    - Evaluate store design (prior to construction)
    - Provide information and advice
    - Inspection and registration of new stores. Periodic re-inspection of existing store.
5. Container Depot/Silo's Inspection;
    - Inspection and approval of new depots and facilities
    - Periodic inspection of container depots and facilities
6. Container Cleanliness;
    - Inspect cleanliness and condition of containers
7. Monitoring during Loading ("Stuffing) at Inland Stores;
    - Containers:
        - Check container cleanliness and condition
        - Supervise loading of container
    - Road motor transport (RMT):
        - Check RMT registration, cleanliness and condition
        - Supervise loading of RMT
    - Flatbed or bulk trucks and rail wagons:
8. Monitoring during Off-loading and Loading of Palletised Cargo in Sea Port;
    - Conventional Vessels:
        - Check condition of pallets and bags and bulk cargo
        - Supervise off-loading of inland transport and loading vessels
        - Product re-inspection when necessary or on request
    - Loading of Containers in Sea Port:
        - Check condition on request
        - Check validity if container cleanliness seal intact
        - Check container cleanliness and condition
        - Supervise loading of container
9. Container Checks in Sea Port Terminal / Holding Store;

- Identify illegal exports (containers not booked / notified)

10. Container monitoring prior to sailing

    Vessel Inspection, Calibration and Carrying Instruction;

    - Vessel inspection (prior to each shipment):
        - Cleanliness and taint free
        - Structure and general condition
    - Vessel previous cargo:
    - Carrying Instruction:
        - Verifying shipping line's carrying instruction for vessel

11. Monitoring Prior to Loading at Airport;
    - Sample product inspection of consignment (if not previously inspected)
    - Supervise loading of aircraft containers
    - Product re-inspection when necessary or on request
12. Quality Monitoring Overseas;
    - Ad-hoc monitoring of product quality on arrival or at point of sale
13. Support Services;
14. Other Support Services;
    - Provide information and advice on:
        - Optimum post-harvest handling, storage and transportation methods and procedures
        - Quality management and food safety systems (EUREP-GAP and HACCP / GMP)
        - Equipment / technology used in the export supply chain
15. Information and Statistics;
    - Conduct or participate in experiments
    - Ad hoc queries and requests for statistics (reports)
    - Information and statistics on internet web-page
16. Systems Auditing and Certification;
    - Internationally accredited auditing and certification service for food safety and quality management systems (HACCP / GMP).

2.3.7 Codes and Regulations for the Export Maize Industry

The different role-players do not have clarity on the forms which should be filled before any exporting of maize can take place, it must be noted that whoever wants to export should register for FBO and be audited for food safety and hygiene standards. However, the implementation of this legislation must be implemented as per Act 119 of 1990; there must be no concerns about the logistical implications of registering each and every maize producer who stores maize in the farm. To combat the practices of exporting directly from the farm and using fraudulent FBO codes, the researcher would like the following proposals to be implemented:

- That exporters source their maize from producers who comply with the food safety and hygiene standards; and
- Exporters who buy directly from the farm cannot use the port silo FBO codes.

According to the Code of Food Law; Codex Alimentarius-CODEX (2011: online) there must be an obligatory food safety management system regulated for food operators including South Africa who is a subscriber to this CODEX. It consists of a supporting system (hygiene conditions, measurements, products and their control) HACCP system, and hygiene training of the personnel. The food companies must have a safety program in written form in place; they must execute it, and keep a record of the measures taken pertaining to food safety. In doing risk assessment, risk management and risk communication, the country can determine the qualitative and/or quantitative estimation. This includes attendant uncertainties of the probability of occurrence and severity of known potential adverse health effects in a given population, based on hazard identification with maize, hazard characterization and exposure assessment.

Based on SANS 10330 (2007:13), the relevant legislation for maize exports is:

- The Foodstuffs, Cosmetics and Disinfectants Act. Act 54 of 1972.
- The Health Act, Act 63 of 1977.
- The International Health Regulations Act. Act 28 of 1974.
- The APS Act, Act 119 of 1990.

- 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 Genetically Modified Organisms Act 25 of 1997.
- The Perishable products export control board Act 9 of 1983.
- The Consumer Act 68 of 2008.
- Customs Act 91 of 1964.

2.3.8 Key trends in the maize export industry

Maize (Zea mays) was selected for this study because of its relative abundance in South Africa and it is a major player in the South African economy. Sustainability of the industry is important for the economy, employment and food security. Growth and diversification of the maize industry has the potential to benefit the maize supply chain, the manufacturing sector and the South African economy. Over the last decade, due to the lack of safety concern and inadequate quality management practices in the maize logistical process, it caused unsafe and poor quality of maize products to be exported. Maize is a major staple cereal in South Africa and therefore, produces large volume of waste. Maize is widely believed to have the greatest risk to affect the exports if the food traceability and safety not been addressed. Based on the current situation of South Africa's economy, competition is increasing globally and has moved to high and the market is becoming tougher to export maize. It is therefore marketing orientation is critical to the survival of exporters. Customers always look for good quality of products/services and safe products to consume; this pushes exporters to provide a better quality of maize products in order to compete in the market. Exporters need to recognise the needs of their customers, so that they can provide the exact products/services to the customers. Buyers of South African grain increasingly demand more rigorous, timely testing for chemical residues and trace elements on cargoes.

For example, Japan has introduced a food sanitation law that lists agricultural chemicals and their maximum toxic or harmful levels for all grains. Europe has established the European Food Safety Authority to regulate food safety in Europe and members of the European Union have embraced labelling and traceability of crops and food. These demands are increasing the importance of research aimed at developing new or adapting existing analytical methods for South African grain. On-going monitoring of domestic and export cargoes to ensure that South African grain is meeting both domestic and international grain safety and sanitation tolerances and end-use quality (e.g. toxic residues, bacterial contamination, weed seeds, insects, and malting quality for specific barley varieties). In light of increasingly stringent international food safety regulations, cargo specific grain safety testing is increasing.

Liaising with both international and South African agencies in regard to trade implications, in order to meet international standards and safety acts on grain safety (e.g. Japanese Food Sanitation Law and the European Union (EUN) tolerances for pesticides). The South African maize industry has undergone dramatic changes in the wake of transformation of the macro-economic environment since 1994. Since 1968, and the introduction of the Agricultural Marketing Act, the Maize Board had controlled every aspect of marketing and trade in maize, including the producer price, storage facilities, purchases by millers and crop export (Essinger *et al.*, 1998). According to the NDA (2004), in 1997, with the implementation of a new Agricultural Marketing Act, the marketing boards and single-channel marketing system were phased out and industry trusts established, with a significant impact on the various aspects of agricultural policy management (NDA, 2004).

These agricultural marketing changes have also had a significant impact in domestic and export markets. Crop prices have fallen towards world prices, farmers have switched to minimum and low-tillage production systems and production has shifted out of marginal areas, thus maintaining total crop output while planting less land (NDA, 2004). Grain producers, traders and processors trade in a ‘free’ market, responding to the forces of supply and demand in setting prices (Vink & Kirsten, 2002). Prices are generated through

the formal commodities market that was established following deregulation, the Agricultural Markets Division (AMD) of the South African Futures Exchange (SAFEX). SAFEX prices are driven by the assessment of various players from information that will affect supply and demand such as weather conditions, consumer preferences, government policy, and trade agreements and so on.

As the production of maize often exceeds the local demand, prices fall to the export parity price, which is the price below which producers can get a better price by exporting their maize. When local demand exceeds local supply, such as during a drought, prices rise to the import parity price, which is the price above which the processors can import maize more cheaply than buying local maize (Vink & Kirsten, 2002). In recent years the production of maize has almost always exceeded local demand, with surpluses of 1.9 billion tons in 2002/3 and 2.1 billion tons in 2003/4 (FEWSNET, 2003), so prices have generally remained close to the export parity price. The import/export parity price band is mainly a function of the world price and the exchange rate. Thus, while prices of commodities such as maize have generally fallen, they have also become increasingly volatile mainly due to exchange rate volatility (Food Pricing Monitoring Committee, 2003), whereas prices further down the supply chain are more stable.

The Codex standard of (1969) contains codes of practices detailing general principles of food hygiene laid down by the international world health organization. The Codex Alimentarius standards have the following criteria:

- It must identify the essential principles of food hygiene applicable throughout the food chain (including primary production through to the final consumer) to achieve the goal of assuring that food is safe and suitable for human consumption.
- It recommends a HACCP based approach as a means to enhance food safety.
- Indicates how to implement those principles.

Provides guidance for specific codes which may be needed for sectors in the food chain; or commodities; to amplify the hygiene requirements specific to those areas, legislative requirements for an export company (Codex standard, 1969).

2.3.9 The Maize HACCP Process

South African food manufacturers have for the last 5 to 10 years experienced the pressure from global food producers and Government, to adopt some form of system to ensure the production and distribution of a safe final food product to their end users. The South African Bureau of Standards (SABS) took the lead in adopting and training in the Codex Alimentarius and HACCP (Hazard Analysis Critical Control Points) standards, originally developed for astronauts. HACCP is a food safety standard that focuses on analysing the hazards associated with the making of the product and how to control it in order to achieve a physically, microbiologically and chemically safe end product.

According to notice: No. R. 908, 27 June 2003 (ACT NO. 54 OF 1972), a HACCP system means the hazard analysis and critical control point system that identifies, evaluates and controls hazards which are significant for food safety, a HACCP plan outlines the control of hazards which are significant for food safety in a segment of the food chain under consideration; and a HACCP certification means the issuing of documentary evidence by a certifying body accredited to do so by the South African National Accreditation System ("SANAS"), a non-profit organisation registered in terms of section 21 of the Companies Act, 1973 (Act No. 61 of 1973), registration No. 199600354108 based on the results of an external HACCP auditing, or in the case of imported foodstuffs, a certifying body accredited for the purpose by an internationally recognised accreditation authority. Based on the ACT, the HACCP system which is science based and systematic identifies specific hazards for their control t o ensures the safety of food. HACCP is a tool to access hazards and establish control systems which focus on the preventing rather than relying mainly on end-product testing. HACCP can be applied throughout the food

chain from primary production to the end consumption and should guide on scientific evidence of risks to human health. In addition enhancing food safety, the implementation of HACCP can provide other significant benefits like aiding inspections by regulatory authorities and promoting international trade by increasing confidence in food safety. A HACCP study consists of seven principles. These principles identify specific food safety hazards (biological. chemical. physical or allergens) that can adversely affect the safety of food and specific preventative measures for their control (*SANS10330*, 2007). The HACCP principles enjoy international acceptance and the details of this approach have been published by the Codex Alimentarius Commission and the National advisory committee on microbiological criteria for foods in America (SANS10330, 2007).

According to the CAC (1999:1), South Africa is a subscriber too; all countries must have an obligatory food safety management system regulated for food operators in place. It consists of a supporting system (hygiene conditions, measurements, products and their control) HACCP system, and hygiene training of the personnel. The food companies must have a safety program in written form in place; they must execute it, and keep a record of the measures taken pertaining to food safety. In doing risk assessment, risk management and risk communication the country can by determining the qualitative and/or quantitative estimation, including attendant uncertainties, of the probability of occurrence and severity of known of potential adverse health effects in a given population base on hazard identification with maize, hazard characterization and exposure assessment (CAC, 1999).

To implement a HACCP process, the FAO/WHO food standards program (2000) stated that there are the following 7 principles must be implemented:

Principle 1: Conduct a hazard analysis by flow charting the process from raw materials to finished product.

Principle 2: Determine the Critical Control Points (CCP'S) where failure to control presents an unacceptable risk of injury to the consumer.

Principle 3: Establish critical limits for the critical control points which must involve a measurable parameter and may also be known as the absolute tolerance or safety limit.

Principle 4: Establish monitoring systems which include frequency and responsibility.

Principle 5: Establish corrective actions to be taken when monitoring indicates that critical control points (CCP's) is not under control.

Principle 6: Establish verification to confirm that HACCP is working correctly (HACCP audit / assessment).

Principle 7: Establish documented system and undertake review (CAC 1999:1).

2.4 THE LOGISTICAL PROCESS INSPECTION IN SOUTH AFRICA

PPECB is an organisation mandated by the Department of Agriculture Forestry and Fisheries to do quality inspections for all South African perishable products destined for export, to be in the forefront of the development of techniques that assist in ensuring that only good quality maize gets exported. Its mandate includes the following pertaining to the logistical management processes:

- PPECB helps protect high value bulk commodity cargos, significantly reducing risk of loss exposure to the trading parties involved.
- Inspection occurs during critical transportation, custody transfer and storage operations. With a long track record of experience and success, PPECB has been providing cargo inspection services on grain for export, having started under the name Dept. of Agriculture performs inspection services to global industry standards and other recognized criteria.
- PPECB only do inspection for export if there is a valid FBO number printed on consignment note.
- Transporter inspection is an integral part of exporting of maize: this is the first inspection before cargo is being loaded for shipment to the port. On the moment PPECB only certified to do inspection on transporter to do a

visible inspection that the trailers is free from insects, which are injurious to stored grain, water damage or contamination at the time of inspection

- Vessel inspection is an integral part of the exporting of maize; this is the last inspection before the cargo is being loaded for shipment to the buyer. On the moment PPECB is only certified to do inspection on vessel to do a visible inspection that the vessel hatches is free from insects which are injurious to stored grain, at the time of inspection. But as times and responsibilities change so will PPECB responsibilities to our clients.
- PPECB have to do checks on the logistics of an export consignment.
- Ensure that consignments comply with the relevant international protocols.
- Inspect and verify the compliance of an exporter's (use Portnet) facilities.
- Conduct a quality assessment of the grain products to be loaded.
- Provide assistance to exporters on international food safety and quality assurance compliance.
- Enhance client relationships through the application of customer care.

2.5 CONCLUSION

In this chapter a holistic perspective of food safety on transporters in South Africa has been elaborated upon. The chapter also focused on food safety in South Africa with specific emphasis on consumer confidence and legislation. Factors influencing the food safety practices, HACCP and factors impacting the food industry were also discussed. In the next chapter a literature review will be conducted on the concept of 'food safety and traceability.

CHAPTER 3: LITERATURE REVIEW

3.1 INTRODUCTION

An assessment of the application of the literature review that are explained in this chapter pertaining to maize exports and the logistical chain management: over the last decades, the safety of food has become more of a public problem than ever before. Manufacturers are now more aware of the importance of producing a product that is of a high quality but also safe for its end users.

The purpose of this chapter is to explore the key factors that affect the quality of maize product in the logistical process, and find out the common approaches that can be used to manage the logistical process for maize export effectively. This will lead to the improvement of the sustainability of the industry. The research problem set for this dissertation, which reads as follows: “Lack of safety concern and adequate quality management in the logistical process for maize export result in unsafe and poor quality of maize product.”

Government has therefore placed an enormous amount of pressure on food producers, to ensure the production of food that 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 process. This is achieved by appointing qualified and competent individuals to ensure that all the processes within the system are synchronized and working to a safer and more traceable maize export process.

To obtain the objectives of this research, the literature review will be divided into distinct categories, namely food safety processes and laws in South Africa regarding to the exports and logistical management and food safety laws and logistical management in other countries regarding to imports, which include United States of America, Finland and the European Union countries. The

problems and solutions for food safety processes pertaining to maize will also be discussed.

3.2 COMMON STANDARDS AND CRITERIA FOR FOOD SAFETY

The common standards and criteria for food safety and quality conditions are following terms describe the key standards and criteria for food quality improvement:

- **APS Act No. 119 of 1990:** APS (Agricultural Product Standards) provides for control over the sale and export of certain agricultural products and other related products, with a view to the maintenance of certain standards regarding the quality of products and the packing, marking and labelling thereof, as well as it describes the official activities and tasks of the officials of the Department of Agriculture (DoA), in particular Notice R.707 of this act (Act No. 119 of 1990).
- **Act No. 119 of 1990-Contaminate:** Means an introduction or occurrence in food or food environment of any biological or chemical agent, foreign matter or other substance not intentionally added to food and which may compromise food safety or suitability (Act No. 119 of 1990).
- **Act No. 119 of 1990-Food Safety Checklists and Compliance Criteria (FSCCC):** Used for various types of FBO's including primary production and on-farm facilities, off-farm pack houses and cold stores, container depots, silos, transport operators, exporters, air/port terminals (Act No. 119 of 1990).
- **Codex Alimentarius (CODEX):** Codex is the mean results of the Commission's work: a set of international food standards, guidelines and codes of practice with the goal to protect the health of consumers and ensure fair practices in the food trade (Codex Alimentarius, 2012).
- **Food Safety (FS):** Assurance that food will not cause harm to the consumer when it is prepared and/or eaten according to its intended use (ISO, 2003:2).
- **Genetically Modified Organisms (GMO):** South Africa has been growing first-generation commercial genetically modified (GM) maize

since 1997. Despite a requirement for non-GM food, especially for export, there is no system for coexistence of GM and non-GM crop. South Africa is one of the few African countries that have introduced genetically modified (GM) crops. South Africa has been growing first-generation commercial GM crops since 1997. In 2008, South Africa was ranked eighth in terms of global commercial GM production.

3.3 PRODUCT QUALITY APPLICATION

Quality means individual needs, expectations, perceptions, and experience of the customer; overall it is the fitness of use of the product (Levine et al., 2001:16). According to South Africa legislation which are regulated under the APS Act, 1990 (Act 119 OF 1990), maize is the most important grain crop in South Africa and is produced throughout the country under diverse environments. According to Du Plessis (2003:1), successful maize production depends on the correct application of production inputs that will sustain the environment as well as agricultural production. These inputs are, inter alia, adapted cultivars, plant population, soil tillage, fertilisation, weed, insect and disease control, harvesting, marketing and financial resources.

In developed countries, maize is consumed mainly as second-cycle produce, in the form of meat, eggs and dairy products. In developing countries, maize is consumed directly and serves as staple diet for some 200 million people. Most people regard maize as a breakfast cereal. However, in a processed form it is also found as fuel (ethanol) and starch. Starch in turn involves enzymatic conversion into products such as sorbitol, dextrine, sorbic and lactic acid, and appears in household items such as beer, ice cream, syrup, shoe polish, glue, fireworks, ink, batteries, mustard, cosmetics, aspirin and paint. Approximately 8, 0 million tons of maize grain are produced in South Africa annually on approximately 3, 1 million hectare of land. Half of the production consists of white maize, for human food consumption, the story of maize (Du Plessis, 2003:1).

3.3.1 ISO22000

International Standards Organisation ISO22000 aims to harmonize the requirements for food safety management in food and food related business on a global level (ISO22000: 2006:9). It is particularly intended for application by organizations that seek a more focused, coherent and integrated food safety management system than is normally required by law. However, this International Standard is not intended for application as minimum food safety is principally assured through the combined efforts of all the stakeholders participating in the food chain. This is best achieved through mutual exchange of relevant data and information among the stakeholders. Recognition of the organization's role and position within the food chain is essential for ensuring sufficient communication to enable the food chain to deliver safe food products to the consumer (ISO22000: 2006:9).

Pertaining to quality in South Africa according to FruitSA (2011:2), in an article about PPECB it stated that "*When a bucket springs a leak the tendency is to apply a patch, and hope it does not leak further. As the bucket gets older, further leaks develop and further patches are applied. At some point there are more patches than bucket, and a new bucket is required".*

FruitSA wants to try and prepare a way forward so that grower confidence in consumer assurance and cold chain activities that can be improved that PPECB deliver. Their question to PPECB is "Can we patch the present bucket, or is a new bucket required"? They describes PPECB as a company, that operates under two main acts; the Perishable Products Export Control Act, 1983 (Act No 9 of 1983) and The Agricultural Products Standards Act, 1990 (Act No 119 of 1990). In terms of the first Act PPECB seeks to safeguard the cold chain for South African perishable products, and the Second helps to assure trading partners regarding the quality of South African perishable produce. PPECB is an assignee of the Department Agriculture, Forestry and Fisheries (FruitSA 2011:2).

3.3.2 Hazard Analysis and Critical Control Point (HACCP):

HACCP consists of seven principles which identify specific food safety hazards such as biological, chemical, physical and allergens that can adversely affect the safety of food and specific preventative measures for their control (SANS10330, 2007:1). This International Standard incorporates the Codex HACCP principles and the HACCP application steps developed by the Codex Alimentarius Commission and supportive safety measures within broader management activities that together constitute a food safety management system. This International Standard requires documentation of activities that impinge on food safety. All employees should be given HACCP training, but at levels relating to their responsibilities within the HACCP plan. Extensive training of line workers is critical because these are the individuals responsible for the product. Everyone at the facility in contact with the products should receive an overview of HACCP, as well as information regarding company's HACCP policies and procedures.

Too maintain the quality of maize and quality in the logistical management processes from production to the export port, product training is needed and training is a process that enables individuals to acquire knowledge, skills / tools, and abilities that will allow role players to fulfil the requirements of their job, achieve their career aspirations, and attain the goals of their organizations. For the organization, training is one of the processes by which it disseminates the products of its research programs, receives feedback from its partners and clients, and ultimately provides the baseline to track the information and conduct evaluation. Thus, training is multifunctional in that it plays a vital role in staff development and at the same time is a conduit for information. Both functions are essential to the success and longevity of the organization. In this process the producers of maize also need to train which is a approach, which involves encouraging farmers to engage in experiments in their own fields so that they can learn, adopt new technologies and spread them to other farmers.

According to the APS Act, 1990 (Act 119 OF 1990), the quality of maize in South Africa over the years has been one of the industry's main focus points

and a grading system was developed to support the trading system for both the cash and future markets. PPECB is mandated by the DOA to inspect maize and maize products for export destinations, this maize must comply to the Official Grading Regulations for maize, which enable the industry to ensure that maize and maize products that adhere to food safety standards reach the consumer, new developments in food safety aspects worldwide require the development of more formal on farm systems which can be audited to ensure that good agricultural practices are continuously used in the production of maize.

