Cape Peninsula University of Technology

Integration of risk management system: towards a sustained access to EU citrus market

by

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Thesis submitted in fulfilment of the requirements for the degree

Master of Engineering: Quality in the Faculty of Engineering and the Built Environment

at the Cape Peninsula University of Technology

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Bellville
29 February 2024

DECLARATION

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

29 February 2024

Signed **Date**

ABSTRACT

In recent years, there has been a significant increase in the stringency of sanitary and phytosanitary risk-mitigating regulations governing the international trade of agricultural products. The European Union's sanitary and phytosanitary regulations are perceived as the most stringent regulations for international trade. To access the lucrative market, producers must comply with both sanitary and phytosanitary regulations and private standards. Developing countries are most affected by the increase in stringency and generally cannot effectively comply, consequently creating a barrier to trade. South Africa is the second largest exporter of citrus worldwide that makes this industry an important foreign exchange earner. The European Union is South Africa's main citrus export market and requires phytosanitary measures for the pest false codling moth. Hence, the revised false codling moth risk management system was implemented to ensure compliance. The study aimed to investigate how to effectively integrate risk management into the citrus producers' existing quality management system to enhance compliance and sustain access to the European Union citrus market. Furthermore, to identify the difficulties experienced by the producers with the integration process.

A case study approach was adopted, with the quantitative research method being employed to collect data. The study was based on a literature review and a survey questionnaire as the data collection strategy. The closed-ended questionnaire sought to elicit the experiences and views of the citrus producers in the Western Cape Province about the integration process. The survey questionnaire was sent to 235 citrus representatives and the final sample size comprised 205 representatives. However, a total of 85 surveys were fully completed and 120 were partially completed. The Statistical Package for the Social Sciences software programme was used to generate descriptive and inferential statistics. Furthermore, reliability tests (Cronbach Alpha) and a factor analysis were conducted, including a one-way ANOVA test.

The study found that the majority of citrus producers reported financial and human resources challenges as the main difficulties experienced with the integration. Moreover, it was found there is no statistically significant difference between how small, medium and large-scale citrus producers viewed and experienced these difficulties. The results also found that the majority of producers perceived the detection of regulated pests (false codling moth) and exceeding the pesticide maximum residue limits as the main non-compliances when exporting citrus to the

European Union market. Additionally, it was found that most of the producers reported integrating the risk management system into their daily operations, planning and recordkeeping on a strategic and operational level. This practice includes conducting internal audits, reviewing stakeholder requirements during a single audit, and reviewing how effectively the risk management system requirements have been implemented.

This study recommends greater government and private sector support to citrus producers, such as the development of an annual training programme with the assistance of producers, providing training workshops and courses during the off-season to all farm workers that are linked to practical applications and the development of standardised forms to facilitate integration and enhance record keeping. Additionally, the government and private sector should provide technical support and enhance awareness regarding import requirements, especially about regulated pests and MRLs. It is further recommended that citrus producers establish an integration team and develop a well-structured integration plan based on the four principal elements of the integration process (integration strategy, level, methodology and audits). A strategic approach (top-down or systems approach) should be adopted, during which integration occurs firstly on a strategic level and then on a tactical and operational level. This process includes identifying common elements between the existing quality management system and the false codling moth risk management system and determining which elements of the risk management system can be effectively integrated and on what level integration should be achieved. The risk management system requirements that cannot be integrated should be effectively implemented separately. Further, integration methods recommended include process maps, a Plan, Do, Check and Act cycle, brainstorming and analysis of common elements.

Key words: Citrus Export, EU Regulations, Risk Management Integration, Sanitary and Phytosanitary Standards and Compliance Challenges

ACKNOWLEDGEMENTS

I wish to thank:

- My God, for giving me the strength and support needed to undertake and pursue this journey.
- My husband, Baikanne, for his support, motivation and patience. Thank you, lovey.
- My children, Lesedi and Alexandra, for their patience and support.
- My family and friends, for their support and motivation, which made this journey a little less stressful.
- My colleagues, for their assistance and engagement regarding my studies, their support meant a lot.
- My supervisor, Dr. L. Valentine, for her time, support, guidance and motivation. Thank you, Dr V.
- My co-supervisor, Prof. B. Yan, for his support, time, and guidance, thank you Prof.
- Citrus Growers Association, Citrus Research International and CGA's Grower Development Company, for their support and assistance – it is much appreciated.
- Western Cape Citrus producers, all the producers who participated in this study, without their participation this would not have been possible − thank you.
- Department of Agriculture, Land Reform and Rural Development, for allowing me access to their database and for their generous financial support in the form of a study bursary.
- Dr C. Uys, the statistician from the Centre for Postgraduate Studies at the Cape Peninsula University of Technology, for her time, assistance and guidance, thank you.

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ABBREVIATIONS

CGA	Citrus Growers Association
CRI	Citrus Research International
DAFF	Department of Agricultural, Forestry and Fisheries
DALRRD	Department of Agriculture, Land Reform and Rural Development
DIS	Directorate Inspection Services
EFSA	European Food Safety Authority
EPPO	European and Mediterranean Plant Protection Organisation
FCM	False codling moth
FMS	False Codling Moth Risk Management System
IMS	Integrated Management System
IPPC	International Plant Protection Convention
ISPM	International Standards for Phytosanitary Measures
NPPO	National Plant Protection Organisation
PUC	Production unit code
QMS	Quality Management System
RM	Risk Management
SPS	Sanitary and Phytosanitary Standards
SPSS	Statistical Package for the Social Sciences
STCs	Specific Trade Concerns
WTO-SPS Agreement	World Trade Organization Agreement on the Application of Sanitary and Phytosanitary Measures