On behalf of the maize producers, Grain South Africa is compelled contribute to the development of good agricultural practises that are practically implementable. Guides from Grain South Africa will have to be developed to enable farmers to meet local and international requirements. These guides will then help the farmers to comply with the export regulations in order not to be rejected at the ports or silo's for export which will cost the farmers a fair amount of extra costs, which include the transporter, silo and inspection costs by PPECB.

3.4 THE CONTEXT OF SUPPLY CHAIN RISK MANAGEMENT

The context of supply chain management is relatively new. It firstly appeared in logistic literature by Oliver and Webber (1982) focused on the supply of raw material. In recent years, many researchers and practitioners addressed the issue of supply chain and risk management (SCRM) (e.g. Peck, 2006; Juttner et al., 2003; Svensson, 2004).

According to Van der Vorst (2005:10), logistics management is part of the supply chain process that plans, implements and control the efficient, effective flow and storage of goods, services and related information from the point-of-origin to the point-of-consumption in order to meet customer requirements and satisfies the requirements imposed by other stakeholders such as government and the retail community. Included within this definition are aspects such as customer service, transportation, storage, plant site selection, inventory control,

order processing, distribution, procurement materials handling, return goods handling, and demand forecasting. Van der Vorst (2005:2) further indicates that Supply Chain Management (SCM) is for the integrated planning, co-ordination and control of all business processes and activities in the supply chain to deliver superior consumer value at less cost to the supply chain as a whole while satisfying the variable requirements of other stakeholders in the supply chain (e.g. government and non-government organizations.

According to Lin et al (2010:50), four factors are considered as the antecedents of supply chain excellence, which include collaboration, organizational conditions, technology adoption, and operations. By identifying the critical success factors for supply chain excellence (SCE), Lin et al (2010:50) further indicated that it also can be implemented through three elements; supply chain processes, supply chain network structures and management components to achieve business excellence. To the industry there are three challenges for implementing SCM:

- Developing trust and collaboration among supply chain members
- Identifying best practises and implementing them in a structured way
- Establishing the latest collaborative information systems (Lin et al., 2010:50).

According to Langley, Coyle, Gibson, Novack and Bardi (2009:20) integrated logistics and supply management is a recurring and cyclical flow process within product supply chains and a complex operations as Figure 5 illustrates, the objective of logistics is to ensure that the desired or products (i.e. goods and services) and information are made available to the client at the designated place and time, in the required condition and quantity and at an acceptable price.

Figure 3.1 showed a process of SCM from the current flow of goods – from manufacturer to store – and shows how a combination of shared warehousing, lead-time reduction, shared transport to urban areas and shared transport to non-urban areas can be combined in a favorable way (Bajorinas, 2008:41).

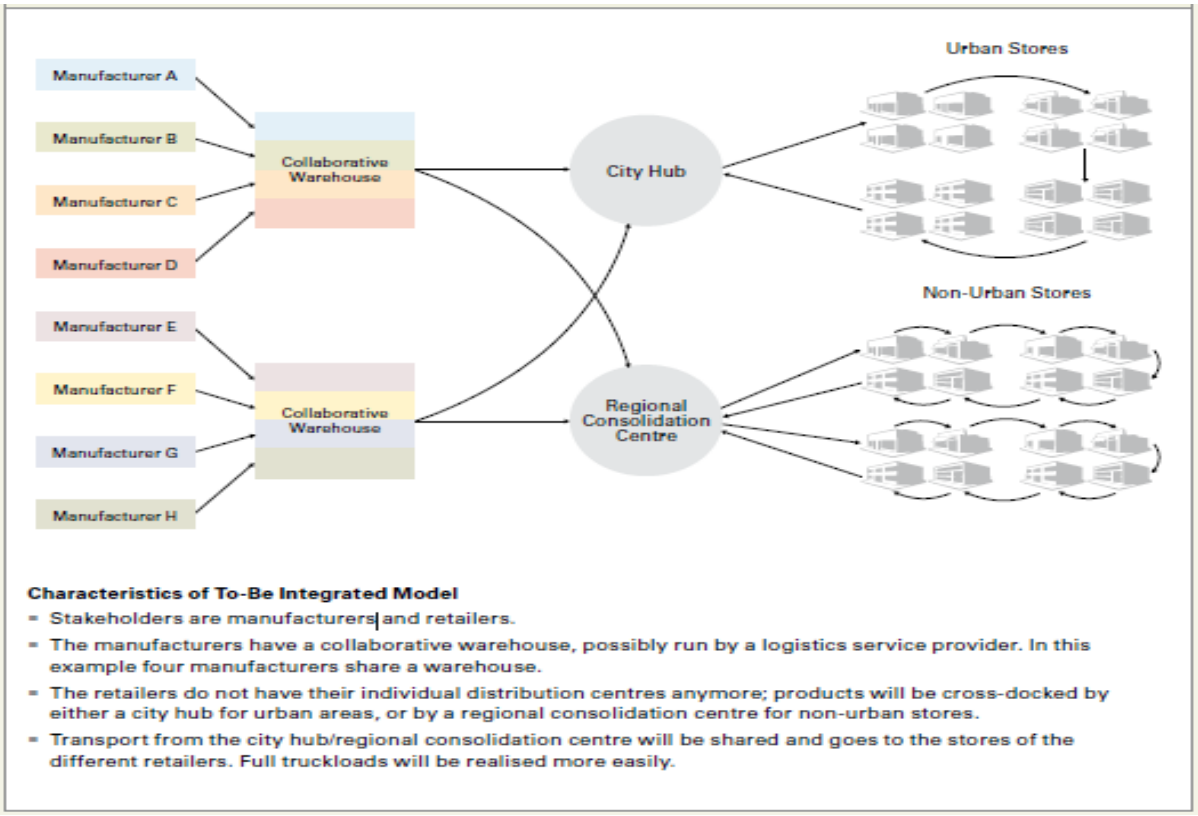


Figure 3.1: A new model for enhanced supply chain collaboration

(Source: Bajorinas, 2008)

In SCM, when there is a negative occurrence or phenomenon called the bullwhip effect it occurs when slight demand variability is magnified as information moves back upstream, meaning that there is uncertainty about the level and pattern of the demand, which resulted in a higher inventory of stockout costs (Langley et al., 2009:20). According to Langley et al (2009:20), the bullwhip factor includes the following:

- Demand forecasting practices
- Min-max inventory management (reorder points to bring inventory up to predicted levels)
- Lead time
- Longer lead times lead to greater variability in estimates of average demand, thus increasing variability and safety stock costs
- Batch ordering
- Peaks and valleys in orders
- Fixed ordering costs
- Impact of transportation costs (e.g., fuel costs)

- Sales quotas
- Price fluctuations
- Promotion and discount policies
- Lack of centralized information

The continuity of SCM is more complex today than ever before (Kildow, 2011: 64-65). There are many factors that influence SCM pertaining to the environment nowadays. Before it was an inconvenience today it is seen as unacceptable (including JIT inventories, out of area suppliers, stringent service level agreements, extended hours of operations et cetera.). With today's challenges of financial difficulties, economic pressures, the transporters must reduce costs to enable them to survive the crunch on pricing, credit concerns, concerns about clients, it is a fight to survive, to be environmental friendly, sustainable and resilient. Guide to SCM and business continuity (Kildow, 2011: 64-65). Thus, the risks and hazards that go hand in hand with SCM also need to be addressed.

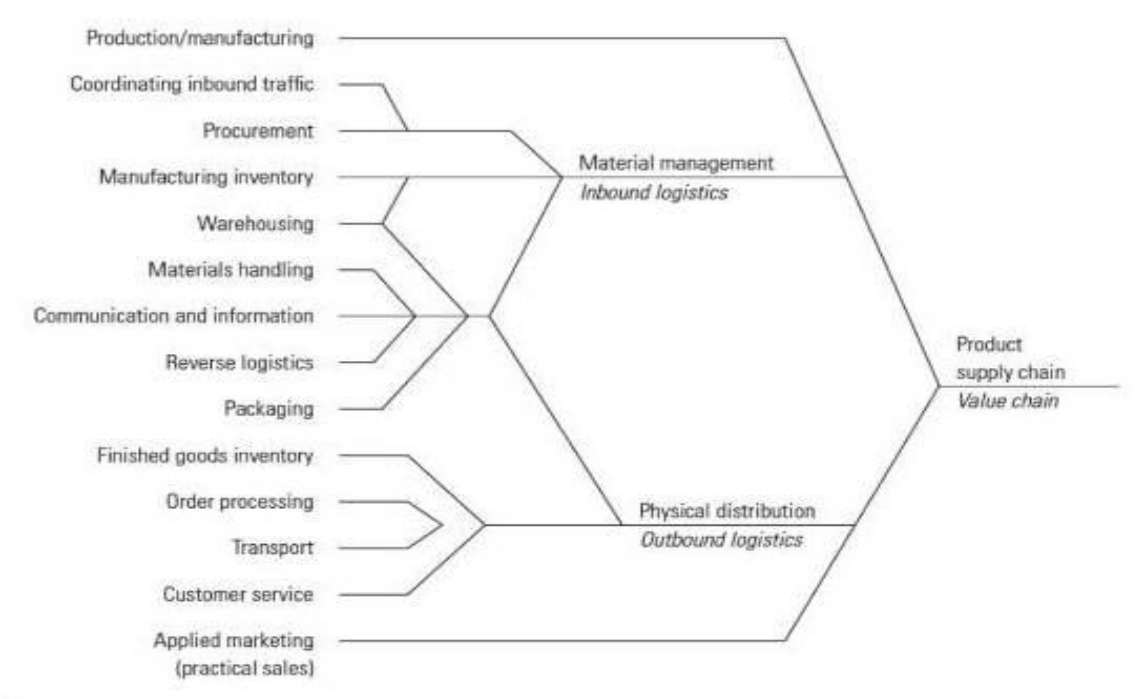


Figure 3.2: Activities integrated logistics and SCM process

(Source: Pienaar & Vogt, 2009:12)

Figure 3.2 describes a network of autonomous or semi-autonomous supply chain management entities collectively responsible for procurement, manufacturing, and distribution activities associated with related export products. After production the products will be transported to collaborative warehouses in which multiple manufacturers store their products for exports. Collaborative transport from the collaborative warehouse will deliver to the ports and to regional consolidation centres. Warehouse locations on the edge of cities will be used as hubs where cross-delivering will take place for final distribution. Non-urban areas will have regional consolidation centres in which products will be cross-docked for final distribution. Final distribution to stores, pick-up points and homes in urban and non-urban areas will take place via consolidated deliveries using efficient assets.

The chain has to contain elements that guarantee a fast information flow between each of the member elements. The whole supply chain must also be agile and flexible in order to compete effectively and to respond quickly to changing customer value chain demand.

3.5 FOOD SAFETY LAWS PERTAINING TO MAIZE EXPORT

According to the European Parliament and the Council of the European Union (EC), Regulation (2002:1), food safety is of global concern and international agreements advocate the protection of consumer health. Governments are responsible for food safety. Because food safety risk management is implemented in food producing companies, and they are the operators who are responsible for food safety in the first place, it is essential that adjustment towards “risk-based” management becomes materialized in food companies. A proper change can only happen if the principles of risk-based management are communicated and understood. In order to achieve such understanding, tools that weigh the food safety risks, prioritize them, and are capable of defining the acceptable limits and/or allowing their follow-up, are needed at different levels of food management and control (European Parliament and the Council of the European Union. 2004:1).

In South Africa, there are three main food safety laws pertaining to the export of maize:

- APS Act, 1990 Act no. 119 of 1990.
- Foodstuffs, Cosmetics and Disinfectants Amendment Act 1972 (Act No. 54 of 1972) and Health Act No. 61.
- Customs and Excise Act1964 (CEA1964:2).

In terms of the Department of Agriculture, Agricultural Products Standard Act No 119 of 1990 (South Africa, 1990:3-4), legislation for the export of maize is critical that the product is handled and transported safely and that all the food safety and traceability laws are adhered to in order to prevent contamination and an unsafe product reaching the consumer. Unsafe processes for maize exports have a detrimental effect on South African exports. Regulations relating to the application of the Hazard Analysis and Critical Control Point (HACCP) system (SANS10330: 2007:1), require maize sorting and grading facilities to have certified HACCP systems in the full supply chain process as from 13 November 2010.

The level of infrastructure development and the quality of services are major factors in the cost of transportation. This study will serve as a guideline to work out export transport logistics costs associated with export of containerized shipment. The reason being that certain illegal producers load directly on the farm, and then take maize to the port, and the legal exporter's load trucks at the silo's and then take it to the port for export. The major component of export transport logistics cost from port to ship are:

- Labour charges for handling, stowing et cetera
- Road transport charges
- Charges free on board
- Charges costs insurance freight
- Port Terminal Handling charges handling charges
- Survey charges – stability
- *SANS10330*A – maritime safety – stability calculation
- PPECB gives an insect free certificate

- High pressure water test make sure hatches is water tide
- Agency charges
- Clearing charges
- Consolidation charges
- Liner freight

Generally, an exporter based in hinterland, irrespective of distance from the servicing gateway port, prefers to move cargo by road to CFS (a transit facility where a exporter stuffs cargo in containers) and containers are transported to port for loading on board following are the steps involved in the movement of shipment of maize by road and stuffing of shipment in container is done at Container Freight Station, a transit facility, before entering in port premises for loading on board the ship.

South African Regulations governing the General Hygiene Requirements for Food Premises and the Transport of Food (R918 of 1999 last amended R1125 of 2003) require all food handling premises to have a certificate of acceptability. To obtain a certificate, the food premises must meet the hygiene requirements of the regulation. This thesis aims to research the methodology of the post-harvest maize exports (DoA, 1990:1-2).

Currently, South Africa implements this Standard Operation Procedure (SOP) for export legislation to the sampling and analyses of grains, oilseeds and groundnuts. This SOP states that South Africa have a fully developed export market economy, and have established specific limits and regulations for physical appearances, pesticides and aflatoxins in food and feed in accordance with other countries legislation.

3.6 FACTORS AFFECT MAIZE LOGISTICAL SUPPLY CHAIN

Over the past decades, a number of factors affect maize logistical supply chain. These factors such as main risk and incidents in maize export process, and the incidents are caused by poisoning, contamination, unclean storages, toxic transportations and premises, et cetera. All these factors have impacted on the

quality and safety of maize product negatively in logistical process. This requires all the food business operators to conform the general hygiene requirements for food premises and the transport, handling and transportation. To withdraw and contaminated transporter, the following procedures have to be taken to adhere to APS Act 119 of 1990:

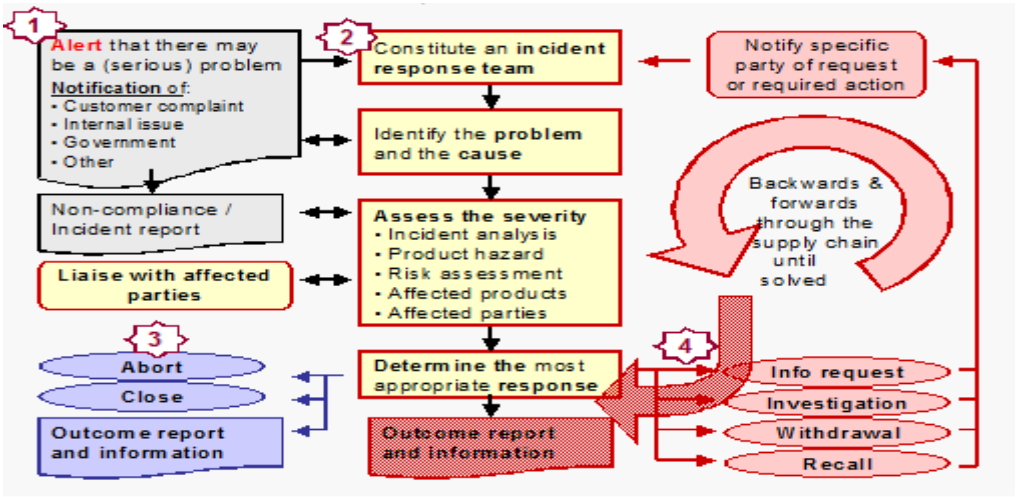


Figure 3.3: Product alerts, withdrawals and recalls
(Source: T-SOP 2007:12 derived from ACT 119 of 1990).

Figure 3.3 describes how the application of a traceability/product tracing tool by a competent authority like PPECB should improve the effectiveness and the efficiency of the actions that may be necessary regarding its measures or requirements within its food inspection (for example food recalls). According to the CAC (Codex Alimentarius, 2012), traceability and product tracing is a tool, that when applied in a food safety context, does not improve food safety outcomes unless it is combined with the appropriate measures and export requirements. However, if applied properly it can contribute to the effectiveness and efficient export process of associated food safety measures. Product tracing is a tool that when applied in a food inspection and certification system, can contribute to the protection of consumers against deceptive marketing practices. It also makes producers aware of food recalls if the traceability legislation is not adhered to. The product tracing tool should be able to identify all the stages of the food chain (Codex Alimentarius, 2012).

According to Keener (2003), the fact that there are so many types of foods with so many containers, temperatures and handling requirements and so many modes of transportation available to the modern food company, it is easy to find out that, independent of the mode of transportation, foods and food ingredients are susceptible to abuse and/or contamination during transportation and storage.

According to the Health Act 54 of 1972 promulgated in notice R 918 (Government Gazette, 2003), regulations governing general hygiene requirements for food premises and the transport of food the South African legislation prohibit the handling and transportation of food that is unsafe for human consumption. For food handling the legislation stated: No person shall handle food in a manner contrary to the provisions of these regulations. If an inspector following an inspection of food premises or a facility is of the opinion:

a) That such food premises or facility are or is in such a condition or used in such a manner; or do or does not comply with these regulations to the extent;
b) That a particular activity with regard to the handling of food takes place in such a manner; or
c) That such circumstances exist with regard to the food premises or facility or any other activity, that they or it constitute a health hazard and that the continued use of the food premises or facility or the activity should be prohibited, the local authority may summarily prohibit the use of the food premises or facility for the handling of food or any of the activities that relate to the handling of food, by serving a written notice in terms of section 52 of the Act on the person in charge or, if he or she is not available, his or her representative informing such person of the prohibition (Government Gazette, 2003).

For transportation the regulation says that no person shall transport food including the products referred to in regulation 14 on or in any part of a vehicle:

a) Unless that part is clean and has been cleaned to such an extent that chemical, physical or microbiological contamination of the food is prevented:

b) Together with;

- contaminated food or waste food;
- Poison or any harmful substance;
- A live animal; or
- Any object that may contaminate or spoil the food (Government Gazette, 2003).

The Health Act 54 of 1972 promulgated in notice R 918 (Government Gazette, 2003), described that have fully developed market economies have established specific limits and regulations for physical appearances, pesticides and aflatoxin in food and feed. These limits and tolerances for South Africa are described in the According to the Health Act 54 of 1972 promulgated in notice R 918 (Government Gazette, 2003). The freight compartment of a vehicle that is used for the transportation of food that is not packed or wrapped in liquid proof and dustproof sealed containers (Government Gazette, 2003):

(a) Shall have an interior surface made of an easy to clean and smooth, rust free, non-toxic and non-absorbent material without open joints or seams and, before food is loaded into such freight compartment, no square centimetre of the said surface shall upon analysis as referred to in Regulation 6(4) contain more than 100 viable micro-organisms.

(b) Shall be dustproof.

(c) Shall not be used simultaneously for the transport of any person or any other item that may contaminate the food.

(1) No person shall transport food including the products referred to in regulation 14 on or in any part of a vehicle -

(a) Unless that part is clean and has been cleaned to such an extent that chemical, physical or microbiological contamination of the food is prevented;

(b) Together with -

(i) Contaminated food or waste food;

(ii) Poison or any harmful substance;

(iii) A live animal; or

(iv) Any object that may contaminate or spoil the food.

(2) Subject to sub regulations (1) and (4), the freight compartment of a vehicle that is used for the transportation of food that is not packed or wrapped in liquid proof and dustproof sealed containers (transporter is also a container).

(a) Shall have an interior surface made of an easy-to-clean and smooth, rust free, non-toxic and non-absorbent material without open joints or seams and, before food is loaded into such freight compartment, no square centimetre of the said surface shall upon analysis as referred to in regulation 6(4) contain more than 100 viable micro-organisms;

(b) Shall be dustproof;

(c) Shall not be used simultaneously for the transport of any person or any other item that may contaminate the food.

(3) Not withstanding any provisions to the contrary contained in this regulation, no non-prepacked food shall be:

(a) Transported in such a manner that it comes into contact with the floor of a vehicle or the floor covering thereof or a surface thereof that can be transported or carried in such a manner that the food could be spoiled or contaminated in any way.

(4) Sub regulations (2) and (3) (a) shall not apply to the transport of venison, fish, molluscs or crustaceans between the food premises and the place where the animals are hunted or the place where the fish, molluscs or crustaceans are caught or harvested: Provided that such transport shall be by the best available method and within a suitable time limit for transport as required by circumstances.

(5) No person shall transport food in bulk and semi-packed food in contravention of the provisions of the Codex Code of Hygienic Practice for the transport of food in bulk and semi-packed food (CAC.RCP 47-2001).

Transportation plays a crucial role in logistical management laws pertaining food safety in maize. Transportations can be found from various regulations and legislations in South Africa such as Health Act 54 of 1972.

It is of paramount importance that the correct loading (PPECB) for a specified product should be adhered to ensure the safety of that product. Growers, exporters, regulatory bodies (PPECB), shippers, retailers and wholesalers involved in the transport of fresh produce should ensure that sanitation requirements are met at the different stages in the transport chain. Trucks and shipping containers should be inspected for cleanliness, odours, dirt and debris before commencement of loading. In some cases it may be important to find out prior loads carried on a truck or in a container. Trucks or containers that were used to transport animals or animal products would increase the risk of contaminating grain if the trucks or containers were not cleaned before loading grain products.