GLOSSARY

The appropriate level of protection (ALOP):	"The level of protection deemed appropriate by the Member establishing a sanitary or phytosanitary measure to protect human, animal or plant life or health within its territory" (WTO-SPS Agreement, n.d).
Interception: (of a pest)	"The detection of a pest during inspection or testing of an imported consignment" (ISPM 5, 2007).
Maximum Residual Limits (MRLs):	"A maximum residue limit (MRL) is the highest level of a pesticide residue that is legally tolerated in or on food or feed when pesticides are applied correctly in accordance with Good Agricultural Practice" (Codex Alimentarius International Food Standards, 2023).
Non-tariff Measures:	All barriers set by a country other than tariffs to regulate, control and manage international trade in an attempt to protect the domestic markets to some extent by restricting imports (Liu, Li, Lin & Liu, 2019).
Notifications:	"Notifications are provided by the importing country to the exporting country to identify significant failures of consignments to comply with specified phytosanitary import requirements or to report emergency action that is taken on the detection of a pest posing a potential threat" (ISPM 13, 2021).
Pest Risk Analysis (PRA):	"The process of evaluating biological or other scientific and economic evidence to determine whether an organism is a pest, whether it should be regulated, and the strength of any phytosanitary measures to be taken against it" (ISPM 5, 2007).
Phytosanitary Certificate:	A certificate is issued to indicate the consignment of plants, plant products and other regulated commodities comply with the specific phytosanitary import requirements of the importing country and are in compliance with the certifying statement (ISPM 12, 2017).
Phytosanitary Measures:	Any official procedure, regulation and legislation to prevent the introduction and/or spreading of quarantine pests, or to minimize the economic impact of a regulated non-quarantine pest (ISPM 5, 2007).
Production Unit Code:	The Production Unit Code refers to the unique code used to identify the farm's agricultural production unit,

	which must be registered with the DALRRD to be able to export to other countries (DALRRD, 2021b).
Quarantine Pest:	“A pest of potential economic importance to the area endangered thereby and not yet present there, or present but not widely distributed and being officially controlled” (ISPM 5, 2007).
Redundancy:	“The duplication of an effect created by two different measures in order to produce an impact higher than the required” (FAO/IAEA, 2010).

CHAPTER ONE: SCOPE OF THE RESEARCH

1.1 Introduction

The stringency of sanitary and phytosanitary (SPS) risk-mitigating regulations for agricultural products has increased significantly over the past years (Melo, Engler, Nahuehual, Cofre & Barrena, 2014). This intensification is largely due to the increase in consumer awareness concerning the safety and quality of agricultural products (Murina & Nicita, 2017). Developing countries are most affected by the increase in stringency because they often cannot comply which, consequently, can act as a barrier to trade (Melo et al., 2014; Murina & Nicita, 2017). The European Union's (EU) SPS regulations are viewed as the most stringent regulations for international trade (Camanzi, Hammoudi & Malorgio, 2019; Iliyasu & Zainalabidin, 2018). To access the EU market besides complying with various SPS regulations (Murina & Nicita, 2017), exporters must also adopt and maintain private standards (Babatunde, 2018; Henson, Masakure & Cranfield, 2011). Compliance with these private standards has become mandatory even if such standards are voluntary (Tennent & Lockie, 2012). Examples of private standards include the Global working group for Good Agricultural Practice (GlobalG.A.P.), British Retail Consortium (BRC) and the International Organization for Standardization (ISO).

The requirements of different stakeholders create the need for exporting companies to adopt, implement and maintain various standards and their associated management systems (MSs). This practice includes the risk management measures (SPS regulations) as required by the regulations of the importing countries (Jacxsens, Van Boxstael, Nanyunja, Jordaan, Luning & Uyttendaele, 2015; Lockie, Travero & Tennent, 2015). Integrating different MSs into a single integrated management system (IMS) have significantly more benefits compared to implementing individual MSs (Bernardo, Simon, Tarí, Molina-Azorín, 2015). These benefits include operational cost reduction, enhanced performance, improvement to the reputational image of an organisation, an enhanced working environment and improved relations with stakeholders (Barbosa, Bueno da Silva, de Souza & Morioka, 2021). Individual MSs are often managed with an emphasis on particular functions, while an IMS focuses on the organisation as a whole and the scope includes the individual MSs applied (Bernardo et al., 2015).

Effectively integrating the quality requirements of private standards and the regulatory risk management regulations seems only rational to ensure the effective

implementation and maintenance of these systems and the benefits are sufficiently achieved. This study sought to investigate how to effectively integrate risk management (RM) into citrus growers' existing quality management system (QMS) to ensure sustained access to the EU citrus market. Furthermore, to identify the difficulties experienced by citrus growers with integrating the RM into the QMS.

1.2 Problem statement

South Africa (SA) is the second largest exporter of citrus fruit globally making the citrus export industry a valuable foreign exchange earner (Malan, von Diest, Moore & Addison, 2018). The EU is South Africa's main citrus export market (Department of Agriculture, Land Reform and Rural Development [DALRRD], 2021) and requires phytosanitary risk-mitigating measures for the pest false codling moth (FCM) (Moore, 2021; DALRRD, 2021: Online). The FCM is a threat to the citrus export industry because it can cause damage to the citrus that has a detrimental impact on the quality of the fruit (Adom, Fening, Billah, Wilson, Hevi, Clottey, Ansah-Amprofi & Bruce, 2021). DALRRD, together with the citrus industry, established the false codling moth risk management system (FMS) as a risk-mitigating measure to ensure citrus exports comply with the EU import requirements (CRI, 2020).

The DALRRD was informed by the EU that it would be imposing more stringent SPS requirements for citrus imported from SA (European Commission 2017/1279, 2017). According to the European and Mediterranean Plant Protection Organisation (EPPO), the decision was based on the outcome of a pest risk assessment conducted for the pest FCM and frequent non-compliance with the EU import requirements from African countries (EPPO, 2013). The DALRRD, together with the citrus industry, subsequently improved the FMS based on the systems approach design, that is a combination of several risk-mitigating measures to collectively manage pest risks to achieve a suitable level of phytosanitary protection (EFSA, 2021; International Standards for Phytosanitary Measures [ISPM] 14, 2019). The improved FMS required citrus growers to modify their existing QMSs to integrate the RM requirements, to ensure they comply with regulations to continue exporting citrus to the EU. Certain growers appointed consultants or third parties to assist with the integration and implementation of the RM requirements. Some hired or designated employees specifically for this purpose, and others opted to integrate the requirements themselves. Integrating different MSs effectively requires financial resources, adequate and suitable workers, access to

consultants with appropriate experience in effective integration, top management participation and sufficient employee training (Almeida, Domingues & Sampaio, 2014).

Non-compliances found by the EU can result in rejection at the port of entry and the consignment being sent back to the exporting country that can have economic consequences for growers (Idris, Singh & Praveen, 2015; Iliyasu & Zainalabidin, 2018). Furthermore, non-compliance can also result in a temporary suspension of an export programme (Kapuya, 2015; South African Government Gazette, 2014). Therefore, poor integration of RM into the QMS of citrus growers can result in poor conformity with the EU import requirements, consequently, resulting in more stringent and expensive SPS requirements that can have a detrimental impact on the economy of SA (Iliyasu & Zainalabidin, 2018; Moore, 2021; South African Government Gazette, 2014).

1.3 Rationale and significance of the study

To participate in the international trade of agri-food products developing countries must comply with both SPS and private standard requirements (Murina & Nicita, 2017). This practice requires a large investment, such as improvements to infrastructure and technology which developing countries generally lack, making it difficult for them to effectively comply (Rao, Bast & de Boer, 2021). The phytosanitary measure, systems approach serves as an alternative to the preferred phytosanitary risk-mitigating measure (Moore, Kirkman & Hattingh, 2016). It, therefore, enables developing countries to participate in trade and access lucrative international markets if the preferred phytosanitary measure is trade restrictive, costly, unsuitable for the commodity being traded and not feasible (Evans, Brokerhoff, Baker & Eschen, 2012).

Information about the implementation and the measures used to reduce risk by countries adopting the systems approach is very limited for public viewing (Quinlan, Leach, Jeger & Mumford, 2020; van Klinken, Fiedler, Kingham, Collins & Barbour, 2020). Many studies have assessed the effectiveness of the systems approach as an effective alternative to the preferred single treatment (Hattingh, Moore, Kirkman, Goddard, Thackeray, Peyper, Sharp, Cronje, Pringle, 2020; Jamieson, DeSilva, Worner, Rogers, Hill & Walker, 2013; van Klinken et al., 2020). Furthermore, numerous studies have evaluated the impact and relevance of SPS and private standards on developing countries concerning international trade (Annor, Mensah-Bonsu & Jatoe,

2016; Babatunde, 2018; Henson, Masakure & Cranfield, 2011; Melo et al., 2014; Rao et al., 2021).

The researcher is unaware of any studies having been conducted on how to effectively integrate the systems approach as an RM system into the existing QMS of agri-food growers, to efficiently comply with the importing regulations of the EU. This research study aimed to contribute an effective method that the citrus growers in SA could employ to integrate RM into their QMS to enhance compliance with the EU import requirements.

1.4 The Research Question

The research question directs and guides the researcher regarding what they want to know about a specific research problem that initiated the research study, furthermore, it elaborates on the stated purpose of the research study that subsequently addresses the research problem (Given, 2012).

1.4.1 Primary Research Question

The primary research question, forming the crux of this dissertation, reads as follows: “How to effectively integrate risk management practices into the existing quality management system to enhance compliance with EU import requirements for citrus growers?”

1.4.2 Investigative Research Questions

The investigative questions in support of the main research question to be researched within the ambit of this dissertation read as follows:

- What are the difficulties experienced by citrus growers with the integration of RM practices into their existing QMS?
- What are the main non-compliances in the agri-food export chain from developing countries to the EU market?
- What is an effective way of integrating risk management and a quality management system?
- What will the recommendations from this study contribute to citrus growers?

1.5 Primary and Key Research Objectives

The research objectives are the fundamental aspects of a research study because it shows what the researcher intends to achieve with the research study (Wilkinson, 2011).

The primary research objective of this dissertation is:

To determine how to effectively integrate risk management into the quality management system of citrus growers, to enhance their compliance with the EU import requirements.

The secondary research objectives of this dissertation are:

- To identify the difficulties experienced by citrus growers with the integration of the RM system into their existing QMS.
- To determine the main non-compliances in the agri-food export chain from developing countries to the EU market.
- To determine an effective way of integrating risk management and quality management system.
- To provide recommendations that will enhance citrus growers' compliance with EU requirements.

1.6 The Research Process

Collis and Hussey (2009) believe that irrespective of the type of research or approach adopted by the investigator, certain fundamental phases in the research process are general to all investigations founded on science. These six fundamental phases are as follows:

- Select the research topic and search for the literature to examine the current body of knowledge and thereby obtain relevant information.
- Conduct a literature review to formulate and define the research problem and research questions.
- Design the research methodology to determine how the research will be conducted and write the research proposal.
- Conduct data collection.
- Analyse and interpret the collected research data.
- Write the research dissertation, thesis or report (Collis & Hussey, 2009).

The Collis and Hussey method outlined above will be applied to this study.