Traceability of the grain loads is the ability to trace grain back to its original source where it was produced. Traceability is important function because it has an impact of food safety scares, or food safety incidents, may have on consumers, maize buyers, governments and the export trade of maize. Traceability must be an effective and cost-efficient management system that can pinpoint a food safety or traceability related problem to a country, maize silo, maize producer and maize production unit, rather than an entire commodity group. Narrowing the scope of a problem can reduce the negative economic impact on the trade point of view and therefore also a public health point of view, increasing the speed and accuracy of tracking and tracing implicated food items can help limit the risk. In order to minimise risk an effective traceability management system can quickly minimise unnecessary expenditure of private and public resources and reduce concerns that the consumer might have.

During product alerts a country must be able to trace the implicated food items which can help regulatory bodies, public health services and maize industry operators in determining the causes of a potential problem, and provide valuable data in cases of withdrawals and recalls to identify and minimise any food-borne hazards. From a food safety point of view, due to the diversity of international maize supply chains, it has become imperative that producers, silo’s, exporters of maize and export maize logistical providers work with their partners in the maize distribution and retail to develop acceptable standards that allow for the identification of maize at all stages of the export value chain

from the producer to the consumer. To embark on this requires a complete view of the food supply chain and the implementation of international food safety standards. Traceability guidelines must also be effective to enable quick identification of sources of maize traceability problems, as well as the identification and separation of defective maize produce.

In terms of the APS Act 119 of 1990, South African maize inspection standards, this includes mandatory plant quality, hygiene and operational standards. The conditions of the maize is prescribed and enforced to all producers/exporters of maize. It is based solely on inspection, sampling and analysis of the maize as per legislation by the South African government (DoA, 1991:2). According to the South African inspection standards, vessel inspection standards, APS Act (1990:21), the South African regulations only make live grain insect infestation inspection mandatory for the vessel.

There is also eight constructs pertaining to the critical success factors for SCM, these factors are environmental uncertainty, customer focus, top management support, supply strategy, information technology, supply network, structure, managing buyer-supplier relationship, and logistics integration (Lin et al, 2010:50).

According to Keener (2003:1), the transportation and food handling practices do not matter whether grain products are genetically modified, certified organic or grown using conventional farming methods. It requires multiple steps in the transportation between point of origin and point of use. The transportation of foods and commodities involves every conceivable form of conveyance (trucks, rail wagons and vessels). Foods and food ingredients are shipped frozen, refrigerated and at ambient temperatures. Maize is shipped by the ton, in bulk or bags. Stretch-wrapped on pallets inside dry-box sea containers, and in the cargo holds of ocean-going freighters. The maize industry thus plays a major role in the South African economy and sustainability of the industry is important for the economy, employment and food security. Growth and diversification of the maize industry has the potential to benefit the maize supply chain, the manufacturing sector and the South African economy. (Keener 2003:1).

3.7 COMMON APPROACHES OF LOGISTICAL SCM

A number of studies that addressed the useful approaches of logistical supply chain management risks. According to Drewry (2009:1), there are different approaches for the export of goods:

3.7.1 The logistical supply chain risk approach

This approach is designed to analyse major areas of risk in the supply chain such as (Drewry, 2009:1):

- Lack of inventory
- Carrier delays and non-performance (all transport modes)
- Transport and logistics cost volatility
- Transport congestion
- New environmental legislation affecting logistics
- Mergers and acquisitions among service providers
- Cargo theft
- Liability for loss or delays
- Bankruptcy of transport providers
- Fines for non-compliance, sometimes running into millions of dollars.

3.7.2 The pre-inspection approach

According to Drewry (2009), if the goods to be exported are not inspected before they are shipped by an independent third-party, the pre-inspection approach can be applied:

- The exporter may find his entire shipment being rejected on arrival at the importer's premises due to the poor quality of the goods. Some unscrupulous importers may do this just to put pressure on an exporter and to try and negotiate a lower price - be careful! experienced importers may request a pre-shipment inspection, to be conducted by an independent inspection company (this is commonly carried out for exports into other African countries). If they don't, then it may be worth suggesting to the importer during the negotiation stage that such an

inspection be carried out as part of the contract. Such an inspection protects both the importer and the exporter.

- The exporter must understand all aspects of international logistics, in particular the contract of carriage. This contract is drawn up between a shipper and a carrier (transport operator).
- Exporters and importers must understand their legal rights to claim against carriers. The "shipper", would be the party that pays the main carrier of freight and this could be either the exporter or the importer, dependent upon the terms under which that particular transaction was effected.

3.7.3 Approach to legal risks

According to Drewry (2009), International laws and regulations change frequently and/or may be applied differently from that of the exporter's own country. It is therefore important that the exporter drafts a contract in conjunction with a legal firm, thereby ensuring that the exporter's interests are taken care of. The exporter should draw up a checklist of basic legal questions aimed at the imported prior to signing any formal contract.

3.7.4 Approach to political risk

The political stability of a foreign country into which a company is exporting is of the utmost importance. Exporters must be constantly aware of the policies of foreign governments in order that they can change their marketing tactics accordingly and take the necessary steps to prevent loss of business and investment (Drewry, 2009).

3.7.5 Approach to managing risks

According to Drewry (2009), the task of managing the export-related risks begins with known what the risks. The first step is therefore to identify the risks that are likely to encounter and to give some 'weighting' to the seriousness of

the risk. The more serious it is the more attention will need to give to addressing the risk in question. With some of the risks outlined above, this can obtain insurance to cover the risk. Three main types of risk cover include credit risk cover, country risk cover and transit risk cover.

Beside the above approaches, many countries have discovered that there is a need for a harmonization of quality factors for food products, that they want the same or a better quality than that they have in their own country when they buy on the open market. According to the Codex the general principles for food hygiene is to:

- Identify the essential principles of food hygiene applicable throughout the food chain (including primary production through to the final consumer), to achieve the goal to ensure that food is safe and suitable for human consumption.
- Recommend HACCP-based approaches a means to enhance food safety. The HACCP System will provide assurance that food is suitable for human consumption and maintain confidence in internationally traded food, and
- Provide health education programmes which will effectively communicate the principles of food hygiene to the industry and the consumers.
- Provide food which is safe and suitable for consumption.
- Ensure that consumers have clear and easily understood information, by way of labelling and other appropriate means , to enable them to protect their food from contamination and growth/survival of food borne pathogens by storing, handling and preparing it correctly, and
- Maintain confidence in internationally traded food. Consumers should recognize their role by following relevant instructions and applying appropriate food hygiene measures.
- Indicate how to implement those principles; and

- Provide guidance for specific codes which may be needed for - sectors of the food chain, processes or commodities, to amplify the hygiene requirements specific to those areas. Food import & export standards programme (FAO/WHO food standards program, 2000: 3-10).

3.8 CONCLUSION

In this chapter, a literature review was conducted on various aspects of the export of maize from South Africa. The application of these and related aspects pertaining to the significance of the logistical supply management and quality within the industry were investigated. In the next chapter, the maize exports efficiency pertaining to the survey and methodology will be addressed.

CHAPTER 4: RESEARCH DESIGN AND METHODOLOGY

4.1 INTRODUCTION

This chapter provides detailed information on the research design and methodology of the study. The data collection design, data validity and reliability and statistical analysis of the questionnaires will be discussed. The aim of this study is to determine whether the fact that maize exporters that do not have quality strategies as their basis have an influence on their sustainability. The data of this chapter obtained from the completed questionnaires will be presented and analysed. Research methodology refers to the overall approaches and perspectives to the research process as a whole and is concerned with the reasons and sites of data collection, the way of how data will be collected and analysed (Collis & Hussey, 2003:55). According to Cochran (2004:2), most of the time researches use the target population to collect observations or data. Researches want to do more than describe our sample (sometimes called descriptive statistics), and make inferences about truth or test the assumptions made through hypothesis and modelling (called inferential statistics).

Badenhorst (2010:127) stated that “questions arise out of our experience of a gap between ourselves and the world, and the need to overcome it”. Questions stimulate thought, define tasks, convey problems and identify issues. It also helps to give our thinking direction. The responses to the questionnaire developed by the researcher for the purpose of obtaining information regarding the existing quality strategies that maize exporters are implementing at present, the barriers of quality management in the maize supply chain, the quality solutions that should be implemented by the role players to improve management of the enterprises and a suitable quality management strategy formalize role players have been analysed by using SPSS software.

4.2 RESEARCH DESIGN AND METHODOLOGY

The current research has made use of a combination research approach; both quantitative and qualitative studies were conducted. A case study method was utilised to identify the key factors that affect the quality of maize product in real life situations.

4.2.1 Research Design

According to Leedy and Ormrod (2010:87), 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 seek 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) described that 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.

Case study research, which includes both quantitative and qualitative research paradigms, was used in this study. The important limitations to this research pertained to the following namely, that only data from the role players in the Klerksdorp, South Africa area was available to the researcher to conduct this research. The research approach in this study was both qualitative and quantitative in nature. A qualitative approach was used for the following reasons:

- To assess the current status of maize exports from South Africa and the perception of this maize quality worldwide.
- To verify the existence of relevant codes, framework, standards and best practices and assess their applicability to the specific quality requirements of maize from South Africa.
- To determine the vision and commitment towards food safety and traceability within the target organisation.
- To determine shortcomings in the current FBO practices within the target organisation.

A quantitative approach was used for the following reasons:

- To ensure objectivity, generalisability and reliability.
- To explain and predict the outcome.
- To confirm and validate theory with quantifiable data.

The primary research method was a literature review, which centred on an assessment of the application of food safety and traceability and related concepts. Furthermore, the literature review reviewed selected the maize industry codes, frameworks, standards and best practices. In addition, the literature review addressed a cross section of the elements of FBO's and the reason for not complying with this legislation. A food safety and traceability efficiency survey was conducted amongst personnel directly responsible for specific areas of food safety and traceability within the target organisation.

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 a research the best method will be a mixed method approach as it can be assumed that both qualitative and quantitative approaches can be used to get complete research data.

4.2.2 Case Study Method

A case study method was selected in this research. According to Yin (1994), a 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, aims of case study research is not only to explore certain phenomena, but also to understand them in a particular context.

Yin (1994) further described 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.
- 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 and 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.
- Experimental case study: Where the research examines the difficulties in implementing new procedures and techniques in an organisation and evaluating the benefits.

- Explanatory case study: Where existing theory is used to understand and explain what is happening.

As this study utilised South African food safety regulations and legislation which is applicable to maize export as the existing theory to identify the non-conformance amongst food business operators (FBO's). This will determine whether these FBO's have an appropriate understanding of food safety regulations and legislation in the current maize export process. In this regard, explanatory case study is therefore selected for this research.

4.3 DATA COLLECTION DESIGN

Based on the defined research methodology, the next step is to interpret the data into a detailed survey for data collection. Questionnaire and several semi-structured interviews were used for data collection. According to Badenhorst (2008:184), the questionnaire fall within the ambit of a broader definition of survey research and for absolute clarity, the questionnaire should give reliable evidence of all the data. Remenyi, Williams, Money and Swartz (2002:290) defined that "Questionnaires are the collection of a large quantity of evidence usually numeric, or evidence that will be converted to numbers, normally by means of answering a questionnaire". A questionnaire is list of carefully structured questions, chosen after considerable testing with a view to elicit reliable responses from a chosen sample. The aim is to establish what a selected group of participants do, think or feel. A positivistic approach suggests structured 'closed' questions, while a phenomenological approach suggests unstructured 'open-ended' questions (Remenyi et al, 2002:290).

According to Cooper and Schindler (2006:204; 208: 210-211), three types of interviews are identifiable:

- Unstructured interview: No specific questions or order of topics to be addressed, with each interview customised to each participant.
- Semi-structured interview: Generally starts with a few specific questions, which is then followed using the individual's tangents of thought with the interviewer probes.

- Structured interview: Similar to a questionnaire to guide the question order and the specific way the questions are asked, but the questions generally remain open-ended.

In one of the opinions of Mouton (1991:91), the nature of the study, methodological triangulation can be employed by using posivistic quantitative and qualitative data collection techniques, affirm that triangulation has been accepted as a method, which increases reliability of data while, simultaneously, compensating for any possible limitations that are experienced when applying a single methodology for data collection. In this study, quantitative data were collected by means of questionnaires and qualitative data were obtained from focus group interviews.

The main survey goal is formulated to achieve the primary research objectives that are highlighted in Chapter 1 as follows:

The roles and responsibilities of role-players in maize export process

The main roles and responsibilities of role-players in maize export process and its performance measurements were listed in Section 3.2 of Chapter 3 (Table 3.1) which formed part of the statements in the questionnaire. These key measurements include registration of FBO's, application processing time, allocated codes, verification of FBO detail for audits, updates according to the DoA FBO database, unauthorised FBO, et cetera .

The key elements of food safety systems which is applicable to maize export process

It is intent to identify whether FBO's follow food safety systems in order to maintain the quality of maize product in the logistical process. It consists of hygiene conditions, measurements, products and their control such as HACCP system and CAC.

Collect data on factors that affect the quality of maize product in the logistical process

The key factors that affect the quality of maize product in the logistical process were identified through detailed literature review in Chapter 3. These key factors include maize handling and transportation, poor traceability, hygiene training of the personnel, record keeping, non conformance pertaining to maize export, low awareness of risks, and poor health concern.

An effective approach for the improvement for the maize export process

Based on the key factors and the main risks of non-conformance in the logistical process for maize export, an effective approach can be determined for the improvement of logistical process management for maize export.

While various measurement scales are available for academic research, a five-scaled Likert scale style (i.e. from strongly disagree to strongly agree was coded as from 1 to 5) was adopted in the questionnaire (Appendix B) to capture the opinions from participants. Participants are asked to respond to each of the statements, by choosing one of the five agreement choices. According to Emory and Cooper (1995:180-181), there are many advantages in using the Likert scale, namely:

- Easy and quick construction.
- Each item meets an empirical test for discriminating ability.
- The Likert scale is also treated as an interval scale
- The Likert scale is probably more reliable than other scale, and it provides a greater volume of data.

4.4 SAMPLING

Organizations in the maize export industry in the South Africa were selected as the chosen respondents. It was expected of these respondents to already have a successful HACCP procedures implemented in their organization. A semi-structured questionnaire was sent to organizations to establish who are responsible for the HACCP implementation in the company and also the different certifications of the organization.

The target population in this study involves 50 organisations in the Free State, South Africa. 127 employees or transporters were participated in the study. All these samples were selected randomly during the period of March to May 2012.

4.5 VALIDITY AND RELIABILITY OF THE STUDY

4.5.1 Validity

According to Collis and Hussey (2003:186), 'validity' is concerned with the extent to which the research findings accurately represents what is happening, and more specifically, whether the data is a true picture of what is being studied. They further indicated that construct validity relates to the problem that there are a number of phenomena, which are not directly observable, such as motivation, satisfaction, ambition and anxiety.

Cooper and Schindler (2006:318-320) described three major forms of validity can be identified, namely ‘content validity’, ‘criterion-related validity’ and ‘construct validity’, which is expanded upon below to provide a holistic perspective of each of the concepts:

- Content validity: Content of the measuring instrument is the extent to which it provides adequate coverage of the investigative (sub-) questions guiding the study. If the instrument contains a representative sample of the universe of subject matter of interest, then content validity is good.
- Criterion-related validity: Reflects the success of measures used for prediction or estimation. Any criterion measures must be judged in terms of the following four qualities:
- Criterion is relevant: If the criterion is defined and scored in the terms the researcher can judge the proper measures of success.
- Freedom from bias: When the criterion gives each respondent the opportunity to score well.
- Availability: The information specified by the criterion must be available.
- Construct validity: In attempting to evaluate construct validity, both the theory and the measuring instrument being used should be considered.

In order to confirm the data validity, the researcher observed the attitude and behaviour of participants during his daily work, which enabled him establish a basic understanding for the design of the questionnaire and interview. The data validations will include the methodology, the experience of the data collection, the assessment of the validity of the data and the analysis of the data. It will give answers to the value of the research, the purpose and the achievements with the research.

4.5.2 Reliability

Reliability also referred to as 'trustworthiness', is concerned with the findings of the research. According to Collis and Hussey (2003:186), the findings can be said to be reliable if you or anyone else repeated the research and obtained the same results. There are three common ways of estimating the reliability of the responses to questions in questionnaires or interviews, namely 'test re-test method', 'split-halves method' and the 'internal consistency method' (Collis & Hussey, 2003:186):

- Test re-test method: The questions are asked of the same people, but on two separate occasions. Responses of the two occasions are correlated and the correlation coefficient of the two sets of data computed, thus providing an index of reliability.
- Split-halves method: The questionnaires or interview record sheets are divided into two equal halves. The two piles are then correlated and the correlation coefficient of the two sets of data computed, thus providing an index of reliability.
- Internal consistency method: Every item is correlated with every other item across the entire sample and the average inter-item correlation is taken as the index of reliability.

It is perhaps Cooper and Schindler (2006:321), who provides the most practical explanation of the concepts ‘validity’ and ‘reliability’, using an archer's 'bow and target' as an analogy. The example from Cooper and Schindler (2006:321) is reformatted here to meet the requirements of this research guide using the 'bow and target' example, reads as: “High reliability means that repeated arrows shot

from the same bow would hit the target in essentially the same place. If we had a bow with high validity as well, then every arrow would hit the bull's eye. If reliability is low, arrows would be more scattered. High validity means that the bow would shoot true every time. Arrows shot from a high-validity bow will be clustered around the bull's eye, even when they are dispersed by reduced reliability. Low validity shots are distorted, and would not hit the bull's eye. When low validity is compounded by low reliability, the pattern of arrows is not only off the bull's eye, but also dispersed'. In this study, the reliability of data was tested through the value of Cronbach Alpha coefficient.

4.6 DATA ANALYSIS

Mouton (2011:99) suggested that data analysis is the process of bringing order, to the following stages:

- Identifying and selection all your data sources.
- Using existing measuring instruments for validity and reliability assessments
- Developing new measuring instruments for design, construction and piloting the data.
- Collecting or gathering all the data.
- Doing fieldwork by using the data documentation.
- Data capturing and data editing.
- Data analyses and interpretation.

The data were received in questionnaires, which were coded and captures on a database that was developed on SPSS for this purpose. These questionnaires were captured twice and then the two datasets were compared to make sure that the information captures was correctly. When the database was developed use is made of rules with respect to the questionnaire that set boundaries for the different variables (questions).

In this study, data were analysed through SPSS statistical programme to generate demographical results, descriptive and inferential statistical results. Descriptive statistics were given for each variable and only the respondents

who completed the entire questionnaire were utilized in the inferential statistics. In essence, the reliability of the statements in the questionnaire posed to the respondents from information of role players in the Central Free State, South Africa are measured by using the Cronbach Alpha tests. A detailed factor analysis was carried out to identify the key factors that affect the product quality in the logistical process for maize export.

A Uni-variate descriptive analysis was also performed to generate frequencies, percentages, means, standard deviations, range, median, et cetera.(refer to chapter 5 table 5.3.5 page 107).

4.6.1 Inferential statistics

Inferential statistics focused on the following methods:

- Cronbach Alpha test.
- Chi-square tests.
- Kruskal-Wallis test.
- Wilcoxon Two-Sample Test.
- Mann-Whitney U test.
- Probability value—measure statistical significance.

According to Nunnally (1978:245), the acceptable levels of Cronbach Alpha Coefficients for each item are more than 0.70 (Table 5.3: page 101), and thus these items (statements) in the questionnaire prove to be reliable and consistent for all the items in the scale. The results of the Cronbach Alpha tests for the raw variables are shown in Table 5.3: page 101. It shows the correlation between the respective item and the total sum score (without the respective item) and the internal consistency of the scale (coefficient alpha) if the respective item would be deleted (Nunnally, 1978:245). By deleting the items (statements) one by one each time with the statement with the highest Cronbach Alpha value, the Alpha value will increase. In the right-most column of which will be shown later, it can be seen that the reliability of the scale would be higher if any of these statements is deleted.

According to Cooper and Schindler (2001:499), The Chi-square (two-sample) tests are the technique that is used to test for significant differences between the observed distribution of data among categories and the expected distribution based on the null hypothesis. It has to be calculated with actual counts rather than percentages.

4.6.2 Descriptive statistics

According to Collis and Hussey (2003:66), descriptive research refer to a research that describes phenomena as they exist, while analytical research is a continuation of descriptive research, and aims to understand phenomena by discovering and measuring causal relations among them. It also describes applied research as the type of research in which the results or findings can by used to solve a specific, existing problem.

4.7 CONCLUSIONS

In conclusion, this chapter provided a description of research design and methodology applied. According to the APS Act (South Africa, 1990:2), FBO's need to register their businesses to comply to South African legislation. This is to ensure that maize products can become fully traceable and that food safety regulations are adhered to, in order to achieve high perception values when we export our products.

This means that all role-players in the maize export logistical chain must adopt innovative approaches and techniques as well as working together to develop a safer end-product which other countries want to buy. In order to meet customer's requirements and needs, FBOs should look at both the technical and commercial aspects of their exported product, and create new, innovative approaches such as just in time (JIT). This can be used to streamline export operations and the supply chain, which will then be applied to product safety and traceability in order to increase maize export profitability.

CHAPTER 5: RESULTS AND DISCUSSION

5.1 INTRODUCTION

This chapter provides a detailed discussion on the results of the data analysis. It includes analysis method, where the validation of the study results and data formulated were discussed. The results and discussion as the main section in this chapter, it includes the demographical-, descriptive- and inferential statistics with detailed discussions. In addition, a technical report with graphical displays was provided. The survey was conducted in the Free State amongst Food Business Operators (FBO's) who employ between 1 and 500 employees. The main aim of this survey is to generate the results of conformance and non-conformance of these FBO's in terms of South African Food Safety regulations and legislations. In this study, the data obtained from the completed questionnaires will be presented and analysed by means of various analyses such as uni-variate, bi-variate and multivariate analysis.

5.2 ANALYSIS METHOD

The data were analysed through SPSS 19 version. As descriptive statistics, frequency tables are displayed in the following sections which show the distributions of the responses. Descriptive statistics is used to summarise the data. As a measure of central tendency and dispersion, Table 5.3 shows the means and standard deviation of all the statements.

A descriptive analysis was performed based on the survey results returned by the research questionnaire respondents are reflected below.

5.2.1 Validation of the study results

The responses to the questions obtained through the questionnaires are indicated in table format for ease of reference. A database was developed in

order to test for responses that were out of the set boundaries. The database in which the data was captured was developed so that data validation was ensured. There are build-in boundaries and rules so that any mistakes made by the data capture could be detected. Other measures to ensure data validity was to capture the information twice and then compare to see whether any mistakes were made and correct it. Data validation is the process of ensuring that a program operates on clean, correct and useful data. The construct validation however can only be taken to the point where the questionnaire measure what it is supposed to measure. Construct validation should be addressed in the planning phases of the survey and when the questionnaire is developed. This questionnaire was designed to measure the constraints to FBO's in the maize export process from farm to port.

5.2.2 Data Format

The data in table 5.1 was sourced from the DAFF, APS Act 119 of 1990 as promulgated in notice R 707 of 13 May 2005, the standard operating procedure on management, allocation, update and access to the food business operator systems and adapted by researcher to suit the maize export role players. The original questionnaire format was coded according to a predetermined coding scheme and captured on a database in SPSS (V.19), which was developed for this purpose. All the demographical information and statements from the questionnaire (Appendix B) as variables were coded as A to G (Table 5.1). The category G represents the demographical data, and category A-E coded for the Likert scale types statements, where category F as the "Yes" and "No" types questions. This information was then analysed.

Table 5.1: Code of all variables

No.	Variables	Code
1	Gender	G1
2	Qualifications	G2
3	Classify your organization	G3
4	Province that your organization operates	G4
5	Number of employees	G5
6	Check on registration for FBO numbers	G6
7	Years of your organization pursuing food safety	G7
8	Type of food safety system has your company in place	G8
9	Your current position	G9
10	You are producers/companies that were identified during export certification	A1
11	You have experienced cases of returned applications to the FBOs	A2
12	You have experienced wrongly allocated FBO codes	A3
13	You update the FBO database with new allocations within 5 working days	A4
14	You verify FBO detail whilst loading/conducting food safety audits	A5
15	All FBO's updated or confirmed their information within the indicated time slot	A6
16	Unauthorized FBO's isolated with the export certification/transport process	A7
17	You are aware of that all exporters must pay inspection levies regularly	B1
18	You always handle maize hygienically during the transportation process	B2
19	You protect maize by avoiding any contamination or poisonous materials	B3
20	You store maize in an environment of clean, non-toxic and absorbent material and water-resistant	B4
21	Walls and joints in the storage premises/transporter are always formed properly and easy to clean.	B5
22	The surroundings of your storage premises/transporter are in a nature that cannot contaminate or contribute to the contamination of maize	B6
23	Maize is inspected at random for possible hazardous or toxic substances at all entry ports/loading sites	C1
24	Port Health Services monitors and evaluates entered maize through the ports and monitoring entering of all serious contaminated cargo	C2
25	Authorities/producers take the lead on removing contaminated maize from producers.	C3
26	Authorities inspect all exported maize at ports and borders, and screening for radiation contamination	C4
27	Refused/rejected shipments for maize export due to quality problems such as broken and damaged maize parts, growth of moulds, dirt, filth, et cetera.	C5
28	The service and negotiating contracts in maize export processes is costly	D1
29	The collection of information in maize export processes takes a long time	D2
30	The legalization and monitoring or enforcement for the maize export processes is complicated	D3
31	The maize inspectors check on your products regularly	D4
32	Your maize products are covered by insurance company in export process	D5
33	You are aware of the logistical supply chain risks for maize export	D6
34	You understand the South African laws for maize export	D7
35	The harmonizing approach of production, processing, and distribution throughout the supply chain did improve your maize export process	E1
36	Contracts signed by role players for export markets did formalize the specifications and improved the maize export process	E2

No.	Variables	Code
37	Better coordination among role-players did improve the maize export process	E3
38	A sound plan for more economic delivery routes improved the maize export process	E4
39	Contracts among role players pertaining to the maize quality for a minimum grade and condition standards improved the maize export process	E5
40	Do you know that transporters/producers sell maize by following the prices from SAFEX	E6
41	You always make sure that the quality of maize for export meets the requirements of your contract by means of legislation	E7
42	You always forecast any circumstances that can affect the maize export processes	E8
43	Food Safety in the logistical supply chain management process mean for you as a percipient	F1
44	You know what happened when the numbers of FBOs do not comply with traceability	F2
45	You understand the FBO process	F3
46	When non-conformances were found to be MAJOR and MINOR in control points, it cannot be rectified by the FBO within 28 days.	F4
47	If no action plan is provided, the FBO will be scheduled for a verification audit within 28 days. Failure to comply will result in a suspension to export.	F5
48	When the traceability plan is inadequately addressing the risk, the FBO will be suspended from maize export, until the FBO can prove compliance.	F6
49	When the risk is addressed with the suggested action plan, the plan will be evaluated within 2 working days, and if approved verification audit will be scheduled to verify compliance with the action plan?	F7
50	Have you been investigated by Government inspector(s) or local authority? Regarding the inspection premises, facility, activity or circumstance which gave rise to the prohibition and the If yes, please indicate briefly.	F8

5.3 RESULTS AND DISCUSSION

This section provides the detailed results and discuss of the study. It includes demographical, descriptive statistics, inferential statistics, and a technical report.

5.3.1 Demographical Statistics

The demographical statistics include the analysis of gender issue, educational level, classify your organization, where does your organization operate, number of people employed by your organization, does your organization check that all the transporters are registered by the Department of Agriculture Forestry and Fisheries for food business operator numbers, how long (specify years), has your organization/production unit been pursuing food safety, what food safety

system (specify the system) has your company in place, and what is your current position in your company.

Figure 5.1 showed that the male participants are the dominant group in the maize export industry as it counts 91.3%, where only 8.7% were female. Based on the record from PPECB in the recent years, male farmers and the owners of maize production and exporters still remain as the dominate food business operators in South Africa.

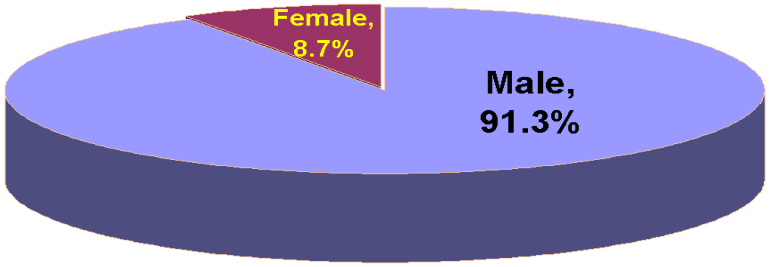


Figure 5.1: Gender

Based on Figure 5.2, educational level is relatively low. It shows that the general graduate degree and others count 4.7% such as graduates from colleges and professional degree. The majority participants have Grade 12 (56.7%) and Grade 1-11 (18.9%), and nearly 20% participants have post school qualifications.

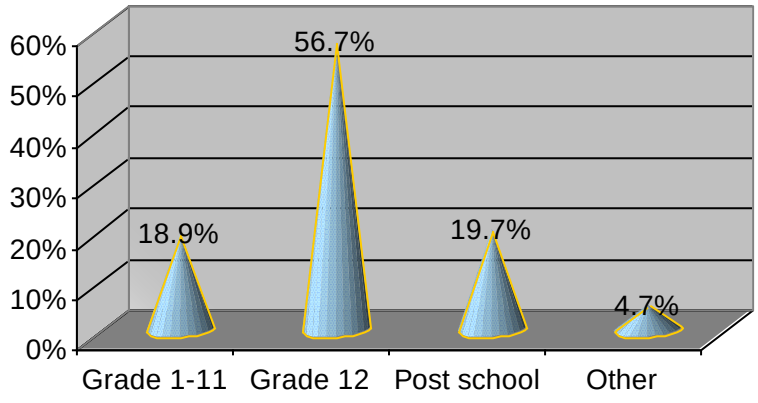


Figure 5.2: Educational level

According to Figure 5.3, showed how the organization was classified. It showed that in general the organizations were registered companies (78.7%), which make it mandatory for them to adhere to all the legislation pertaining to import

and exports of maize, the main legislation include the foodstuffs, cosmetics and disinfectants act, health act, the international health regulations act, the APS act, the fertilizer and farm feeds, agriculture remedies and stock remedies act, the plant breeders act, the agricultural pests act, the plant improvement act the genetically modified organisms act, the perishable products export control board act, the consumer act, and the customs act, and others that is count 14.2% such as transporters and farms. Because the values is relatively low it will be a good thing for them to be educated in order to adhere to all legislation, but the perception they had is that the companies they deliver the maize, must have all the food safety systems and traceability requirements in place and not them they are too small too spent the extra money on food safety and traceability. Some participants of this research was trust owned companies (3.1%) and others (3.9%) were mainly sub contractors to transport the maize to the silo's or ports.

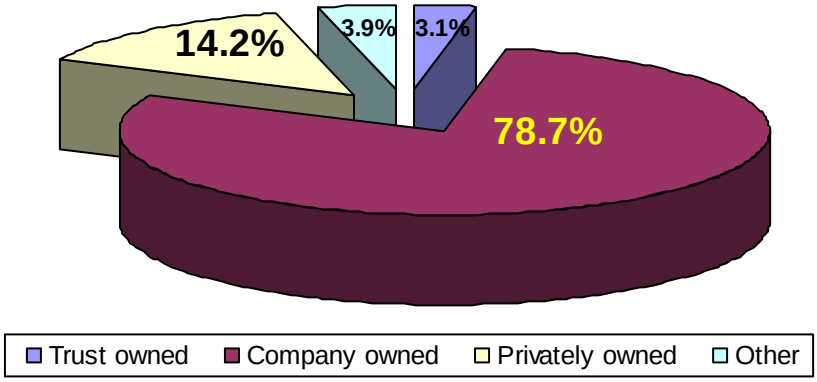


Figure 5.3: How the organization was classified

Figure 5.4 shows in which provinces the organization operates. It showed that in general the organizations were operating from the Free State (67.7%), in Kwazulu Natal (29.1%) were operating there in which indicate that the most maize have to be transported long distances to our borders or ports which make the risks is so much higher because of the distances the maize travels from the farm to place of export. In Limpopo (2.4%) were operating from which indicate that all the export maize have to travel by transporters and the risks is always there that the maize export traceability and food safety procedures are not being followed correctly, the other (0.8%) indicates the other 9 provinces where the maize is being transported from for exports.

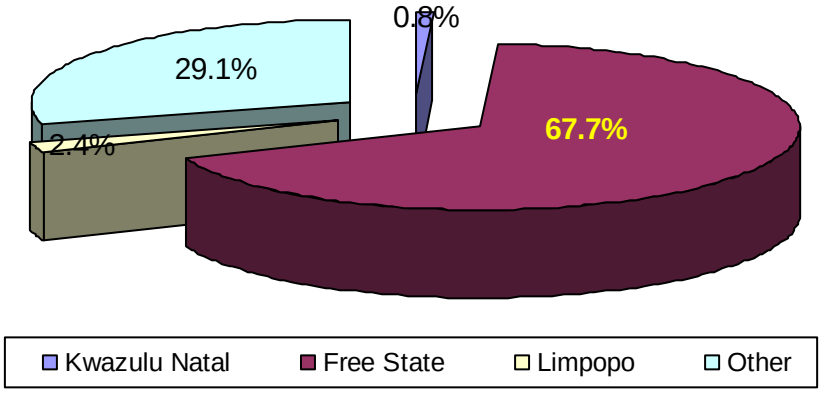


Figure 5.4: Where the organisation operates

Figure 5.5 shows the total amount of employees that the organisations has, which export maize. It indicates that there is quite a substantial amount of employees working in the maize industry and if the role players don't follow the correct procedures and adhere to legislation there could be serious job losses, when the perception of the buyer of the maize is that our maize is of an inferior quality with no food safety systems and food traceability in place. There were no other statistically significant differences between the management and employees when comparing them with respect to their responses on the questions.

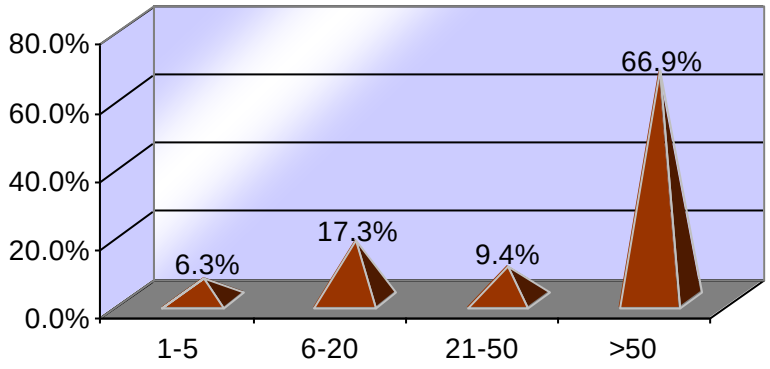
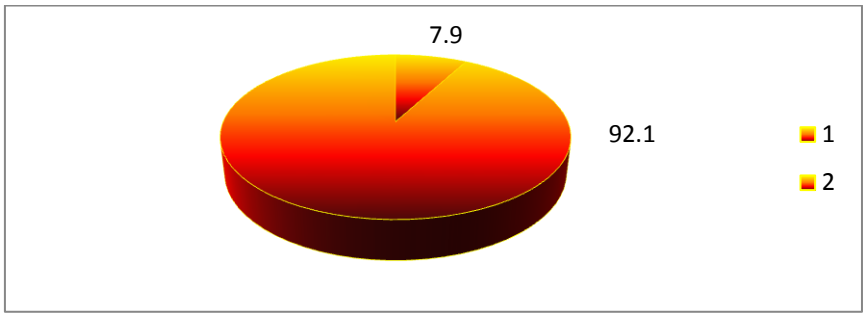


Figure 5.5: Total amount of employees of the organizations

Figure 5.6 below shows the question: Does your organization check that all the transporters are registered by the Department of Agriculture Forestry and Fisheries for Food Business Operator numbers, indicates that there is quite a substantial amount of 92.1 percent does confirm that the company check for the

correct FBO numbers, it is a positive finding for our maize industry and only 7.9 percent does not check if the FBO number is registered or correspond with the transporter.



5.6 Does your organization check that all the transporters are registered by the DAFF for FBO numbers?

Figure 5.7 - The findings were that in the 6-10 years food safety system category, it was indicated that there was a substantial amount of 66.9 percent that had been pursuing some sort of food safety system which indicates that food safety in the maize industry does exist for a few years already and that is a positive finding for our maize industry. The other findings were in the 0-5 years, category 18.9 percent have been pursuing some sort of food safety system, which show food safety is relatively new to those companies, in the 11-20 years category 3.9 % follows a food safety system, and in the more than 20 years category which indicates that the food safety and traceability of maize still got a long way to go before a full food safety and traceability system as required by legislation will be fully implemented.

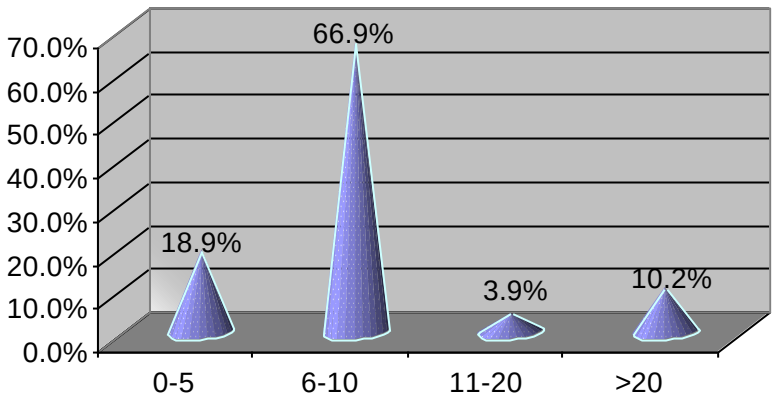


Figure 5.7: Years of your company has pursuing FBO codes

In Figure 5.8, the question stating “What type of food safety system has your company in place?” the majority of the companies (74%) indicated that their companies follow a HACCP food safety system, but the employees of the company did not know that the FBO number is on the invoices, which indicate that a lot of training must be done for the employees to understand the food safety and traceability. Nearly 18.9 **%** claimed that they are following other systems, such as ISO 22000 ISO 19001:2003 or ISO 14001 which is other food safety systems. Only 3.9% and 3.1% follow ISO13030 (a food safety process that includes all the stages of food safety) and ISO9001:2008 (a documented food safety process) respectively.

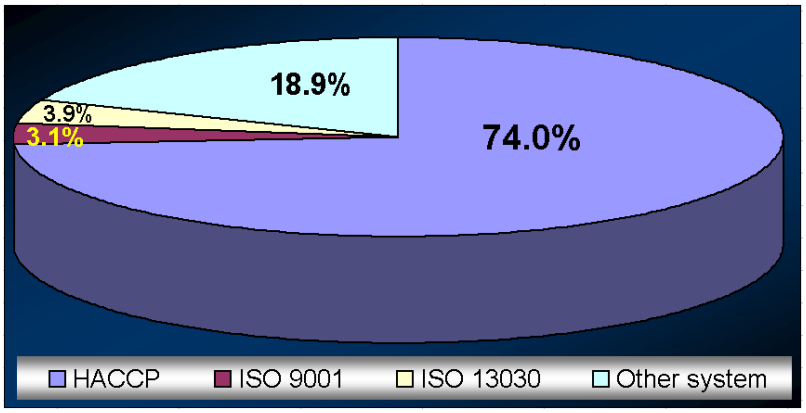


Figure 5.8: What type of food safety system has your company in place

Figure 5.9 Shows that the participants of the questionnaire was (37.8%) general managers which run the companies and is in charge should there be a recall of their maize. It shows that (26.8%) was senior managers that also have to take responsibilities for the quality and food safety management of the companies and is also responsible for the training of junior personnel like office staff, if they adhere to the food safety and traceability legislation of the maize exports then all of South Africa will have qualified and trained personnel to export maize. The logistical employees is one of the most important role player that must adhere to the maize legislation as the quality of service for an exporter is high on their lists of client satisfaction, and although transport costs are excessive and can create major barriers such as overloading, fines, theft, potholes and competition from other export transporters is a real threat to them, it can become the major reason for rejection at the ports and borders as they are an essential link to the

food safety and traceability of the maize has been jeopardized because of the transporter unwillingness to adhere to legislation.

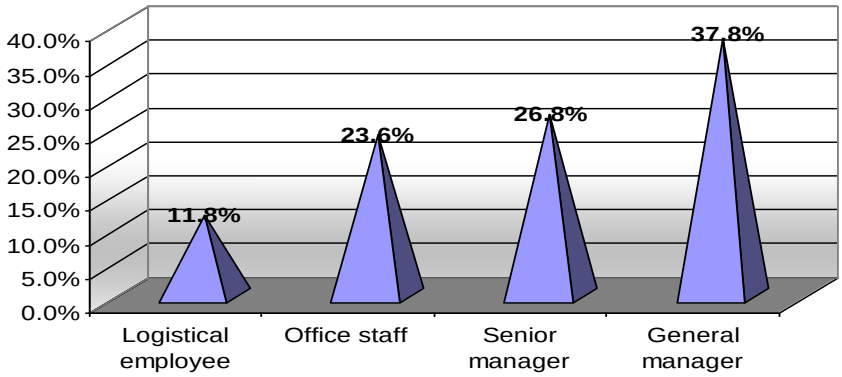


Figure 5.9: Position held in the organization

5.3.2 Descriptive Statistics

This questionnaire was tested for descriptive statistics by using the measures of central tendency, variation and shape. The arithmetic mean and standard deviation was tested and found to be reliable and consistent. According to Levine, Ramsey and Smidt (2001:103-104), most sets of data will show a distinct tendency to group or cluster about a central point, which make it possible with a set of data to select typical values or averages to represent the entire set. Descriptive value is referred as a measure of central tendency.

Fifty questions were asked in the questionnaire. These questions are designed to collect the opinions from role players on the key components of the FBO legislation. Descriptive statistics was performed on all variables see table 5.2; displaying means, standard deviations, frequencies, percentages, cumulative frequencies and cumulative percentages. Refer computer printout in Annexure B.