1.7 Chapter and Content Analysis

The chapter and content analysis applicable to this research study are as follows:

- **Chapter One:** The scope of the study: This chapter outlines the crux of the study by providing a brief introduction and background to the research problem. In addition, it provides the investigative questions, research objectives, research process, particular design and methodology strategy, critical assumptions, constraints and the significance of the study.
- **Chapter Two:** Overview of the research environment: This chapter provides a holistic perspective of the research environment about the SA citrus export industry concerning the international trade of citrus fruit to the EU. It also presents the reader with the required comprehensive background to the research problem and why the study was undertaken within the chosen environment.
- **Chapter Three:** Literature review: In this chapter, a literature review was performed by evaluating and scrutinising previous research and emerging trends to construct a theoretical framework for the research problem. The academic context established by the literature review concerning the specific features of the study will be used to make recommendations for the possible mitigation of the research problem.
- **Chapter Four:** Data collection design and methodology: This chapter elaborates on the quantitative approach to the data collection design and methodology employed for this study. Data will be collected from citrus growers situated in the Western Cape, using the research instrument questionnaire.
- **Chapter Five:** Data presentation: Description, analysis and synthesis of results: In this chapter the collected research data will be analysed and interpreted. Furthermore, key aspects and findings of the research will be discussed and synthesized with the literature review.
- **Chapter Six:** Conclusion and recommendations: In this concluding chapter, primary aspects concerning the research study will be revisited. The research findings will be brought into the overall context of the research and previous research reviewed to conclude and make recommendations to possibly mitigate the research problem to benefit the citrus growers.

1.8 Conclusion

In this chapter, the research topic was introduced and the crux of the study outlined. The research process applied was indicated, including the research problem, research question, investigative questions and the objectives of the research. In the next chapter, a holistic perspective of the research background will be provided to enable a comprehensive understanding of the research problem and research environment as it pertains to the South African plant health legislative framework, the citrus export industry of SA and the FMS.

CHAPTER TWO: THE RESEARCH ENVIRONMENT

2.1 Introduction

Chapter Two provides a synopsis of the research environment as it relates to the research problem and the need for this study. The chapter will focus on the following aspects to provide a comprehensive background to the research environment.

- South African Plant Health Legislation
- South African Citrus Industry
- Citrus Market
- False Codling Moth Risk Management System
- European Union (EU) Interception Notification Data for Citrus Export Non-compliances

2.2 South African plant health legislation

Plants and plant products have the potential to carry harmful plant pests and diseases. Furthermore, trade in these goods has been identified as the most significant global pathway for plant pests and diseases, damaging plant health (Hantula, Müller & Uusivuori, 2014). This conduit can have an unacceptable impact on the economy, environment and society overall (Yoe, Griffin & Bloem, 2020). Economically important pests directly subjected to official regulation are quarantine pests and regulated non-quarantine pests (South African Government Gazette, 2014). The former are pests with the potential to have an economic impact on a region threatened by it and not in existence yet or are present but not prevalent and are under official control (ISPM 5, 2007). The latter are pests already present in the region of the importing country and have an unacceptable economic impact on the intended use of those plants it affects (ISPM 5, 2007).

The Department of Agriculture, Land Reform and Rural Development (DALRRD) has been mandated with the responsibility of preventing, mitigating and controlling the introduction, spread and establishment of plant diseases and pests (Department of Agricultural, Forestry & Fisheries [DAFF], 2017). However, protecting the South African agriculture and forestry industry against harmful pests is becoming more difficult because of the significant increase in international travel and more stringent requirements for the use of pesticides (South African Government Gazette, 2014). The

importance of protecting the plant health status of the country has far-reaching consequences if not sufficiently achieved. Such consequences include significant costs to farmers, tax-payers and consumers as a result of damage to crops, lower crop yields and the cost required for phytosanitary measures. Moreover, it can have a detrimental effect on the agriculture and forestry products' availability, quality and international competitiveness (South African Government Gazette, 2014). Plant pests known to be present in South Africa (SA) have the potential to endanger these industries, as well as the plant resources of countries SA export to. This can harm SA's ability to access, maintain and expand current international markets, including accessing new markets (South African Government Gazette, 2014).

2.2.1 The plant health legislative structure

SA is a signatory member of the World Trade Organization's Agreement on the Application of Sanitary and Phytosanitary Measures (WTO-SPS Agreement) and the International Plant Protection Convention (IPPC). The country, therefore, is obligated to comply with the requirements of these treaties and fully attain the associated benefits (DAFF, 2017). The WTO-SPS agreement requires member states to ensure their plant health or phytosanitary legislation and associated policies are in line with the relevant international and national commitments to enable fair and safe international trade of plant commodities (DAFF, 2017). Chapter Three will elaborate more on these international treaties and their specific role.

To comply, the DALRRD has established the National Plant Protection Organisation of South Africa (NPPOZA) to develop and enforce plant health legislation or phytosanitary measures (DAFF, 2017). The NPPOZA consists of three directorates within the DALRRD, namely the directorates Inspection Services (DIS), Plant Health (DPH) and Food Import and Export Standards (DFIES) (DAFF, 2017). It is the responsibility of the NPPOZA to ensure that phytosanitary measures are based on sound scientific principles and relevant international standards (DAFF, 2017). Figure 2.1 below provides an outline of the NPPOZA structure within the DALRRD.