Table 5.2: Descriptive Statistics (n=127)

Var	R	Min.	Max.	Mean	SD.	Skew.	Kurt.
G1	1	1	2	1.09	.282	2.975	6.958
G2	3	1	4	2.10	.754	.505	.258
G3	3	1	4	2.19	.545	1.587	3.489
G4	4	1	5	2.91	1.380	.820	-1.287
G5	3	1	4	3.37	.985	-1.199	-.033
G6	1	1	2	1.92	.270	-3.166	8.150

Var	R	Min.	Max.	Mean	SD.	Skew.	Kurt.
G7	3	1	4	2.06	.800	1.129	1.395
G8	4	1	5	1.91	1.616	1.314	-.189
G9	3	1	4	2.91	1.042	-.449	-1.049
A1	4	1	5	3.89	1.624	-.993	-.743
A2	4	1	5	1.99	1.530	1.134	-.359
A3	4	1	5	1.46	.974	2.009	3.167
A4	4	1	5	1.69	1.282	1.652	1.388
A5	4	1	5	2.08	1.670	1.027	-.789
A6	4	1	5	1.91	1.496	1.248	-.093
A7	4	1	5	2.09	1.638	1.004	-.781
B1	4	1	5	4.09	1.623	-1.318	-.158
B2	4	1	5	4.87	.706	-5.315	26.963
B3	4	1	5	4.85	.725	-4.978	23.843
B4	4	1	5	4.83	.788	-4.630	20.127
B5	4	1	5	4.83	.788	-4.630	20.127
B6	4	1	5	4.87	.634	-5.566	31.497
C1	4	1	5	4.76	.930	-3.784	12.688
C2	4	1	5	4.04	1.540	-1.233	-.160
C3	4	1	5	4.68	1.015	-3.156	8.607
C4	4	1	5	4.68	1.023	-3.115	8.312
C5	4	1	5	4.71	1.001	-3.342	9.631
D1	4	1	5	4.72	.948	-3.502	10.976
D2	4	1	5	4.35	1.400	-1.872	1.721
D3	4	1	5	4.51	1.221	-2.342	3.912
D4	4	1	5	4.70	.970	-3.284	9.584
D5	4	1	5	4.74	.945	-3.589	11.449
D6	4	1	5	4.76	.932	-3.736	12.412
D7	4	1	5	4.59	1.122	-2.694	5.800
E1	4	1	5	4.71	.960	-3.370	10.148
E2	4	1	5	4.65	1.072	-3.001	7.414
E3	4	1	5	4.73	.921	-3.526	11.261
E4	4	1	5	4.70	.929	-3.295	10.020
E5	4	1	5	4.82	.791	-4.553	19.571
E6	4	1	5	4.60	1.156	-2.699	5.615
E7	4	1	5	4.76	.932	-3.736	12.412
E8	4	1	5	4.65	1.051	-2.918	7.135
F1	2	1	3	1.06	.302	5.207	28.164
F2	2	1	3	1.14	.393	2.841	7.928
F3	2	1	3	1.28	.499	1.586	1.640
F4	2	1	3	1.35	.496	.813	-.865
F5	1	1	2	1.34	.475	.690	-1.548
F6	1	1	2	1.32	.469	.767	-1.435
F7	2	1	3	1.35	.494	.853	-.789
F8	2	1	3	1.73	.479	-.613	-.545

R—Range; Min—Minimum; Max—Maximum; SD—Standard Deviation; Skew—Skewness; Kurt—Kurtosis

The mean is the most common measure of central tendency; this is done by summing up the observed numerical values of a variable in a set of data and then dividing the total by the number of observations involved.

Table 5.2 shows the descriptive statistics on all the 50 items among a group of samples (n=127). The basic statistic parameters that were evaluated: mean – average value, min and max – values, range – difference between max and min, SD – Standard Deviation, Skew – Skewness and Kurt – Kurtosis, in order to determine the differences between groups using an univariable analysis (ANOVA). The results also showed that the observations are within a good mean and standard deviation. It makes it a more than the acceptable standard tendency for data of all the observations. The descriptive statistics for all the variables in the questionnaire measuring the FBO's, description and the employee's responses to the questionnaire with respect to quality with the frequencies in each category and the percentage out of total number of questionnaires. It is of importance to note that statistics are based on the total sample.

The only comparisons that could be made was between silos, transporters and suppliers to determine whether they agreed in their responses to the food business operator codes. No comparative statistics were done due to small sample size. The statistically significant results are shown in Table 5.10 and all the rest of the comparisons can be seen in Annexure B as SPSS printouts.

Firstly, all the companies that filled in the questionnaire were compared with employees who filled in the questionnaire with respect to the questions posted to them. Secondly a comparison was made between the responses of management for 32 companies and their employees who filled in the questionnaire for each company. The test used to compare the managers with the employees is the chi- square test with Fisher Exact test where there were expected values of less than 5 in a cell. All the statistically significant differences are discussed in this paragraph and all the tests are shown in Appendix C.

Table 5.2 shows the results of central and dispersion parameters. It describes the mean and the median which are summary measures used to describe the most "typical" value in a set of values. Statisticians refer to the mean and

median as measures of central tendency. The overall results of the mean value were average (Median), because the standard error of the mean (Error) was always as much as five times lower than its mean. The values of the basic, central and dispersion parameters in the range of minimal and maximal results (Range) always had five or more standard deviations (SD). It can therefore be concluded with certainty that the results had a very high level of sensitivity that all the role-players have knowledge of FBO numbers. There exists the optimal distribution curve in the zones around the mean value (Skew). Skewness indicates that the variable that shows the number of the role–players had slightly more positive results towards FBO numbers. However, Kurtosis, whose value was significantly higher than 2.75, points out that the distribution does not differ from the norm, which further means that the results of these questionnaires are trustworthy. This can be explained with different companies that have a role to play in the export process.

5.3.3 Inferential statistics

The following inferential statistics are performed on the reliability test, Chi-square test to compare management and employees, and ANNOVA with Friedman's test.

The reliability of the statements in the questionnaire posted to the sample respondents are tested by using the Cronbach Alpha tests. Cronbach Alpha is an index of reliability associated with the variation accounted for by the true score of the "underlying construct". Construct is the hypothetical variables that are being measured (Cooper & Schindler, 2006:216-217). More specific, Cronbach alpha measures how well a set of items (or variables) measures a single uni-dimensional latent construct. The reliability test (Cronbach Alpha Coefficient) was done on all the items (statements), which represent the measuring instrument of this survey, with respect to the responses rendered in this questionnaire.

In table 5.2 statistical computations refer to the basic statistic parameters that were evaluated: Column 5 describes arithmetic mean that is the most commonly used measure of central tendency, it was calculated by summing the observed numerical values of a variable in the set of the data taken from the FBO's that completed the questionnaire and then dividing the total by the number of the observations that was involved. The average value, min and max values, the difference between max and min, and the range was also calculated. The control charts for central tendency (x bar chart) and the variation (r chart and s chart) was performed to calculate to calculate the standard deviation, of each sub-group. A symmetrical distribution was defined where a vertical line is drawn through the mean of the distribution that was depicted by a histogram, as the data was not symmetrical but asymmetrical which mean the data can be either positively or negatively skewed, that is the reason why the skewness was analysed. Kurtosis, was also analysed to calculate the relative concentration of the values in the centre of the distribution as compared to the tail tests, in order to determine the differences between groups if it was leptokurtic (very big), mesokurtic (not so big), or platykurtic (very low). The conclusion was t a mesokurtic distribution as figure 5.2 indicates because of the distribution that had a prominent peak and the relatively large proportions of the values that fall within the tails.

According to Table 5.3, the Cronbach Alpha Coefficients for all 50 items in the questionnaire was at 0.895 which was more than the acceptable level of 0.70; this questionnaire proves to be reliable and consistent.

TABLE 5.3: Cronbach Alpha Coefficients

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.895	.896	50

By studying Table 5.4, where the results of central and dispersion parameters are shown, we can conclude that overall results of the mean value were good (Mean), because the standard error of the mean (Error) was always as much as five times lower than its mean. The values of the basic, central and dispersion

parameters in the range of minimal and maximal results (Range) always had five or more standard deviations (SD), whence we can conclude with certainty that the results had a very high level of sensitivity of the FBO numbers. There exists the optimal distribution curve in the zones around the mean value (Skew). Skewness indicates that the variable that shows the number of the role players had slightly more positive results towards FBO numbers. However, Kurtosis, whose value was significantly higher than 2.75, points out that the distribution does not differs from normal, which further means that the results of these questionnaires are rather trustworthy. This can be explained with different companies that have a role to play in the export process.

Table 5.4: Item-total statistics

VAR	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
G1	166.17	429.809	.068	.896
G2	165.17	430.844	-.023	.897
G3	165.07	437.699	-.319	.899
G4	164.34	436.611	-.136	.902
G5	163.90	415.501	.354	.894
G6	165.33	430.464	.015	.896
G7	165.22	427.278	.086	.896
G8	165.35	462.597	-.496	.910
G9	164.36	417.911	.273	.895
A1	163.35	404.805	.360	.894
A2	165.26	417.187	.178	.898
A3	165.80	418.880	.271	.895
A4	165.60	412.723	.322	.894
A5	165.21	405.221	.341	.895
A6	165.37	407.532	.352	.894
A7	165.17	407.100	.315	.895
B1	163.18	401.830	.402	.894
B2	162.40	410.993	.668	.891
B3	162.41	410.948	.652	.891
B4	162.44	412.424	.549	.892
B5	162.44	411.656	.574	.892
B6	162.40	417.569	.489	.893
C1	162.50	406.284	.626	.891
C2	163.23	403.283	.404	.893
C3	162.59	402.276	.670	.890
C4	162.59	401.268	.690	.889
C5	162.56	400.361	.729	.889
D1	162.54	400.298	.774	.889
D2	162.90	397.959	.548	.891
D3	162.75	397.419	.651	.889

VAR	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
D4	162.56	400.056	.762	.889
D5	162.52	402.619	.714	.889
D6	162.51	401.276	.762	.889
D7	162.67	406.013	.516	.891
E1	162.55	398.090	.825	.888
E2	162.61	406.064	.541	.891
E3	162.51	406.604	.648	.890
E4	162.56	404.728	.669	.890
E5	162.44	406.585	.733	.890
E6	162.67	401.152	.606	.890
E7	162.51	400.220	.791	.889
E8	162.61	400.912	.680	.889
F1	166.20	433.168	-.204	.897
F2	166.12	433.258	-.166	.897
F3	165.98	431.824	-.067	.897
F4	165.90	432.375	-.093	.897
F5	165.92	430.586	-.006	.896
F6	165.94	431.292	-.042	.897
F7	165.91	433.216	-.134	.897
F8	165.54	429.130	.069	.896

Table 5.5 showed Inter-Item Correlation Matrix. It showed the relationships between all the variables. All the negative values are highlighted as red colour. According to Pallant (2010:123), Pearson correlation coefficients (r) can range from -1 to +1. This shows a positive or negative relationship between variables. Based on the Table 5.5, those negative values showed that the relationships between variables are not significant.

Table 5.5: Inter-Item Correlation Matrix

	A1	A2	A3	A4	A5	A6	A7	B1	B2	B3	B4	B5	B6	C1	C2	C3	C4	C5	D1	D2	D3	D4	D5	D6	D7	E1	E2	E3	E4	E5	E6	E7	E8	F1	F2	F3	F4	F5	F6	F7
A2	0.04																																							
A3	0.14	0.48																																						
A4	0.14	0.51	0.74																																					
A5	0.20	0.51	0.60	0.78																																				
A6	0.17	0.55	0.63	0.79	0.92																																			
A7	0.20	0.48	0.55	0.66	0.89	0.85																																		
B1	0.39	0.23	0.17	0.19	0.28	0.25	0.29																																	
B2	0.35	0.13	0.09	0.10	0.12	0.12	0.11	0.35																																
B3	0.21	0.02	0.10	0.11	0.03	0.01	0.02	0.27	0.60																															
B4	0.31	0.02	0.07	0.09	0.11	0.09	0.11	0.38	0.41	0.62																														
B5	0.23	0.04	0.10	0.11	0.07	0.05	0.06	0.30	0.43	0.64	0.82																													
B6	0.26	0.11	0.06	0.05	0.06	0.06	0.07	0.28	0.54	0.53	0.73	0.81																												
C1	0.38	0.17	0.12	0.11	0.16	0.15	0.15	0.17	0.56	0.44	0.29	0.36	0.46																											
C2	0.54	0.05	0.05	0.14	0.10	0.09	0.11	0.29	0.25	0.40	0.34	0.24	0.22	0.39																										
C3	0.34	0.08	0.08	0.08	0.10	0.08	0.10	0.23	0.49	0.56	0.45	0.51	0.40	0.49	0.40																									
C4	0.23	0.03	0.03	0.00	0.04	0.05	0.05	0.32	0.51	0.58	0.41	0.44	0.37	0.52	0.43	0.62																								
C5	0.34	0.05	0.08	0.11	0.13	0.14	0.12	0.30	0.53	0.60	0.42	0.46	0.43	0.54	0.48	0.74	0.81																							
D1	0.27	0.05	0.05	0.08	0.07	0.07	0.06	0.29	0.56	0.63	0.48	0.57	0.47	0.57	0.41	0.70	0.86	0.88																						
D2	0.12	0.14	0.05	0.08	0.12	0.11	0.10	0.19	0.33	0.37	0.39	0.42	0.32	0.42	0.27	0.42	0.57	0.52	0.63																					
D3	0.14	0.10	0.09	0.07	0.10	0.09	0.04	0.32	0.40	0.45	0.35	0.51	0.39	0.51	0.26	0.51	0.60	0.57	0.68	0.54																				
D4	0.27	0.01	0.01	0.04	0.09	0.10	0.09	0.32	0.54	0.61	0.45	0.51	0.46	0.70	0.38	0.65	0.80	0.73	0.80	0.60	0.71																			
D5	0.30	0.03	0.04	0.05	0.10	0.10	0.07	0.35	0.57	0.64	0.63	0.71	0.68	0.58	0.31	0.52	0.61	0.59	0.64	0.53	0.58	0.78																		
D6	0.30	0.03	0.05	0.05	0.12	0.11	0.09	0.36	0.77	0.65	0.48	0.55	0.49	0.59	0.25	0.56	0.60	0.61	0.67	0.49	0.59	0.80	0.81																	
D7	0.39	0.11	0.11	0.13	0.09	0.08	0.12	0.23	0.45	0.51	0.41	0.49	0.40	0.42	0.46	0.41	0.29	0.42	0.34	0.23	0.30	0.44	0.53	0.56																
E1	0.39	0.02	0.00	0.05	0.09	0.09	0.08	0.33	0.74	0.62	0.54	0.56	0.54	0.57	0.35	0.67	0.73	0.72	0.80	0.50	0.59	0.80	0.72	0.83	0.47															
E2	0.21	0.08	0.07	0.09	0.08	0.06	0.01	0.27	0.36	0.42	0.29	0.18	0.07	0.36	0.26	0.37	0.42	0.42	0.46	0.40	0.49	0.56	0.44	0.59	0.40	0.61														
E3	0.27	0.02	0.03	0.04	0.09	0.08	0.02	0.21	0.56	0.44	0.32	0.30	0.18	0.39	0.23	0.53	0.54	0.50	0.55	0.33	0.40	0.56	0.42	0.59	0.42	0.73	0.63													
E4	0.26	0.02	0.04	0.00	0.06	0.05	0.09	0.24	0.57	0.45	0.33	0.32	0.23	0.40	0.28	0.52	0.57	0.50	0.55	0.35	0.53	0.55	0.43	0.58	0.38	0.72	0.46	0.80												
E5	0.31	0.01	0.06	0.05	0.08	0.08	0.10	0.30	0.64	0.51	0.37	0.36	0.20	0.46	0.29	0.58	0.58	0.57	0.62	0.37	0.47	0.62	0.48	0.65	0.50	0.80	0.55	0.87	0.83											
E6	0.33	0.11	0.09	0.13	0.16	0.16	0.14	0.31	0.44	0.34	0.20	0.24	0.15	0.32	0.27	0.44	0.45	0.45	0.48	0.34	0.57	0.48	0.43	0.50	0.26	0.61	0.52	0.54	0.52	0.63										
E7	0.35	0.08	0.12	0.11	0.17	0.16	0.14	0.33	0.63	0.51	0.33	0.42	0.32	0.63	0.30	0.55	0.62	0.64	0.68	0.51	0.62	0.80	0.68	0.84	0.52	0.81	0.65	0.69	0.66	0.80	0.67									
E8	0.28	0.10	0.10	0.09	0.05	0.04	0.05	0.21	0.57	0.63	0.31	0.34	0.26	0.42	0.28	0.50	0.60	0.55	0.58	0.39	0.52	0.58	0.48	0.60	0.43	0.72	0.58	0.63	0.77	0.71	0.52	0.68								
F1	0.25	0.00	0.01	0.11	0.13	0.13	0.11	0.37	0.30	0.01	0.09	0.01	0.00	0.00	0.21	0.02	0.19	0.15	0.05	0.13	0.09	0.21	0.05	0.28	0.20	0.27	0.32	0.18	0.16	0.22	0.29	0.34	0.21							
F2	0.33	0.05	0.09	0.13	0.10	0.08	0.12	0.29	0.16	0.15	0.05	0.12	0.08	0.08	0.45	0.16	0.28	0.22	0.19	0.15	0.18	0.22	0.02	0.08	0.28	0.14	0.13	0.08	0.08	0.12	0.12	0.14	0.15	0.53						
F3	0.40	0.18	0.23	0.25	0.24	0.22	0.23	0.12	0.07	0.06	0.04	0.04	0.08	0.01	0.31	0.14	0.04	0.06	0.03	0.10	0.04	0.06	0.02	0.01	0.18	0.07	0.07	0.06	0.03	0.03	0.05	0.04	0.03	0.25	0.53					
F4	0.45	0.22	0.21	0.28	0.27	0.23	0.24	0.13	0.07	0.05	0.08	0.02	0.07	0.13	0.39	0.12	0.12	0.17	0.06	0.01	0.05	0.07	0.00	0.02	0.21	0.09	0.14	0.05	0.04	0.00	0.11	0.07	0.02	0.38	0.51	0.69				
F5	0.39	0.25	0.24	0.28	0.26	0.22	0.25	0.08	0.04	0.06	0.01	0.07	0.05	0.03	0.33	0.03	0.03	0.02	0.07	0.09	0.10	0.09	0.13	0.12	0.18	0.04	0.08	0.06	0.05	0.00	0.12	0.01	0.05	0.24	0.42	0.67	0.93			
F6	0.37	0.23	0.22	0.26	0.24	0.20	0.23	0.10	0.06	0.04	0.02	0.07	0.04	0.11	0.29	0.04	0.04	0.03	0.01	0.03	0.03	0.01	0.12	0.04	0.09	0.01	0.11	0.07	0.02	0.01	0.14	0.02	0.01	0.25	0.48	0.63	0.90	0.93		
F7	0.40	0.25	0.24	0.26	0.26	0.22	0.23	0.18	0.07	0.05	0.17	0.13	0.20	0.20	0.27	0.06	0.09	0.08	0.06	0.04	0.06	0.11	0.14	0.09	0.18	0.12	0.19	0.06	0.04	0.00	0.17	0.14	0.03	0.28	0.40	0.61	0.89	0.88	0.88	
F8	0.20	0.01	0.10	0.01	0.07	0.09	0.12	0.05	0.01	0.05	0.11	0.11	0.05	0.04	0.20	0.02	0.09	0.08	0.13	0.07	0.07	0.06	0.03	0.04	0.11	0.07	0.00	0.01	0.06	0.01	0.05	0.01	0.13	0.07	0.22	0.37	0.40	0.43	0.41	0.39

* Red colour represents negative values

According to the results in Table 5.6, the value of between people, between items and within people, residual, the p-value is at .000, which indicates all the variables between items are significant with regard to FBO numbers.

Table 5.6: ANOVA with Friedman's Test

		Sum of Squares	df	Mean Square	Friedman's Chi-Square	Sig
Between People		1076.727	125	8.614		
	Between Items	13485.845[a]	49	275.221	4381.872	.000
Within People	Residual	5515.535	6125	.900		
	Total	19001.380	6174	3.078		
Total		20078.107	6299	3.188		

Grand Mean = 3.35

a. Kendall's coefficient of concordance W = .672.

Appendix D showed the summary of One-way ANOVA (sig.) of the *P-values* of all the variables (A, B, C, D, E, and F). The P-values are equal or less than 0.05, it indicates that these variables are significant between groups. For example, the p-value of FBOs are producers/companies that were identified during export certification (A1) in terms of gender (G1) issue between groups is at .229, which is not statistically significant. However, A1 verse classification of organisations (G3), years of your organization pursuing food safety (G7), type of food safety system has your company in place (G8), and the current position (G9) are equally at .000, which suggests all of them are statistically significant.

5.3.4 Sample

The target population is FBO's in the maize role-players companies in the Free State. The sample of the population was drawn from 32 organisations in the Free State, Gauteng and Northwest areas who have received the questionnaires. In total 127 respondents from the population of FBO's answered the questionnaire. The items (statements) in the questionnaire will be tested for reliability in the following paragraph.

5.3.5 Uni-variate graphs

It is important to note that there is a high deciding factor for statement A1 to A7. There are a high percentage of participants who were non committal or described as the 'undecided' factor, largely due to the fact that management have a 'don't care' attitude for legislation, other than what is on the invoice. Most silo role-players do register for FBO's, and in the logistical management nobody does register for FBO's instead they do rely on the silos to register and comply to all the legislation .This could be due to the fact that clients are unaware of what the silos do or the legislation. The statements were mostly positive, except for statements A2 and A4, which were stated negatively and thus a negative outcome would be positive. However for statement E8, although also negatively put, the role-players were equally split with respect to whether they agreed or disagreed.

The statements are sorted from the most positive responses to the least positive responses and are represented in Figure 5.10. Overall most of the respondents agreed to strongly agree with all of the statements. The statements resulted in negative responses are those that were stated negatively and thus a negative response can then be seen as positive.

Category A (1-7) was formulated to identify the roles and responsibilities of role-players and whether the FBO's conform to South African maize legislation. Based on the results shown in Figure 5.10, the majority of participants (64.6%) agreed and (20.5%) strongly disagreed with the statements. It was important for the participants to be able to identify the FBO codes (A1). In A3 for example, more than 80% strongly disagreed that they have received wrongly allocated FBO codes (A3); because they aren't sure where the FBO codes are generated, and more than 75% did not update the FBO database with new allocations within 5 working days (A4), as they weren't aware that this is a main condition of the legislation. The statement in (A5) do you verify FBO detail whilst conducting food safety audits, most of the participants disagreed (68.5%). They felt it was unnecessary to verify the FBO details because the producers have account numbers with their companies they know the clients personally.

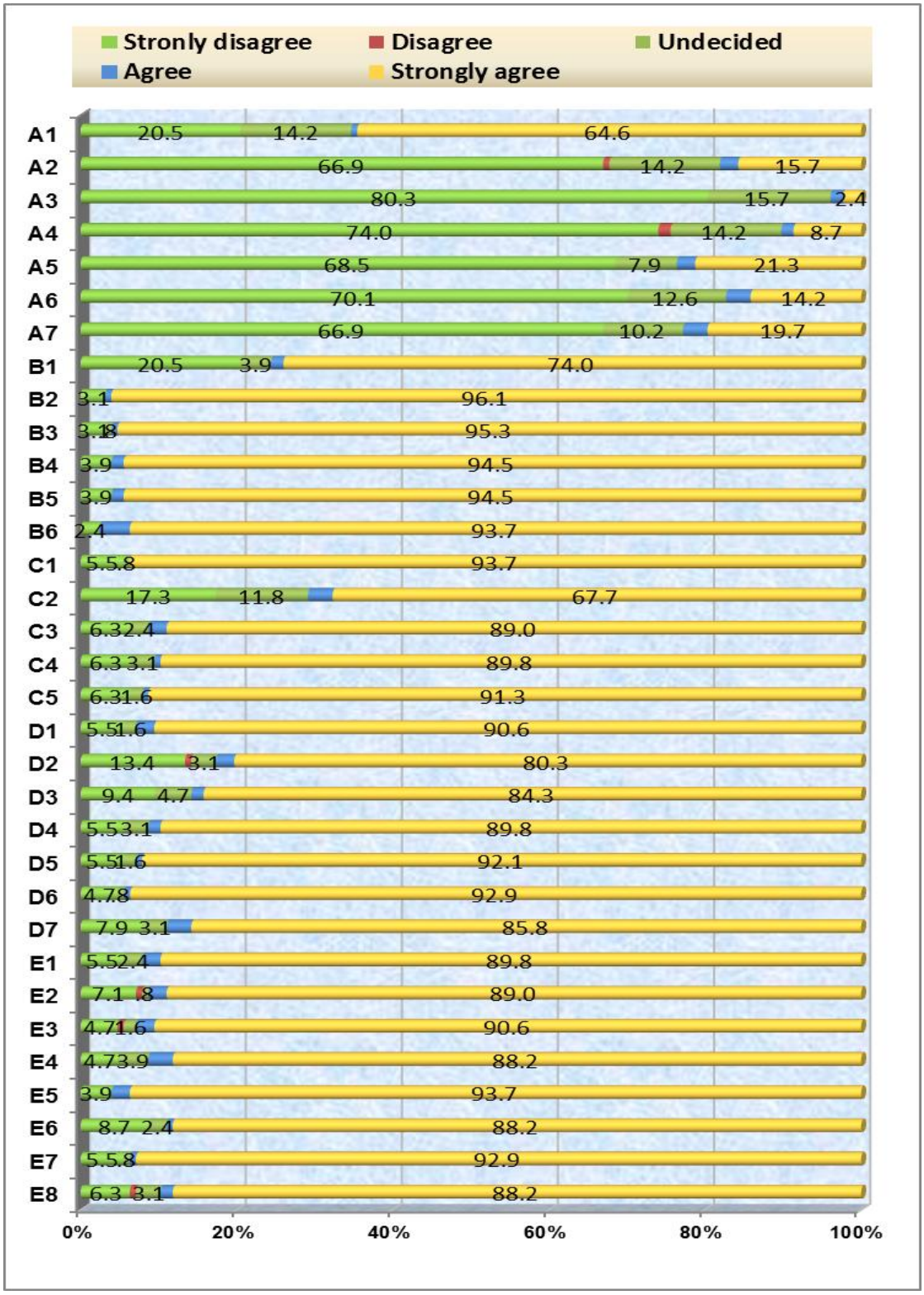


Figure 5.10: Summary of the results of the questionnaires

The statement in (A6) do the FBO update their details within the allocated time slots, most participants disagreed because they did not know FBO codes need to be updated. At a figure of 70.1%, this shows that training is necessary in order to keep them updated with the legislation. Finally the statement, if

unauthorised FBO s were isolated with the export certification process (66.9%) disagreed as if the client pays their monthly accounts then they may use the company facilities to store and export the maize.

Interestingly, based on the results pertaining to statement B1, does your company pay inspection fees regularly, the majority of participants (64.6%) did agree and (20.5%) strongly disagreed with the statements. The answers were based on company computer records and not inspection fees the clients have to pay for the export role-players. This clearly shows that personnel are not aware of the inspection fees to be paid for services rendered at the ports or silos. The undecided factor was high (3.9%) and also come forward in this statement. The reason for this being that the participants are vaguely aware that there are costs involved but could not identify for what reasons were for these inspection fees. They were under the impression that these were service fees to be paid to them by their clients. Then in question B2-B6, most participants also agreed to the statements, the statement asked was about the physical, hygienic and handling practises exercised by the role-players and they strongly agreed. This is because the participants physically notice any quality or handling problems. This shows that the physical handling of maize is important to the role-players in the export process, although they are only vaguely aware that the maize must be handled correctly.

Based on the results showed in Figure 5.11, C1, the statement that maize is inspected at random for possible hazardous or toxic substances at all entry ports/loading sites (93.7%), the majority of participants did strongly agree and (5.58%) were undecided with the statements. The reason for the undecided answers was due to the fact that the companies at which the questionnaires were answered were mainly silos and all the maize in the silos is graded. The results show again that because the maize was physically handled and all the grading was done at the premises, the participants are aware of the reasons for maize being inspected and graded. The results in C2 showed that the statement that Port Health Services monitors and evaluates maize that enters through the ports, controls and monitors the possible entering of all serious contaminated cargo (67.7%) of participants strongly agreed against (17.3%).

Some of the participants knew that the research work was carried out by PPECB and others did not know this. Therefore the participants thought that PPECB was also Port Health Services. This statement is partly true as PPECB, inspectors of DAFF, and employees of Port Health Services, all do inspections on the export maize at ports The undecided factor was high (11.8%) due to a lack of understanding of the various inspection companies. In the statements from C3-C5 all the answers to the statements were on average 90% strongly agree and the rest agree. These answers are very positive as all the role-players are aware of the physical risks in the export process, but training has to be done regarding the legislation of maize exports to ensure role-players understand the risks involved with exports.

Based on the results showed in Figure D1, the statement that, the service and negotiating contracts in maize export processes is costly (90.6%) strongly agree and (5.5%) strongly disagree. This indicates that management understands company costs and expenses. However employees are not aware of these costs. This shows that communication regarding expenses is not discussed with all the role players. In the statements from D2-D6, all the answers to the statements were on average 87% strongly agree and the rest agree. These answers are very positive because all the role-players know about the physical risks. Based on the results showed in Figure D7, in the statement does the participant understand the South African laws for maize export. 85.8% of the respondents strongly agree, 7.9% agree and 3.9% are undecided. The interesting fact in this undecided factor is that the participants are mainly transporters who are unaware of the laws that affect the transport of maize from the silo or farm to the port or border post. As outlined before, training would be highly beneficial for all maize transporters, with an appropriate certificate of competence to be issued. In the statements from D2-D6 all the answers to the statements were on average 87% strongly agree and the rest agree. These answers are once again very positive as all the role-players know about the physical risks.

The harmonising approach of the various stages of production, processing and distribution throughout the supply chain did improve the maize export process in

your organisation, 89.8% strongly agreed is a very positive response, it indicates that most of the role-players feel that the export of maize is seen by them as very important and they follow food safety and traceability management procedures. The other 5.52% who strongly disagree shows that they don't believe inspection and other procedures effect them, and once again show that training must be done to rectify the risks that is involved with the export of maize. In the statements from E2-D8 all the answers to the statements were on average 91% strongly agree and the rest agree. These answers are also very positive as the role-players are aware of the documentation process and that the prices of maize vary from day to day due to its dependence on the SAFEX prices and the time that the maize was handled and stored by the depot or silo.

To conclude with the statements from A1-E8 all the answers to the statements were on average, very positive, because most of the role-players know about the chemical, biological, physical and documentation procedures and risks with the export of maize.

5.4 CONCLUSION

The research has shown that most companies know something about food safety and traceability, but they are not interested to follow the procedures and systems that are legally in place to safeguard South African maize from being unsafe and not traceable. A lot of training and stricter legislation must be put into place to safeguard our maize from being unsafe and untraceable.

CHAPTER 6: CONCLUSION AND RECOMMENDATIONS

6.1 INTRODUCTION

In this concluding chapter, the final analogies will be drawn from the analyses conducted within the ambit of Chapter 5 and the research hypothesis which will be rejected or accepted. The research hypothesis will also be re-stated and particular reference will be made to the limitations within which the research topic has been conducted. For the purpose of completeness, the research problem, research hypothesis and investigative questions will also be re-stated and elaborated upon. The key research findings will be mapped to the research content and specific recommendations will be made to not only mitigate the research problem but to serve am approach for the target organization to develop retention strategies and programmes. To reiterate the relevance of this study and its application in the maize export process, the following:

- The millions tons of maize that were exported from South Africa.
- Food safety and traceability as client requirements.
- Logistical supply management to ensure food safety to customers and consumers.

This chapter also discussed the final research design, the data collection design, discussed the re-visiting of the research problem questions, and sub-questions. At the end of this chapter is also a recommendation that was drawn from the contents of this thesis. The conclusions are made based on the research question of the study. The primary research question of the study was asked in Chapter One as: “How to maintain the quality and safety of maize product through logistical management, food safety management and traceability in the maize export processes in South Africa”

6.2 THE RESEARCH PROBLEM RE-VISITED

The research problem formulated in Paragraph 1.4 of Chapter 1 reads as follows: “Lack of safety concern and adequate quality management, in the

logistical process for maize export result in unsafe and poor quality of maize products". Based on the literature study underpinned by the results from the research survey, it is evident that all silos register for FBO numbers and none of the farmers or transporters do register for FBO numbers which mean that there is no food safety or traceability system as enforced is legislation. PPECB should address this issue as they are the legal entity that can stop transporters or any role-players from exporting illegal maize. They are the only company as per government ruling that may inspect and pass maize for export since 1991. This meant that for 22 years the company did not fulfil its legal role in the export process pertaining to maize.

The Perishable Products Export Control Board (PPECB) is an independent service provider of quality assurance and food safety, and also provides cold chain management services for producers and exporters of perishable agricultural and food products. This concluding chapter presents the summary, recommendations and conclusions regarding governance issues in the Information and communication technology organisation (ICT). A general reflective overview of the study will be provided, with the research design and methodology, the research problem, research question and sub-questions being re-stated and elaborated upon. The primary research objectives are addressed, the research findings are mapped to the research content, and a generic governance framework is proposed to address the research problem.

The research problem formulated in Paragraph 1.4 of Chapter 1 read as follows: The research conducted in terms of this dissertation has identified the relevant aspects that need to be addressed in order to mitigate the problem of inadequate food safety and traceability pertaining to maize exports. In the opinion of the author, the research problem can be solved should the findings in Paragraph 5.4 of Chapter 5 be utilised.

6.3 THE RESEARCH QUESTION RE-VISITED

The research question, which formed the crux of the research in this dissertation, formulated within the ambit of Chapter 1, Paragraph 1.5.1 reads as

follows: “That the logistical management, food safety management and traceability of maize export is not up to world standard”. The literature review that was conducted within the ambit of Chapter 3 together with the survey in Chapter 4 identified the relevant aspects that need to be addressed to provide an answer to the research question.

6.3.1 The roles and responsibilities of role-players

Base on the research findings, in Chapter 3, Paragraph 3.5, the key common responsibilities of the role players is that they must adhere too is the principles of risk-based food safety management, they must understand their roles and responsibilities in the food chain, and it must be communicated and understood by all the role players, who must adhere to the reality food safety risks, prioritize and define the acceptable limits and solve all the food safety and traceability issues before the maize get exported. From an overall perspective, the role players in the FBO process was regarded as good when it comes to silos but poor when the other role players (transporters and farms), was researched. The underlying reasons for that was that the role players:

- Don’t know the legislation when it comes to export s with maize and are not monitored for applying the legislation, and In addition,
- The responsibilities are not always clearly defined when it comes to the export process of maize

6.3.2 Do the maize producers follow food safety systems?

According the Chapter 3, Paragraph 3.7.5 the HACCP-based approaches is being followed by most of the role players, but the real food safety system that role players follow is good agricultural principals (GAP) and not HACCP which is a minimum food safety system that all the role players must adhere to as a means to enhance food safety, however, there is a lack of appropriate understanding of what a HACCP system is about. The in-depth interview investigation discovered that these companies actually follow a GAP system, which is very basic when it comes to food safety and traceability. The GAP

system does provide some assurance that food is suitable for human consumption and will help to maintain confidence in internationally traded maize.

The food safety and traceability systems like: HACCP, CAC, CPA, *SANS10330*, ISO 22000, ISO 9001:2000, EU 1148, APS act and the Health act, do address food safety and traceability in general.

- Some role players have a GAP system in place and this system only help to improve the quality and safety of the produce grown. It focuses on production, processing, soil, water, hands and surfaces. Which does not address the food safety and traceability fully?
- Others have their own food safety system which is unofficial and not suitable for the export of maize.

6.3.3 The risks that are involved when maize exporters purchase maize

According to Chapter 3, Paragraph 3.6 traceability is the biggest risk pertaining to maize exports and also has the greatest impact of food safety scares / incidents may have on consumers, retailers, governments and trade. An effective and cost-efficient traceability system can pinpoint a food safety related risks to a specific country, silo, producer and harvest land, rather than an entire commodity group.

It is clear that risk governance, embracing risk identification, assessment, management and communication, has become a crucial but often highly controversial, therefore the risks for maize are:

- Physical risks is the risks associated with, premises, equipment and facilities and the risk of contamination at storage or transport of the maize for example: waste or mould, rancid, sour, objectionable of mouldy smell or taste, wet or caked patches , not be of an excessively high temperature, free of insects free from poisonous chemical substances and moisture content.

- Chemical risks is the risks associated with maximum residue levels ex that exceed hazardous waste
- Biological risks are the risks associated with aflatoxin, mycotoxins, and genetically modified maize.

6.3.4 The universal logistical supply chain management processes

According to Chapter 3, Paragraph 3.4 the logistics management is part of the supply chain process that plans, implements and control the efficient, effective flow and storage of goods, services and related information from the point-of-origin to the point-of-consumption in order to meet customer requirements and satisfies the requirements imposed by other stakeholders such as government and the retail community. Included within this definition are aspects such as customer service, transportation, storage, plant site selection, inventory control, order processing, distribution, procurement materials handling, return goods handling, and demand forecasting. The universal SCM processes include materials, inventory management, warehousing, material handling, facility location, distribution information management, customer service and all the activities concerning the external customers. Transporting risks loading and off-loading points, bad roads, strikes and security also have impacts. Maize may become contaminated, or may not reach its destination in a suitable condition for consumption, unless effective control measures like the just in time methods are not introduced during transport, even where adequate hygiene control measures have been taken earlier in the food chain have impacts on the SCM process. Therefore the supply chain management process must be strictly adhered to in order to prevent poor quality maize reaching the port of export.

6.3.5 The approach of improving the maize export processes

According to Chapter 3, Paragraph 3.7.2, an entire shipment of maize can be rejected on arrival at the importer's premises due to the poor quality of the maize products. Some unscrupulous importers may do this just to put pressure on an exporter and to try and negotiate a lower price - be careful, experienced

importers may request a pre-shipment inspection, to be conducted by an independent inspection company. High quality maize product is the best approach in the maize export process, other approaches worth mentioning is:

- Adherence to legislation safe guard different role players in the maize export process. If the acts and processes to improve the traceability are not adhered to that is when food safety and traceability become a big risk for the consumer of maize.
- Any law or procedure is as good as the entities that govern it and if the role players do not adhere strictly to the laws, the enforcement of the laws are not applied, that is when the process becomes a critical non-conformance and bad quality maize reaches it clients and a bad reputation cannot be fixed that easily.
- The basic systems of health quality assurance used in food production are GMP, GHP and HACCP; these systems must be strictly adhered to, in order to safeguard the end consumer of the maize.

6.4 GENERAL CONCLUSION AND RECOMMENDATIONS

6.4.1 Conclusion

Based on the findings of this study, applying legal approaches such as FBO's in the export process, it plays a significant role in the LSM awareness in offering training opportunities logistical supply management and quality of maize, if the role players for example the employees could obtain necessary trainings; customer satisfaction due to the high quality of maize could motivates employees to be more involved in the food safety and traceability of the maize. export process to contribute safer ideas that can boost the continuous safety and traceability improvement process.

Beside the positive responses from both the management and other employees, however, there are some weak areas that need to be addressed. This includes:

- Management does not drive the strong competency and knowledge in Implementing safer export maize processes.
- Safer maize exports require that information flow effectively and efficiently within an organization, in order to maintain high quality of export maize products.
- However, many role players do not have an effective communication channel between management and employees; this resulted in poor information flow to all the employees and ultimately affect the legality of the export process, because
- Employees were not well informed by the management of the legislation the FBO'S must adhere to in the maize export process.

6.4.2 Recommendations

Based on the research findings, this research provided the following recommendations:

- The maize industry role players (silos, on farm storage facilities of grains and alternative storage sites such as silo bags, bunkers and grain dams) should agree upon a common definition for the competence of food safety role players.
- PPECB as a statutory organisation, also operates as an assignee for the Department of Agriculture under the requirements of the various laws pertaining to maize exports, which conducts its business in terms of the maize export legislation pertaining to export inspection, and who issue the phytosanitary certificate, which is the most essential document for all the role players in the maize export process, must fully implement the various food safety and traceability legislation.
- In this research, risk-based food quality management was inspected and treated according to APS Act (1990: 1-21) and HACCP procedures, which is the legislation in place but not adhered to in South Africa with regard to the export of maize.
- The road transport operators should register for FBO in order for them to be audited for food safety and hygiene standards.

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APPENDICES

APPENDIX A: CONSENT LETTER

Faculty of Engineering
Department of Industrial Systems & Engineering
Cape Peninsula University of Technology
P. O. Box 1906
Bellville
7535

The Director

Date: 1 November 2011

MTECH: QUALITY STUDY CONSENT LETTER

Principal Investigators: **Mr. Jacobus Swart**

Co-investigators: **Dr. Bingwen Yan (Research supervisor, CPUT)**

Physical Address: **Faculty of Engineering**

Cape Peninsula University of Technology,

Symphony Way, 7535

We seek permission to conduct a survey for the dissertation as identified above which is being conducted by Mr. Jacobus Swart and Dr. Bingwen Yan (research supervisor) from the Department of Industrial and Systems Engineering, in the Engineering Faculty, Cape Peninsula University of Technology. The title of the research is: "The impact of the logistical process on food safety and quality for maize export in South Africa". The dissertation will be submitted in fulfilment of the requirements for the Master of Technology Degree in Quality by Jacobus Swart.

Why is the research being conducted?

The purpose of this study is to critically examine the current quality systems and logistical export environment, employed by the maize export industry, with a view to identifying quality gaps and determining appropriate quality strategies that can assist the maize industry to continually improve the effectiveness and efficiency of their quality and logistical performance when maize is being exported.

Who can participate in the survey?

This survey is intended to be conducted at the various maize export organization offices, quality assurance and the logistical process organizations at the following organizations:

- Senwes co-op silos
- Free state co-op silos
- Noordwes co-op silos
- Various private maize farms
- Various private maize silos
- Various logistical companies
- Pioneer foods offices
- PPECB port offices
- Portnet offices

We therefore seek your approval to allow staff from head office, quality assurance and logistical export supply chain, employees of the above organizations, their management teams, other employees as well as their general workers to take part in the survey. The study is intended to explore the views, attitudes and perceptions of participants on the logistical export supply chain employed by the organizations in the implementation of their maize export programs.

What will be the benefits of participating?

This research will assist the organizations to appreciate and use quality management systems in the implementation of their export programs. The research will also assist the export logistical chain to appreciate the success factors of the current strategies, note issues affecting their effectiveness, determine and employ appropriate strategies to ensure quality maize products being exported.

Ethics

The researcher will respect the participant's right to privacy. The nature and quality of participants' performance will be strictly kept confidential. Findings will be reported in an ethical manner.

Faculty of Engineering
Department of Industrial Systems & Engineering
Cape Peninsula University of Technology
P. O. Box 1906
Bellville
7535

CONSENT FORM FOR THE RESEARCH PROJECT

"The impact of the logistical process on food safety and quality for maize export in South Africa"

By Jacobus Swart

DECLARATION BY STUDENT CHIEF EXECUTIVE OFFICER:

From: Jacobus Swart

I declare that:

I understand that the project will be conducted as described in your information letter, the copy of which I am in possession of. I am pleased to consent to the survey to be conducted in the PPECB statutory environment.

I also consent that the information may be:

- Used and kept for future research studies [X]
- Used and discarded [ ]

Signed at (*place*) Grabouw on (*date*) 1 November 2011

Print Name: Sarel van Wyk

Supervisor (PPECB)
Date: 1/11/2011

PASSED FOR EXPORT PPECB RSA

Signature for chief executive officer

DECLARATION BY THE INVESTIGATOR

I, Jacobus Swart declare that I explained the information in this document to (*Names of*

Participant) Jacobus Johannes Swart

I encouraged him/her to ask questions and took adequate time to answer them.