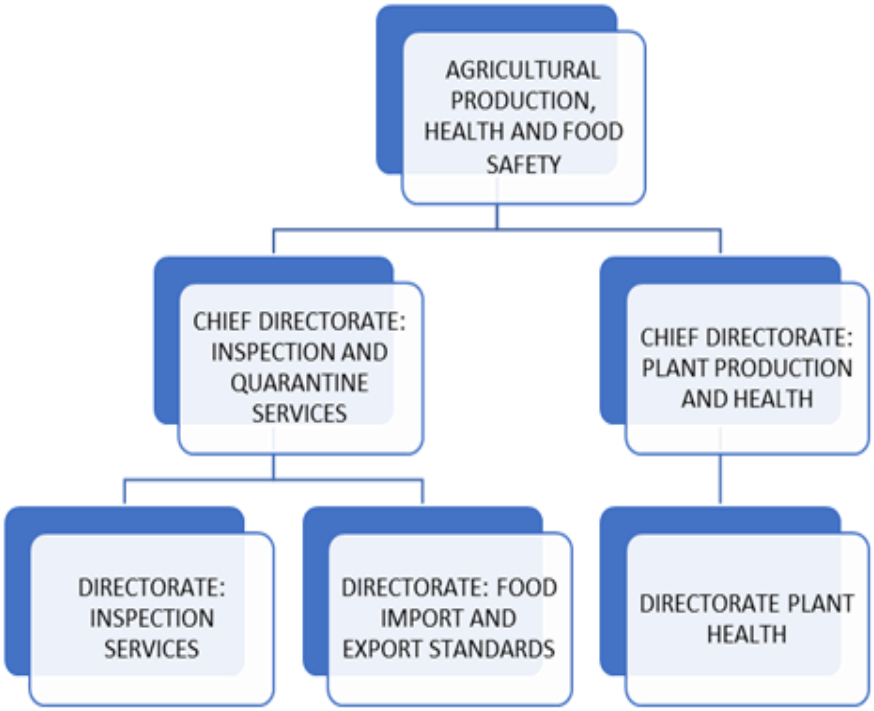

Figure 2. 1: The NPPOZA structure within the DALRRD

(Source: DAFF, 2017)

2.2.2 The NPPOZA Directorates

2.2.2.1 The Directorate Inspection Services (DIS)

The mandate of the DIS is to ensure various stakeholders comply with the plant health legislation and RM strategies or systems related to plant and plant products. The DIS aim to provide inspection and quarantine services by focusing on providing leadership, support and guidance to ensure adherence to plant health legislation. This process includes overseeing the effective implementation of various RM systems or strategies about regulated plant and plant products (DALRRD, 2021: Online). The functions of the DIS include providing RM inspections or audits at selected border points, conducting national RM inspections or audits and providing national diagnostic and quarantine services, including animal quarantine and inspection services (DALRRD, 2021: Online).

The DIS is the primary directorate responsible for phytosanitary inspections per the border control strategy of the DALRRD (South African Government Gazette, 2014). The directorate consists of various sub-directorates, with the sub-directorate National Plant and Plant Products Inspection Services (NPPPIS) as the directorate specifically

mandated with enforcing the FMS for citrus exported to the EU (DALRRD, 2021: Online, DALRRD, 2021b).

2.2.2.2 The Directorate Plant Health (DPH)

The mandate of the DPH is to develop legislation, policies, guidelines and standards and norms to ensure the provision of the necessary phytosanitary legislative framework to manage plant health risks. This includes ensuring compliance with relevant plant health international and national commitments (South African Government Gazette, 2014).

2.2.2.3 The Directorate Food Import and Export Standards (DFIES)

The DFIES aim to enhance compliance with the WTO-SPS Agreement by strengthening the government's sanitary and phytosanitary (SPS) capacity (DALRRD, 2021: Online). The directorate achieves this goal by facilitating national phytosanitary awareness campaigns (South African Government Gazette, 2014). Furthermore, their functions include monitoring and analysing the WTO-SPS notifications, developing and maintaining an SPS notification database, establishing and assisting with various stakeholder platforms and providing institutional support related to the WTO-SPS notifications for SA and various trading partners (DALRRD, 2021: Online).

2.2.3 The National Plant Health or Phytosanitary Regulatory System

The national phytosanitary regulatory system is presently administered under the Agricultural Pests Act of 1983 (Act no. 36 of 1983) and its associated regulations. This is the primary act for the implementation of the plant health policy and is implemented in conjunction with other legislation and relevant international agreements (DALRRD, 2021: Online; DAFF, 2017). Applicable acts for the implementation of the plant health legislation are indicated below for informational purposes.

2.2.3.1 Agricultural Pests Act (Act no. 36 of 1983)

The Agricultural Pests Act (Act no. 36 of 1983) makes provision for phytosanitary measures to prevent and combat pests associated with agriculture and forestry products. These measures include provisions for their national control and matters connected therewith. The act is currently administered under three directorates,

namely DPH, DIS and the directorate Climate Change and Disaster Management (DCCDM) (South African Government Gazette, 2014).

2.2.3.2 Agricultural Product Standards Act (Act no. 119 of 1990)

The purpose of the above act is to make provision for control over the sale and export of certain agricultural products, including the sale of imported products and related products, and matters connected therewith (South Africa, 1990). The act is presently administered under the directorate Food Safety and Quality Assurance and the DIS's quality division (DALRRD, 2021: Online). The Directorate of Food Safety and Quality Assurance's objective is to regulate the food safety and quality of agricultural products through the provisions made in the Agricultural Product Standard Act. The Directorate aims to achieve this goal by standardising quality norms through the establishment of standards for agricultural goods and disseminating the information to all relevant stakeholders (DALRRD, 2021: Online). The act also makes provision for the appointment of assignees to ensure compliance with established standards and requirements. This practice includes inspections at the point of sale, production, packaging and export (DALRRD, 2021: Online; South Africa, 1990). One of the assignees currently appointed for all agricultural products (including citrus) intended for export is the Perishable Products Export Control Board (PPECB) (DALRRD, 2021: Online).