I am satisfied that he/she adequately understand all aspects of the research, as discussed above

Signed at (*place*) Bellville on (*date*) 6 November 2011

Signature of investigator----------

Further Information

In the event there is need to seek further information regarding this study, please feel free to contact the following:

Jacobus Swart

Researcher

Cell: +2796923975

Fax: 0865587194
mailto:transporters@vodamail.co.za

or kobuss@ppecb.com

NO.

APPENDIX B: QUESTIONNAIRE

April/May 2012

QUESTIONNAIRE ON FOOD SAFETY AND TRACEABILITY

Dear Sir/Madam,

The success of the future of the export of maize depends on you the customer. For this reason we are continuously seeking ways to improve on the export of maize processes, the customer, as well as the other role players involved in this process. We kindly ask you to complete this questionnaire, which will be used for research purposes with the aim of improving the logistical supply chain for the export process as much as possible. By taking part in this study you will be contributing to the enhancement of these programmes.

We kindly request that you complete the attached questionnaire. The questionnaire is anonymous. The statements are related to your personal work opinions, thoughts and feelings, being experienced by you while working in the maize logistical export process.

Thank you very much in advance for your help. It should take about 20 minutes to complete the questionnaire. There are no right or wrong answers to the questions. Please ensure that you respond to every question and feel free to ask for clarification by emailing or phoning the researcher (details below), for further explanation where necessary. All information provided will be treated in absolute confidence. Nobody can be recognised in the analysed results. Your name does not appear anywhere on the questionnaire, therefore no individual respondents can be identified.

Thank you participating voluntary.

Jacobus Swart

Researcher

Cell: +2796923975 Fax: 0865587194

mailto:transporters@vodamail.co.za or kobuss@ppecb.com

If you as participant are unsure if you have a registered food business operator code then right-click on the following shortcuts, it will help to register your transporter for free within 24 hours after applying.

- Registration form
  Standard Operating Procedure on management, allocation, update and access to the FBO database

SECTION A: COMPANY AND INDIVIDUAL PROFILE

Please tick ☑ the box which most accurately reflects your sentiments using the following sections:

1. Gender

Male	Female

2. Qualifications

Grade 1-11	Grade 12	Post school	Other

3. Classify your organization?

Trust owned	Company owned	Privately owned	Other

4. Where does your organization operate? (Specify Province/s)?

Kwazulu Natal	Free State	Mpumalanga	Limpopo	Other province

5. Number of people employed by your organization/production unit?

1-5	6-20	21-50	More than 50

6. Does your organization register all the transporters with the Department of Agriculture Forestry and Fisheries for Food Business Operator numbers?

Yes	No

7. How long has your organization/production unit been pursuing food safety? Specify years.

0-5	6-10	11-20	More than 20

8. What food safety system has your company in place? Please specify the system.

HACCP	ISO 9001	ISO 12002	SANS 13030	Other system

9. What is your current position in company?

Logistical employee	Office staff	Senior Manager	General manager

SECTION B: FOOD SAFETY DESIGN *(explain what to do here??)*

No	Statement	SD	TD	UD	TA	SA	Comment
A1	You always identified exporting producers during export certification						
A2	You have a number of returned applications to the FBO						
A3	You have received wrongly allocated FBO codes						
A4	You update the FBO database with new allocations within 5 working days						
A5	You verify FBO detail whilst conducting food safety audits						
A6	All FBO's updated or confirmed their information within the indicated time slot						
A7	Unauthorised FBO's isolated with the export certification process						
B1	You pay your inspection fees regularly.						
B2	You handled maize hygienically on the food premises and with the equipment thereon.						
B3	You protect maize effectively by the best available method against contamination or spoilage by poisonous or offensive materials or pollution or by any other agent whatsoever.						
B4	Your storage premises for maize have no open joints or open seams and are made of smooth, rust-free, non-toxic, cleanable and non-absorbent material that is dust-proof and water-resistant.						
B5	Walls and joints in your storage premises are formed properly and easy to clean.						
B6	The surroundings of your storage premises are of such a nature that cannot contaminate or contribute to the contamination of maize.						
C1	Maize is inspected at random for possible hazardous or toxic substances at all entry ports.						
C2	Port health services monitors and evaluates maize that enters through the ports, controls and monitors the possible entering of all seriously contaminated cargo						
C3	Authorities take the lead on removing contaminated maize from producers.						
C4	Authorities inspect all exported maize at ports and borders, and screening for radiation contamination						

C5	Refused shipments for maize export due to quality problems such as broken and damaged maize parts, growth of moulds like Aflatoxin contamination, high residue levels, discoloration, dirt, filth, et cetera.						
D1	The service and negotiating contracts in maize export processes is costly.						
D2	The collection of information in maize export processes takes a long time.						
D3	The legalisation and monitoring or enforcement for the maize export processes is complicated.						
D4	The maize inspectors check on your products regularly.						
D5	Your maize products are covered by insurance company in export process.						
D6	You are aware of the logistical supply chain risks for maize export.						
D7	You understand the South African laws for maize export.						
E1	The harmonizing approach of the various stages of production, processing, and distribution throughout the supply chain did improve the maize export process in your organisation.						
E2	Contracts signed by role players to markets by formalizing specification, which improved the maize exports						
E3	Better coordination among role-players did improve the maize export process.						
E4	A sound plan for more economic delivery routes improved the maize export process.						
E5	Contracts among role players pertaining to the maize quality for a minimum grade and condition standards improved the maize export process.						
E6	You sell maize by following the prices from SAFEX.						
E7	You always make sure that the quality of maize for export meets the requirements of the legislation.						
E8	You always forecast any circumstances that can affect the maize export processes.						

SECTION C: Understanding the logistical supply chain management and food safety legislation on transporters (describe briefly)

1. What does food safety in the logistical supply chain management process mean for you as a participant?

2. Do you know what happens when FBO numbers do not comply with traceability?

3. Do you understand the FBO process?

4. Do you know that when non-conformances have been found as MAJOR and MINOR in control points, and cannot be rectified by the FBO within 28 days (for example construction changes), an opportunity for providing an action plan will be given?

5. Do you know that if no action plan is provided, the FBO will be scheduled for a VERIFICATION audit within 28 days? Failure to comply will result in a suspension of the FBO to export.

6. Do you know that when the traceability plan is inadequately addressing the risk, the FBO will be suspended from maize exports until the FBO can prove its compliance?

7. When the risk is addressed with the suggested action plan, the plan will be evaluated within 2 working days. If approved, the verification audit will be scheduled to verify compliance with the action plan?

8. Have you been investigated by inspector(s) regarding the food premises, facility, activity or circumstance which gave rise to the prohibition and the local authority? If yes, please indicate briefly.

Thank you very much for your participation! Your inputs will be highly appreciated and valued.

APPENDIX C: FREQUENCIES TABLES FOR ALL VARIABLES

Computer printout

GET

FILE='C:\Documents and Settings\Administrator\Desktop\Swart J\JJ Swart-Maize questionaire.sav'.

DATASET NAME DataSet2 WINDOW=FRONT.

FREQUENCIES VARIABLES=G1 G2 G3 G4 G5 G6 G7 G8 G9 A1 A2 A3 A4 A5 A6 A7 B1 B2 B3 B4 B5 B6 C1 C2 C3 C4 C5 D1 D2 D3 D4 D5 D6 D7 E1 E2 E3 E4 E5 E6 E7 E8 F1 F2 F3 F4 F5 F6 F7 F8

/ORDER=ANALYSIS.

Frequencies

Notes

Output Created		16-OCT-2012 22:32:15
Comments		
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	Active Dataset	DataSet2
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	127
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics are based on all cases with valid data.
Syntax		FREQUENCIES VARIABLES=G1 G2 G3 G4 G5 G6 G7 G8 G9 A1 A2 A3 A4 A5 A6 A7 B1 B2 B3 B4 B5 B6 C1 C2 C3 C4 C5 D1 D2 D3 D4 D5 D6 D7 E1 E2 E3 E4 E5 E6 E7 E8 F1 F2 F3 F4 F5 F6 F7 F8 /ORDER=ANALYSIS.
Resources	Processor Time	00:00:00.11
	Elapsed Time	00:00:00.11

[DataSet2] C:\Documents and Settings\Administrator\Desktop\Swart J\JJ Swart-Maize questionaire.sav

Frequency Table

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	male	116	91.3	91.3	91.3
	Female	11	8.7	8.7	100.0
	Total	127	100.0	100.0	

Qualifications

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Grade 1-11	24	18.9	18.9	18.9
	Grade 12	72	56.7	56.7	75.6
	Post school	25	19.7	19.7	95.3
	Other	6	4.7	4.7	100.0
	Total	127	100.0	100.0	

Classify your organization

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Trust owned	4	3.1	3.1	3.1
	Company owned	100	78.7	78.7	81.9
	Privately owned	18	14.2	14.2	96.1
	Other	5	3.9	3.9	100.0
	Total	127	100.0	100.0	

Province that your organization operates

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Kwazulu Natal	1	.8	.8	.8
	Free State	86	67.7	67.7	68.5
	Limpopo	3	2.4	2.4	70.9
	Other	37	29.1	29.1	100.0
	Total	127	100.0	100.0	

Number of employees

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1-5	8	6.3	6.3	6.3
	6-20	22	17.3	17.5	23.8
	21-50	12	9.4	9.5	33.3
	more than 50	84	66.1	66.7	100.0
	Total	126	99.2	100.0	
Missing	System	1	.8		
Total		127	100.0		

Check on registration for FBO numbers

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	10	7.9	7.9	7.9
	No	117	92.1	92.1	100.0
	Total	127	100.0	100.0	

Years of your organization pursuing food safety

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0-5	24	18.9	18.9	18.9
	6-10	85	66.9	66.9	85.8
	11-20	5	3.9	3.9	89.8
	More than 20	13	10.2	10.2	100.0
	Total	127	100.0	100.0	

Type of food safety system has your company in place

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	HACCP	94	74.0	74.0	74.0
	ISO 9001	4	3.1	3.1	77.2
	ISO 13030	5	3.9	3.9	81.1
	Other system	24	18.9	18.9	100.0
	Total	127	100.0	100.0	

Your current position

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Logistical employee	15	11.8	11.8	11.8
	Office staff	30	23.6	23.6	35.4
	Senior manager	34	26.8	26.8	62.2
	General manager	48	37.8	37.8	100.0
	Total	127	100.0	100.0	

You are producers/companies that were identified during export certification

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	26	20.5	20.5	20.5
	Undecided	18	14.2	14.2	34.6
	Tend to agree	1	.8	.8	35.4
	Strongly agree	82	64.6	64.6	100.0
	Total	127	100.0	100.0	

You have experienced cases of returned applications to the FBOs

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	85	66.9	66.9	66.9
	Tend to disagree	1	.8	.8	67.7
	Undecided	18	14.2	14.2	81.9
	Tend to agree	3	2.4	2.4	84.3
	Strongly agree	20	15.7	15.7	100.0
	Total	127	100.0	100.0	

You have experienced wrongly allocated FBO codes

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	102	80.3	80.3	80.3
	Undecided	20	15.7	15.7	96.1
	Tend to agree	2	1.6	1.6	97.6
	Strongly agree	3	2.4	2.4	100.0
	Total	127	100.0	100.0	

You update the FBO database with new allocations within 5 working days

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	94	74.0	74.0	74.0
	Tend to disagree	2	1.6	1.6	75.6
	Undecided	18	14.2	14.2	89.8
	Tend to agree	2	1.6	1.6	91.3
	Strongly agree	11	8.7	8.7	100.0
	Total	127	100.0	100.0	

You verify FBO detail whilst loading/conducting food safety audits

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	87	68.5	68.5	68.5
	Undecided	10	7.9	7.9	76.4
	Tend to agree	3	2.4	2.4	78.7
	Strongly agree	27	21.3	21.3	100.0
	Total	127	100.0	100.0	

All FBO's updated or confirmed their information within the indicated time slot

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	89	70.1	70.1	70.1
	Undecided	16	12.6	12.6	82.7
	Tend to agree	4	3.1	3.1	85.8
	Strongly agree	18	14.2	14.2	100.0
	Total	127	100.0	100.0	

Unauthorised FBO's isolated with the export certification/transport process

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	85	66.9	66.9	66.9
	Undecided	13	10.2	10.2	77.2
	Tend to agree	4	3.1	3.1	80.3
	Strongly agree	25	19.7	19.7	100.0
	Total	127	100.0	100.0	

You are aware of that all exporters must pay inspection levies regularly

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	26	20.5	20.5	20.5
	Undecided	5	3.9	3.9	24.4
	Tend to agree	2	1.6	1.6	26.0
	Strongly agree	94	74.0	74.0	100.0
	Total	127	100.0	100.0	

You always handle maize hygienically during the transportation process

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	4	3.1	3.1	3.1
	Tend to agree	1	.8	.8	3.9
	Strongly agree	122	96.1	96.1	100.0
	Total	127	100.0	100.0	

You protect maize by avoiding any contamination or poisonous materials

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	4	3.1	3.1	3.1
	Undecided	1	.8	.8	3.9
	Tend to agree	1	.8	.8	4.7
	Strongly agree	121	95.3	95.3	100.0
	Total	127	100.0	100.0	

You store maize in an environment of clean, non-toxic and absorbent material and water-resistant

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	5	3.9	3.9	3.9
	Tend to agree	2	1.6	1.6	5.5
	Strongly agree	120	94.5	94.5	100.0
	Total	127	100.0	100.0	

Walls and joints in the storage premises/transporter are always formed properly and easy to clean.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	5	3.9	3.9	3.9
	Tend to agree	2	1.6	1.6	5.5
	Strongly agree	120	94.5	94.5	100.0
	Total	127	100.0	100.0	

The surroundings of your storage premises/transporter are in a nature that cannot contaminate or contribute to the contamination of maize

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	3	2.4	2.4	2.4
	Tend to agree	5	3.9	3.9	6.3
	Strongly agree	119	93.7	93.7	100.0
	Total	127	100.0	100.0	

Maize is inspected at random for possible hazardous or toxic substances at all entry ports/loading sites

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	7	5.5	5.5	5.5
	Undecided	1	.8	.8	6.3
	Strongly agree	119	93.7	93.7	100.0
	Total	127	100.0	100.0	

Port Health Services monitors and evaluates entered maize through the ports and monitoring entering of all serious contaminated cargo

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	22	17.3	17.3	17.3
	Undecided	15	11.8	11.8	29.1
	Tend to agree	4	3.1	3.1	32.3
	Strongly agree	86	67.7	67.7	100.0
	Total	127	100.0	100.0	

Authorities/producers take the lead on removing contaminated maize from producers.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	8	6.3	6.3	6.3
	Undecided	3	2.4	2.4	8.7
	Tend to agree	3	2.4	2.4	11.0
	Strongly agree	113	89.0	89.0	100.0
	Total	127	100.0	100.0	

Authorities inspect all exported maize at ports and borders, and screening for radiation contamination

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	8	6.3	6.3	6.3
	Undecided	4	3.1	3.1	9.4
	Tend to agree	1	.8	.8	10.2
	Strongly agree	114	89.8	89.8	100.0
	Total	127	100.0	100.0	

Refused/rejected shipments for maize export due to quality problems such as broken and damaged maize parts, growth of moulds, dirt, filth, et cetera.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	8	6.3	6.3	6.3
	Undecided	2	1.6	1.6	7.9
	Tend to agree	1	.8	.8	8.7
	Strongly agree	116	91.3	91.3	100.0
	Total	127	100.0	100.0	

The service and negotiating contracts in maize export processes is costly

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	7	5.5	5.5	5.5
	Undecided	2	1.6	1.6	7.1
	Tend to agree	3	2.4	2.4	9.4
	Strongly agree	115	90.6	90.6	100.0
	Total	127	100.0	100.0	

The collection of information in maize export processes takes a long time

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	17	13.4	13.4	13.4
	Tend to disagree	1	.8	.8	14.2
	Undecided	4	3.1	3.1	17.3
	Tend to agree	3	2.4	2.4	19.7
	Strongly agree	102	80.3	80.3	100.0
	Total	127	100.0	100.0	

The legalisation and monitoring or enforcement for the maize export processes is complicated

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	12	9.4	9.4	9.4
	Undecided	6	4.7	4.7	14.2
	Tend to agree	2	1.6	1.6	15.7
	Strongly agree	107	84.3	84.3	100.0
	Total	127	100.0	100.0	

The maize inspectors check on your products regularly

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	7	5.5	5.5	5.5
	Undecided	4	3.1	3.1	8.7
	Tend to agree	2	1.6	1.6	10.2
	Strongly agree	114	89.8	89.8	100.0
	Total	127	100.0	100.0	

Your maize products are covered by insurance company in export process

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	7	5.5	5.5	5.5
	Undecided	2	1.6	1.6	7.1
	Tend to agree	1	.8	.8	7.9
	Strongly agree	117	92.1	92.1	100.0
	Total	127	100.0	100.0	

You are aware of the logistical supply chain risks for maize export

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	7	5.5	5.5	5.5
	Undecided	1	.8	.8	6.3
	Tend to agree	1	.8	.8	7.1
	Strongly agree	118	92.9	92.9	100.0
	Total	127	100.0	100.0	

You understand the South African laws for maize export

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	10	7.9	7.9	7.9
	Undecided	4	3.1	3.1	11.0
	Tend to agree	4	3.1	3.1	14.2
	Strongly agree	109	85.8	85.8	100.0
	Total	127	100.0	100.0	

The harmonizing approach of production, processing, and distribution throughout the supply chain did improve your maize export process

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	7	5.5	5.5	5.5
	Undecided	3	2.4	2.4	7.9
	Tend to agree	3	2.4	2.4	10.2
	Strongly agree	114	89.8	89.8	100.0
	Total	127	100.0	100.0	

Contracts signed by role players for export markets did formalize the specifications and improved the maize export process

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	9	7.1	7.1	7.1
	Tend to disagree	1	.8	.8	7.9
	Undecided	1	.8	.8	8.7
	Tend to agree	3	2.4	2.4	11.0
	Strongly agree	113	89.0	89.0	100.0
	Total	127	100.0	100.0	

Better coordination among role-players did improve the maize export process

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	6	4.7	4.7	4.7
	Tend to disagree	1	.8	.8	5.5
	Undecided	2	1.6	1.6	7.1
	Tend to agree	3	2.4	2.4	9.4
	Strongly agree	115	90.6	90.6	100.0
	Total	127	100.0	100.0	

A sound plan for more economic delivery routes improved the maize export process

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	6	4.7	4.7	4.7
	Undecided	5	3.9	3.9	8.7
	Tend to agree	4	3.1	3.1	11.8
	Strongly agree	112	88.2	88.2	100.0
	Total	127	100.0	100.0	

Contracts among role players pertaining to the maize quality for a minimum grade and condition standards improved the maize export process

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	5	3.9	3.9	3.9
	Tend to agree	3	2.4	2.4	6.3
	Strongly agree	119	93.7	93.7	100.0
	Total	127	100.0	100.0	

Do you know that transporters/producers sell maize by following the prices from SAFEX

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	11	8.7	8.7	8.7
	Undecided	3	2.4	2.4	11.0
	Tend to agree	1	.8	.8	11.8
	Strongly agree	112	88.2	88.2	100.0
	Total	127	100.0	100.0	

You always make sure that the quality of maize for export meets the requirements of your contract by means of legislation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	7	5.5	5.5	5.5
	Undecided	1	.8	.8	6.3
	Tend to agree	1	.8	.8	7.1
	Strongly agree	118	92.9	92.9	100.0
	Total	127	100.0	100.0	

You always forecast any circumstances that can affect the maize export processes

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	8	6.3	6.3	6.3
	Tend to disagree	1	.8	.8	7.1
	Undecided	4	3.1	3.1	10.2
	Tend to agree	2	1.6	1.6	11.8
	Strongly agree	112	88.2	88.2	100.0
	Total	127	100.0	100.0	

Food Safety in the logistical supply chain management process mean for you as a percipient

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	121	95.3	95.3	95.3
	No	4	3.1	3.1	98.4
	Other	2	1.6	1.6	100.0
	Total	127	100.0	100.0	

You know what happened when the numbers of FBOs do not comply with traceability

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	111	87.4	87.4	87.4
	No	14	11.0	11.0	98.4
	Other	2	1.6	1.6	100.0
	Total	127	100.0	100.0	

You understand the FBO process

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	95	74.8	74.8	74.8
	No	29	22.8	22.8	97.6
	Other	3	2.4	2.4	100.0
	Total	127	100.0	100.0	

When non-conformances were found to be MAJOR and MINOR in control points, it cannot be rectified by the FBO within 28 days.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	83	65.4	65.4	65.4
	No	43	33.9	33.9	99.2
	Other	1	.8	.8	100.0
	Total	127	100.0	100.0	

If no action plan is provided, the FBO will be scheduled for a verification audit within 28 days. Failure to comply will result in a suspension to export.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	84	66.1	66.1	66.1
	No	43	33.9	33.9	100.0
	Total	127	100.0	100.0	

When the traceability plan is inadequately addressing the risk, the FBO will be suspended from maize export, until the FBO can prove compliance.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	86	67.7	67.7	67.7
	No	41	32.3	32.3	100.0
	Total	127	100.0	100.0	

When the risk is addressed with the suggested action plan, the plan will be evaluated within 2 working days, and if approved verification audit will be scheduled to verify compliance with the action plan?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	84	66.1	66.1	66.1
	No	42	33.1	33.1	99.2
	Other	1	.8	.8	100.0
	Total	127	100.0	100.0	

Have you been investigated by Government inspector(s) or local authority? Regarding the inspection premises, facility, activity or circumstance which gave rise to the prohibition and the If yes, please indicate briefly.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	36	28.3	28.3	28.3
	No	89	70.1	70.1	98.4
	Other	2	1.6	1.6	100.0
	Total	127	100.0	100.0	