2.2.3.3 Plant Improvement Act (Act no. 53 of 1976)

The above act makes provision for the registration of premises where specific plants can be sold or cleansed, or where propagating plant materials are packed and sold. The act also prescribes the criteria whereby these plants or propagating materials can be sold for cultivation purposes, provides for a certification system to ensure the quality of specific plants and propagating material is maintained, and includes provisions for recognising certain plant varieties and regulating the export and import of specific plants and propagating material (South Africa, 1976). These provisions promote and improve the quality of plant propagating material available in the agricultural trade, which is achieved through numerous programmes such as certification schemes (South African Government Gazette, 2014).

2.2.3.4 Perishable Products Export Control Board (PPECB)

The PPECB is a public entity established and mandated in terms of the Perishable Products Export Control Act of 1983 (Act no. 9 of 1983), to provide cold chain management and quality certification services of all fresh produce at various inspection points to ensure compliance with export quality requirements (PPECB, 2022: Online). The PPECB is also assigned by the DALRRD under the Agricultural Product Standards Act to provide inspection and food safety services (DALRRD, 2021a). Furthermore, the organisation is officially recognised and has been approved as a third-country inspection authority under the European Commission Regulation 543 of 2011. The approval by the European Commission acknowledges the South African inspection systems as equal to the EU inspection bodies, a fact that contributes to fewer frequent inspections in the EU at the point of import (PPECB, 2022: Online). The PPECB's quality inspection services reduce the risk associated with exporting perishable products for the exporters and producers (PPECB, 2022: Online). Moreover, the DALRRD have assigned certain critical control-related duties to the PPECB for citrus exported to the EU under the FMS, to enhance compliance (CRI, 2020).

2.3 South African citrus industry

In the 1940s the citrus industry was well organized and heavily controlled by the state, specifically the Minister of Agriculture via a single statutory body known as Outspan International (Dlikilili & van Rooyen, 2018). The deregulation of the industry in 1997 led to a range of operational and policy changes promoting competition in the sector. Producers became more business-driven actors operating in a less regulated environment and more exporting agents entered the sector competing for the produce of growers (Dlikilili & van Rooyen, 2018; Genis, 2018).

Citrus production in SA occurs mainly in the Western Cape, Limpopo, Mpumalanga, KwaZulu-Natal, Eastern Cape and Northern Cape provinces (DALRRD, 2020). The province with the greatest number of hectares under citrus production for the citrus season 2020 was the Limpopo province, followed by the other provinces as indicated by Figure 2.2 below (Citrus Growers Association [CGA], 2021a). The citrus production regions are further expanded when one includes the Southern African Development Community (SADC) region, specifically Swaziland and Zimbabwe (CGA, 2021b). However, these regions produce much smaller volumes of citrus (DALRRD, 2020).

Province	Area (ha)
Limpopo	37 825
Eastern Cape	25 705
Western Cape	17 938
Mpumalanga	7 639
Kwa-Zulu Natal	2 431
Northern Cape	1 956
Zimbabwe	1 035
North West	866
Swaziland	823
Free State	12
Grand Total	**96 230**

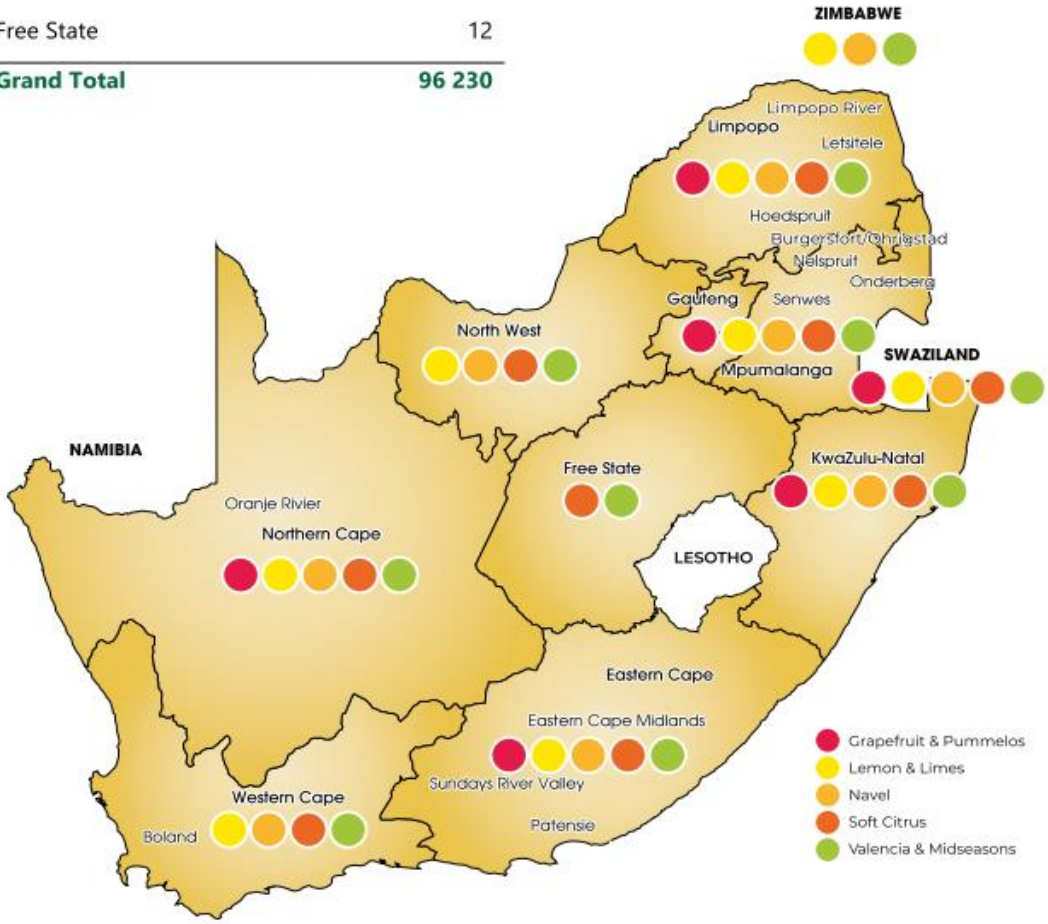

Figure 2. 2: The citrus production regions

(Source: CGA, 2021a)

The industry produces several varieties of citrus that consist mainly of four general groups, namely soft citrus, oranges, grapefruit, and lemons and limes (DALRRD, 2020). The citrus production season starts in March with lemons and soft citrus and continues until October when the oranges are harvested (Fresh Produce Exporters' Forum [FPEF], 2021). The production regions can be distinguished predominantly by the climate of the regions. The Western Cape and Eastern Cape are considered more

conducive for producing Navel oranges and lemons due to their cooler growing areas, thus production is mostly focused on these varieties (DALRRD, 2020). Producers in these cooler regions are also able to satisfy consumer demand for soft citrus or easy peelers such as Clementines and Satsumas, therefore, most of SA's soft citrus cultivars are produced in these two provinces (DALRRD, 2020, Mather & Greenberg, 2003). While the Limpopo, Mpumalanga and KwaZulu-Natal provinces are considered warmer and more conducive for producing grapefruit and Valencia oranges (DALRRD, 2020).

The citrus sector employs more than 100 000 people with the majority of employees working in the orchards on farms and in packhouses (DALRRD, 2020). The farms in the Western Cape and Eastern Cape are mainly small in size and the bulk of the citrus is packed in big packhouse facilities privately owned by cooperatives. The farm sizes in the Limpopo, Mpumalanga and KwaZulu-Natal provinces are much larger and most producers pack their citrus in smaller privately owned packhouse facilities (DALRRD, 2020).

2.3.1 Citrus growers or producers

The citrus industry consists of diverse producers or growers, from large profitable farms to small-scale farms predominantly selling their products to the local market (Dlikilili & van Rooyen, 2018). Large commercial farming groups are the leading citrus exporters and appoint employees specifically to ensure compliance with various stakeholder requirements (Roberts, Landani & Chisoro, 2020). Fréguin-Gresh and Anseeuw (2014) claim that the South African citrus industry has predominately remained dualistic with 1 400 medium to large-scale export-driven producers controlling 80 per cent of the production volume, and 2 200 small-scale farmers with an average of less than 100 trees each producing citrus mainly for the domestic market. According to Urquhart (1999), the citrus farms in SA generally range from 0,5 to 500 hectares (ha) with certain farms having up to 6 000 ha. Further, the author claims that most farms are family-owned and medium-scale farms, and farms in Olifants River Valley have an average size of 40 ha.

When classifying farming types in the South African context, Kirsten and Van Zyl (1998) assert it should not be done based on the land size but on the turnover or the level of net farm income. The authors state that "size is not a good criterion for defining small farms. For example, one hectare of irrigated peri-urban land, suitable for

vegetable farming or herb gardening, has a higher profit potential than 500 hectares of low-quality land in the Karoo". Additionally, Kirsten and Van Zyl (2019) state that it would not be wise to use farm size to determine the farm category as there is variation between different pieces of land in terms of land quality and production potential. The authors also argue based on the definition of small- medium and micro-sized companies of the Department of Trade and Industry, which is a turnover of R5 million and below that most commercial farms can be categorised as small and medium-scale companies.

The DALRRD's draft National Policy on Comprehensive Producer Development Support defines producers in relation to providing support and for the objective of classifying South African producers in the agricultural, forestry and fisheries sector as follows:

- "Smallholder producer: Is defined as a producer that produces (at primary, secondary, and tertiary level) for household consumption and markets, therefore farming is consciously undertaken in order to meet the needs of the household and derive a source of income. These are usually the new entrants aspiring to produce for market at a profit with a maximum annual turnover of up to R5 million per annum."
- "Medium Scale Commercial producer: Is defined as a venture undertaken by an individual or business entity for the purpose of production and sale of agricultural, forestry and fisheries products to make a profit. These are established enterprises producing for market to make a profit with an annual turnover ranging from R5 million to R20 million."
- "Large Scale Commercial producer: Is defined as a venture undertaken by an individual or business entity for the purpose of production and sale of agricultural, forestry and fisheries products to make a profit. These are established enterprises producing for market to make a profit with an annual turnover above R20 million" (DAFF, 2018).

For this study in the context of citrus export producers, the definition provided by the DALRRD's National Policy on Comprehensive Producer Development Support will be applied to categories for citrus producers or growers.

2.3.2 Citrus associations

Citrus producers are supported by various entities such as the DALRRD, the Citrus Growers Association (CGA) of Southern Africa, CGA's Grower Development Company (CGA-GDC), Citrus Research International (CRI), Fresh Produce Exporters' Forum (FPEF), Agricultural Research Council (ARC) and academic institutions. Some of these associations will be discussed below to provide a background on each entity and expand on the ways they support the industry.

2.3.2.1 Citrus Growers Association of Southern Africa (CGA)

The CGA is the main organisation representing the interest of the citrus producers in SA exporting citrus. The organisation have approximately 1 400 members throughout Southern Africa (including Zimbabwe and Swaziland). The CGA was established by citrus producers after the de-regulation of the sector in 1997 due to concerns that functions previously performed by the Citrus Board would be discontinued or reduced. The CGA aimed to fill that gap and represent the citrus producers' interests to various citrus industry stakeholders, such as the government, research institutions, suppliers and exporters (CGA, 2022: Online).