APPENDIX D: STATISTICAL RESULTS—ONE WAY ANOVA

SUMMARY OF ONE-WAY ANOVA (Sig.) OF ALL THE VARIABLES (A, B, C, D, E, F)										
		G1	G2	G3	G4	G5	G6	G7	G8	G9
A1	Between Groups	.229	.258	.000	.229	.000	.163	.000	.000	.000
A2	Between Groups	.851	.345	.148	.396	.380	.082	.491	.024	.001
A3	Between Groups	.753	.139	.291	.248	.511	.413	.337	.077	.121
A4	Between Groups	.560	.445	.128	.381	.211	.000	.135	.094	.063
A5	Between Groups	.437	.658	.115	.017	.210	.043	.014	.005	.005
A6	Between Groups	.211	.618	.208	.044	.210	.016	.015	.009	.017
A7	Between Groups	.246	.606	.098	.008	.106	.304	.002	.007	.011
B1	Between Groups	.993	.108	.192	.268	.044	.819	.000	.001	.000
B2	Between Groups	.512	.020	.000	.854	.194	.534	.009	.018	.001
B3	Between Groups	.476	.030	.008	.981	.000	.257	.086	.000	.025
B4	Between Groups	.404	.246	.310	.893	.019	.345	.008	.001	.279
B5	Between Groups	.718	.196	.266	.949	.085	.345	.011	.005	.301
B6	Between Groups	.815	.041	.060	.633	.030	.861	.001	.001	.856
C1	Between Groups	.636	.181	.000	.885	.000	.405	.000	.001	.089
C2	Between Groups	.352	.959	.000	.713	.000	.579	.000	.000	.020
C3	Between Groups	.430	.205	.000	.878	.000	.567	.000	.000	.000
C4	Between Groups	.891	.047	.035	.827	.000	.805	.018	.000	.026
C5	Between Groups	.314	.057	.000	.926	.000	.494	.001	.000	.013
D1	Between Groups	.315	.030	.014	.973	.001	.438	.040	.000	.006
D2	Between Groups	.671	.444	.434	.764	.084	.718	.312	.007	.061
D3	Between Groups	.725	.000	.182	.771	.002	.402	.034	.000	.004
D4	Between Groups	.819	.051	.019	.347	.000	.498	.000	.000	.008
D5	Between Groups	.705	.033	.006	.921	.001	.627	.000	.000	.101
D6	Between Groups	.658	.014	.000	.525	.013	.368	.001	.002	.003
D7	Between Groups	.888	.918	.000	.622	.000	.978	.000	.000	.059
E1	Between Groups	.294	.020	.000	.618	.005	.162	.000	.001	.000
E2	Between Groups	.350	.005	.017	.723	.004	.639	.041	.018	.037
E3	Between Groups	.507	.088	.008	.258	.008	.057	.001	.043	.000
E4	Between Groups	.663	.063	.002	.113	.006	.156	.003	.049	.000

E5	Between Groups	.429	.170	.000	.088	.012	.185	.000	.029	.000
E6	Between Groups	.230	.000	.111	.011	.003	.156	.000	.004	.000
E7	Between Groups	.658	.032	.002	.147	.009	.584	.000	.000	.000
E8	Between Groups	.571	.138	.003	.826	.002	.443	.070	.075	.001
F1	Between Groups	.750	.532	.084	.391	.122	.494	.000	.034	.078
F2	Between Groups	.212	.960	.001	.291	.001	.728	.001	.000	.051
F3	Between Groups	.055	.035	.000	.226	.002	.248	.000	.000	.096
F4	Between Groups	.570	.015	.000	.124	.000	.308	.000	.000	.097
F5	Between Groups	.632	.034	.000	.057	.000	.339	.000	.000	.021
F6	Between Groups	.713	.004	.000	.071	.001	.391	.000	.000	.020
F7	Between Groups	.905	.002	.000	.189	.000	.331	.000	.000	.043
F8	Between Groups	.201	.014	.113	.907	.609	.250	.013	.060	.430

ONE-WAY ANOVA—Gender

A, B, C, C, D,E, F Vs G1		Sum of Squares	df	Mean Square	F	Sig.
A1	Between Groups	3.841	1	3.841	1.461	.229
	Within Groups	328.615	125	2.629		
	Total	332.457	126			
A2	Between Groups	.083	1	.083	.035	.851
	Within Groups	294.909	125	2.359		
	Total	294.992	126			
A3	Between Groups	.095	1	.095	.099	.753
	Within Groups	119.417	125	.955		
	Total	119.512	126			
A4	Between Groups	.563	1	.563	.341	.560
	Within Groups	206.461	125	1.652		
	Total	207.024	126			
A5	Between Groups	1.701	1	1.701	.608	.437
	Within Groups	349.512	125	2.796		
	Total	351.213	126			
A6	Between Groups	3.527	1	3.527	1.583	.211
	Within Groups	278.520	125	2.228		
	Total	282.047	126			

ONE-WAY ANOVA—Gender

A, B, C, C, D,E, F Vs G1		Sum of Squares	df	Mean Square	F	Sig.
A7	Between Groups	3.640	1	3.640	1.361	.246
	Within Groups	334.408	125	2.675		
	Total	338.047	126			
B1	Between Groups	.000	1	.000	.000	.993
	Within Groups	332.047	125	2.656		
	Total	332.047	126			
B2	Between Groups	.216	1	.216	.432	.512
	Within Groups	62.509	125	.500		
	Total	62.724	126			
B3	Between Groups	.270	1	.270	.511	.476
	Within Groups	65.888	125	.527		
	Total	66.157	126			
B4	Between Groups	.437	1	.437	.702	.404
	Within Groups	77.752	125	.622		
	Total	78.189	126			
B5	Between Groups	.082	1	.082	.131	.718
	Within Groups	78.107	125	.625		
	Total	78.189	126			
B6	Between Groups	.022	1	.022	.055	.815
	Within Groups	50.702	125	.406		
	Total	50.724	126			
C1	Between Groups	.196	1	.196	.225	.636
	Within Groups	108.718	125	.870		
	Total	108.913	126			
C2	Between Groups	2.076	1	2.076	.874	.352
	Within Groups	296.727	125	2.374		
	Total	298.803	126			
C3	Between Groups	.648	1	.648	.627	.430
	Within Groups	129.116	125	1.033		
	Total	129.764	126			

ONE-WAY ANOVA—Gender

A, B, C, C, D,E, F Vs G1		Sum of Squares	df	Mean Square	F	Sig.
C4	Between Groups	.020	1	.020	.019	.891
	Within Groups	131.744	125	1.054		
	Total	131.764	126			
C5	Between Groups	1.022	1	1.022	1.021	.314
	Within Groups	125.198	125	1.002		
	Total	126.220	126			
D1	Between Groups	.915	1	.915	1.017	.315
	Within Groups	112.440	125	.900		
	Total	113.354	126			
D2	Between Groups	.358	1	.358	.182	.671
	Within Groups	246.697	125	1.974		
	Total	247.055	126			
D3	Between Groups	.187	1	.187	.125	.725
	Within Groups	187.545	125	1.500		
	Total	187.732	126			
D4	Between Groups	.050	1	.050	.053	.819
	Within Groups	118.580	125	.949		
	Total	118.630	126			
D5	Between Groups	.130	1	.130	.144	.705
	Within Groups	112.295	125	.898		
	Total	112.425	126			
D6	Between Groups	.172	1	.172	.197	.658
	Within Groups	109.261	125	.874		
	Total	109.433	126			
D7	Between Groups	.025	1	.025	.020	.888
	Within Groups	158.683	125	1.269		
	Total	158.709	126			
E1	Between Groups	1.022	1	1.022	1.109	.294
	Within Groups	115.198	125	.922		
	Total	116.220	126			

ONE-WAY ANOVA—Gender

A, B, C, C, D,E, F Vs G1		Sum of Squares	df	Mean Square	F	Sig.
E2	Between Groups	1.012	1	1.012	.880	.350
	Within Groups	143.744	125	1.150		
	Total	144.756	126			
E3	Between Groups	.376	1	.376	.442	.507
	Within Groups	106.521	125	.852		
	Total	106.898	126			
E4	Between Groups	.166	1	.166	.191	.663
	Within Groups	108.464	125	.868		
	Total	108.630	126			
E5	Between Groups	.395	1	.395	.629	.429
	Within Groups	78.440	125	.628		
	Total	78.835	126			
E6	Between Groups	1.942	1	1.942	1.457	.230
	Within Groups	166.578	125	1.333		
	Total	168.520	126			
E7	Between Groups	.172	1	.172	.197	.658
	Within Groups	109.261	125	.874		
	Total	109.433	126			
E8	Between Groups	.358	1	.358	.323	.571
	Within Groups	138.697	125	1.110		
	Total	139.055	126			
F1	Between Groups	.009	1	.009	.102	.750
	Within Groups	11.487	125	.092		
	Total	11.496	126			
F2	Between Groups	.242	1	.242	1.574	.212
	Within Groups	19.207	125	.154		
	Total	19.449	126			
F3	Between Groups	.915	1	.915	3.756	.055
	Within Groups	30.440	125	.244		
	Total	31.354	126			

ONE-WAY ANOVA—Gender

A, B, C, C, D,E, F Vs G1		Sum of Squares	df	Mean Square	F	Sig.
F4	Between Groups	.080	1	.080	.324	.570
	Within Groups	30.975	125	.248		
	Total	31.055	126			
F5	Between Groups	.052	1	.052	.230	.632
	Within Groups	28.389	125	.227		
	Total	28.441	126			
F6	Between Groups	.030	1	.030	.136	.713
	Within Groups	27.734	125	.222		
	Total	27.764	126			
F7	Between Groups	.004	1	.004	.014	.905
	Within Groups	30.752	125	.246		
	Total	30.756	126			
F8	Between Groups	.376	1	.376	1.650	.201
	Within Groups	28.521	125	.228		
	Total	28.898	126			

ONE-WAY ANOVA—Qualifications

A, B, C, C, D,E, F Vs G2		Sum of Squares	df	Mean Square	F	Sig.
A1	Between Groups	10.677	3	3.559	1.360	.258
	Within Groups	321.779	123	2.616		
	Total	332.457	126			
A2	Between Groups	7.825	3	2.608	1.117	.345
	Within Groups	287.167	123	2.335		
	Total	294.992	126			
A3	Between Groups	5.207	3	1.736	1.868	.139
	Within Groups	114.304	123	.929		
	Total	119.512	126			
A4	Between Groups	4.431	3	1.477	.897	.445
	Within Groups	202.593	123	1.647		
	Total	207.024	126			

ONE-WAY ANOVA—Qualifications

A, B, C, C, D,E, F Vs G2		Sum of Squares	df	Mean Square	F	Sig.
A5	Between Groups	4.544	3	1.515	.537	.658
	Within Groups	346.668	123	2.818		
	Total	351.213	126			
A6	Between Groups	4.054	3	1.351	.598	.618
	Within Groups	277.993	123	2.260		
	Total	282.047	126			
A7	Between Groups	5.001	3	1.667	.616	.606
	Within Groups	333.046	123	2.708		
	Total	338.047	126			
B1	Between Groups	15.921	3	5.307	2.065	.108
	Within Groups	316.126	123	2.570		
	Total	332.047	126			
B2	Between Groups	4.780	3	1.593	3.382	.020
	Within Groups	57.944	123	.471		
	Total	62.724	126			
B3	Between Groups	4.606	3	1.535	3.068	.030
	Within Groups	61.551	123	.500		
	Total	66.157	126			
B4	Between Groups	2.582	3	.861	1.400	.246
	Within Groups	75.607	123	.615		
	Total	78.189	126			
B5	Between Groups	2.911	3	.970	1.586	.196
	Within Groups	75.278	123	.612		
	Total	78.189	126			
B6	Between Groups	3.278	3	1.093	2.833	.041
	Within Groups	47.446	123	.386		
	Total	50.724	126			
C1	Between Groups	4.220	3	1.407	1.653	.181
	Within Groups	104.693	123	.851		
	Total	108.913	126			

ONE-WAY ANOVA—Qualifications

A, B, C, C, D,E, F Vs G2		Sum of Squares	df	Mean Square	F	Sig.
C2	Between Groups	.735	3	.245	.101	.959
	Within Groups	298.068	123	2.423		
	Total	298.803	126			
C3	Between Groups	4.726	3	1.575	1.550	.205
	Within Groups	125.038	123	1.017		
	Total	129.764	126			
C4	Between Groups	8.204	3	2.735	2.722	.047
	Within Groups	123.559	123	1.005		
	Total	131.764	126			
C5	Between Groups	7.461	3	2.487	2.576	.057
	Within Groups	118.759	123	.966		
	Total	126.220	126			
D1	Between Groups	7.928	3	2.643	3.083	.030
	Within Groups	105.426	123	.857		
	Total	113.354	126			
D2	Between Groups	5.304	3	1.768	.900	.444
	Within Groups	241.751	123	1.965		
	Total	247.055	126			
D3	Between Groups	25.455	3	8.485	6.431	.000
	Within Groups	162.278	123	1.319		
	Total	187.732	126			
D4	Between Groups	7.245	3	2.415	2.667	.051
	Within Groups	111.384	123	.906		
	Total	118.630	126			
D5	Between Groups	7.666	3	2.555	3.000	.033
	Within Groups	104.759	123	.852		
	Total	112.425	126			
D6	Between Groups	9.007	3	3.002	3.677	.014
	Within Groups	100.426	123	.816		
	Total	109.433	126			

ONE-WAY ANOVA—Qualifications

A, B, C, C, D,E, F Vs G2		Sum of Squares	df	Mean Square	F	Sig.
D7	Between Groups	.649	3	.216	.168	.918
	Within Groups	158.059	123	1.285		
	Total	158.709	126			
E1	Between Groups	8.887	3	2.962	3.395	.020
	Within Groups	107.333	123	.873		
	Total	116.220	126			
E2	Between Groups	14.145	3	4.715	4.440	.005
	Within Groups	130.611	123	1.062		
	Total	144.756	126			
E3	Between Groups	5.513	3	1.838	2.230	.088
	Within Groups	101.384	123	.824		
	Total	106.898	126			
E4	Between Groups	6.237	3	2.079	2.497	.063
	Within Groups	102.393	123	.832		
	Total	108.630	126			
E5	Between Groups	3.141	3	1.047	1.702	.170
	Within Groups	75.693	123	.615		
	Total	78.835	126			
E6	Between Groups	26.674	3	8.891	7.710	.000
	Within Groups	141.846	123	1.153		
	Total	168.520	126			
E7	Between Groups	7.549	3	2.516	3.038	.032
	Within Groups	101.884	123	.828		
	Total	109.433	126			
E8	Between Groups	6.076	3	2.025	1.873	.138
	Within Groups	132.979	123	1.081		
	Total	139.055	126			
F1	Between Groups	.203	3	.068	.736	.532
	Within Groups	11.293	123	.092		
	Total	11.496	126			

ONE-WAY ANOVA—Qualifications

A, B, C, C, D,E, F Vs G2		Sum of Squares	df	Mean Square	F	Sig.
F2	Between Groups	.047	3	.016	.100	.960
	Within Groups	19.402	123	.158		
	Total	19.449	126			
F3	Between Groups	2.108	3	.703	2.956	.035
	Within Groups	29.246	123	.238		
	Total	31.354	126			
F4	Between Groups	2.537	3	.846	3.648	.015
	Within Groups	28.518	123	.232		
	Total	31.055	126			
F5	Between Groups	1.923	3	.641	2.973	.034
	Within Groups	26.518	123	.216		
	Total	28.441	126			
F6	Between Groups	2.788	3	.929	4.576	.004
	Within Groups	24.976	123	.203		
	Total	27.764	126			
F7	Between Groups	3.429	3	1.143	5.145	.002
	Within Groups	27.327	123	.222		
	Total	30.756	126			
F8	Between Groups	2.371	3	.790	3.665	.014
	Within Groups	26.527	123	.216		
	Total	28.898	126			

ONE-WAY ANOVA--Classify your organization

A, B, C, C, D,E, F Vs G3		Sum of Squares	df	Mean Square	F	Sig.
A1	Between Groups	67.462	3	22.487	10.438	.000
	Within Groups	264.994	123	2.154		
	Total	332.457	126			
A2	Between Groups	12.508	3	4.169	1.815	.148
	Within Groups	282.484	123	2.297		
	Total	294.992	126			
A3	Between Groups	3.561	3	1.187	1.259	.291
	Within Groups	115.951	123	.943		
	Total	119.512	126			
A4	Between Groups	9.303	3	3.101	1.929	.128
	Within Groups	197.721	123	1.607		
	Total	207.024	126			

ONE-WAY ANOVA--Classify your organization

A, B, C, C, D,E, F Vs G3		Sum of Squares	df	Mean Square	F	Sig.
A5	Between Groups	16.463	3	5.488	2.016	.115
	Within Groups	334.750	123	2.722		
	Total	351.213	126			
A6	Between Groups	10.207	3	3.402	1.539	.208
	Within Groups	271.840	123	2.210		
	Total	282.047	126			
A7	Between Groups	16.807	3	5.602	2.145	.098
	Within Groups	321.240	123	2.612		
	Total	338.047	126			
B1	Between Groups	12.513	3	4.171	1.606	.192
	Within Groups	319.534	123	2.598		
	Total	332.047	126			
B2	Between Groups	26.774	3	8.925	30.535	.000
	Within Groups	35.950	123	.292		
	Total	62.724	126			
B3	Between Groups	6.056	3	2.019	4.132	.008
	Within Groups	60.101	123	.489		
	Total	66.157	126			
B4	Between Groups	2.238	3	.746	1.208	.310
	Within Groups	75.951	123	.617		
	Total	78.189	126			
B5	Between Groups	2.468	3	.823	1.336	.266
	Within Groups	75.721	123	.616		
	Total	78.189	126			
B6	Between Groups	2.953	3	.984	2.535	.060
	Within Groups	47.771	123	.388		
	Total	50.724	126			
C1	Between Groups	14.713	3	4.904	6.404	.000
	Within Groups	94.200	123	.766		
	Total	108.913	126			
C2	Between Groups	45.909	3	15.303	7.443	.000
	Within Groups	252.894	123	2.056		
	Total	298.803	126			
C3	Between Groups	23.529	3	7.843	9.081	.000
	Within Groups	106.234	123	.864		
	Total	129.764	126			
C4	Between Groups	8.854	3	2.951	2.953	.035
	Within Groups	122.910	123	.999		
	Total	131.764	126			
C5	Between Groups	23.319	3	7.773	9.291	.000
	Within Groups	102.901	123	.837		
	Total	126.220	126			
D1	Between Groups	9.333	3	3.111	3.679	.014
	Within Groups	104.021	123	.846		
	Total	113.354	126			
D2	Between Groups	5.411	3	1.804	.918	.434
	Within Groups	241.644	123	1.965		
	Total	247.055	126			
D3	Between Groups	7.248	3	2.416	1.646	.182
	Within Groups	180.484	123	1.467		
	Total	187.732	126			

ONE-WAY ANOVA--Classify your organization

A, B, C, C, D,E, F Vs G3		Sum of Squares	df	Mean Square	F	Sig.
D4	Between Groups	9.190	3	3.063	3.443	.019
	Within Groups	109.440	123	.890		
	Total	118.630	126			
D5	Between Groups	10.671	3	3.557	4.300	.006
	Within Groups	101.754	123	.827		
	Total	112.425	126			
D6	Between Groups	24.372	3	8.124	11.747	.000
	Within Groups	85.061	123	.692		
	Total	109.433	126			
D7	Between Groups	40.981	3	13.660	14.272	.000
	Within Groups	117.728	123	.957		
	Total	158.709	126			
E1	Between Groups	23.533	3	7.844	10.410	.000
	Within Groups	92.688	123	.754		
	Total	116.220	126			
E2	Between Groups	11.518	3	3.839	3.544	.017
	Within Groups	133.238	123	1.083		
	Total	144.756	126			
E3	Between Groups	9.680	3	3.227	4.082	.008
	Within Groups	97.218	123	.790		
	Total	106.898	126			
E4	Between Groups	12.342	3	4.114	5.255	.002
	Within Groups	96.288	123	.783		
	Total	108.630	126			
E5	Between Groups	10.885	3	3.628	6.568	.000
	Within Groups	67.950	123	.552		
	Total	78.835	126			
E6	Between Groups	8.010	3	2.670	2.046	.111
	Within Groups	160.510	123	1.305		
	Total	168.520	126			
E7	Between Groups	12.762	3	4.254	5.413	.002
	Within Groups	96.671	123	.786		
	Total	109.433	126			
E8	Between Groups	14.554	3	4.851	4.793	.003
	Within Groups	124.501	123	1.012		
	Total	139.055	126			
F1	Between Groups	.602	3	.201	2.264	.084
	Within Groups	10.894	123	.089		
	Total	11.496	126			
F2	Between Groups	2.544	3	.848	6.171	.001
	Within Groups	16.904	123	.137		
	Total	19.449	126			
F3	Between Groups	6.353	3	2.118	10.419	.000
	Within Groups	25.001	123	.203		
	Total	31.354	126			
F4	Between Groups	9.001	3	3.000	16.733	.000
	Within Groups	22.054	123	.179		
	Total	31.055	126			
F5	Between Groups	8.957	3	2.986	18.847	.000
	Within Groups	19.484	123	.158		
	Total	28.441	126			

ONE-WAY ANOVA--Classify your organization

A, B, C, C, D,E, F Vs G3		Sum of Squares	df	Mean Square	F	Sig.
F6	Between Groups	7.196	3	2.399	14.345	.000
	Within Groups	20.568	123	.167		
	Total	27.764	126			
F7	Between Groups	9.396	3	3.132	18.035	.000
	Within Groups	21.360	123	.174		
	Total	30.756	126			
F8	Between Groups	1.363	3	.454	2.030	.113
	Within Groups	27.534	123	.224		
	Total	28.898	126			