This organisation's objective is to enhance its members' profitability in the long term through key strategies. These strategies are to ensure that access to international markets is retained, to fund and direct research and development to ensure the citrus produced complies with the relevant quality standards and phytosanitary requirements, to represent citrus producers by engaging with relevant stakeholders, facilitate effective logistics, promote industry transformation and to provide quality assurance (CGA, 2022: Online). All members exporting citrus pay a levy that is administered by the CGA and mandates growers to recommend priorities and expenditures under the guidance of the National Agricultural Marketing Council (NAMC) (CGA, 2022: Online).

The CGA's Grower Development Company (CGA-GDC) was established by the CGA to implement the organisation's transformation mandate. The CGA-GDC's main objective is to empower Black citrus producers and promote transformation in the citrus industry and agriculture sector as a whole (CGA-GDC, 2020). This process is achieved by facilitating and supporting Black farmers with technical support and providing production infrastructure, assisting with access to funding and markets, and providing business management support (CGA-GDC, 2021: Online). There are approximately

145 productive small and medium-sized Black producers under the representation of the CGA and 77 of these farmers are exporting citrus (CGA-GDC, 2020).

2.3.2.2 Citrus Research International (CRI)

The CRI is a research and technical services organisation mainly focused on enhancing the Southern African citrus industry's long-term global competitiveness. The organisation aims to achieve this goal through coordinating and funding research by the CRI group and collaboration with various partners. One of the core objectives of the organisation as commissioned by the CGA is to conduct research and develop the technical issues that can impact and enhance the industry's ability to gain new markets and retain and maintain existing markets. Other core functions of the CRI include disease management, fruit quality management (QM), cultivar development, improvement and evaluation (CRI, 2021: Online).

The CRI has been vital in the development of the FMS per the relevant guidelines as provided by the IPPC and its international standards, specifically International Standards for Phytosanitary Measures (ISPM) 14 on the systems approach (CRI, 2020; Hattingh et al., 2020). The organisation has also developed production guidelines for controlling the false codling moth (FCM) on citrus (CRI, 2021: Online).

2.3.2.3 Fresh Produce Exporters' Forum (FPEF)

This organisation is a non-profit company funded by its members. The FPEF members include fresh produce exporter agents, packhouses, producer-exporters, logistics and service providers. The forum's main aim is to provide leadership and services to its members, including to the international buying sector and the fresh produce export sector as a whole (FPEF, 2021: Online). To achieve this goal, the organisation requires its members to follow a strict Code of Conduct that provides confidence to the trading sector that the organisation's members are dependable trading partners. Services provided by the FPEF include conducting awareness campaigns of the SA fresh produce sector, providing information (market trends, market statistics), engaging with regulatory authorities on behalf of their members regarding technical and operational efficiencies to enhance growth in the export sector, post-harvest research, assisting with industry transformation, innovation and development (FPEF, 2021: Online).

2.3.3 Citrus market

This sector is the third biggest horticulture industry in SA after deciduous fruits and vegetables (DALRRD, 2020). The citrus sector contributed R16.1 billion to the total gross value of South African agricultural production for the 2018/2019 production season (DALRRD, 2020). South African citrus is destined for three markets, namely export, processing and the local market. The export market is the largest contributor to citrus income because of the commercial value of exports and, therefore citrus production is primarily aimed at the export market (CGA, 2021a, DALRRD, 2020). As shown in Figure 2.3 below the largest contributor for the production years from 2011 until 2020 has been the export market, followed by the processed market and the local market (CGA, 2021a).

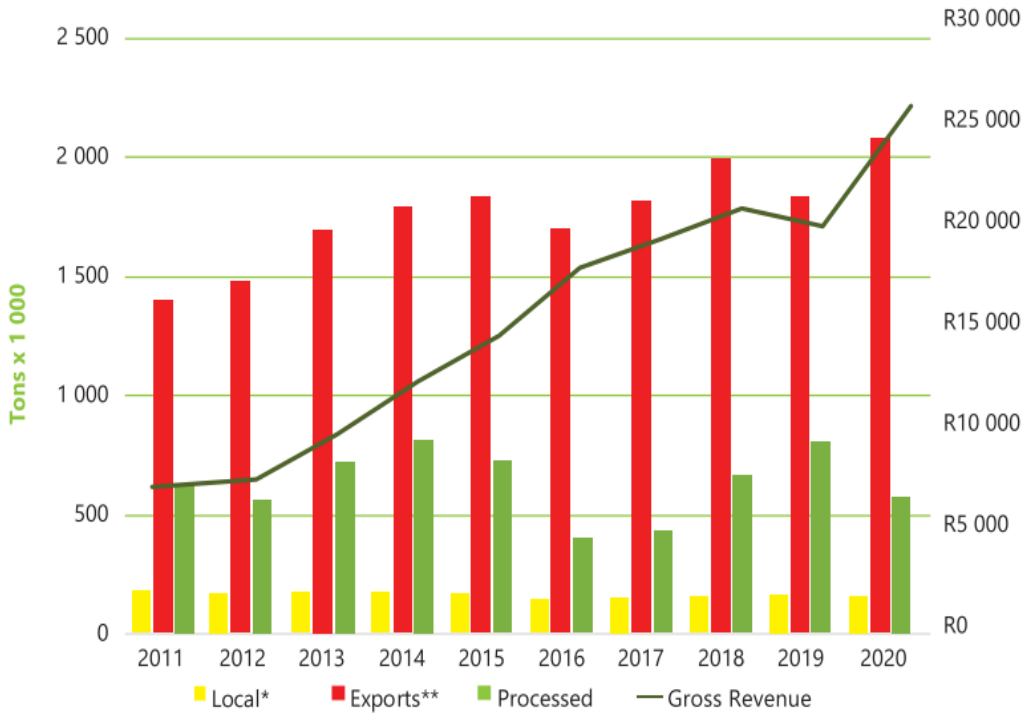

Figure 2. 3: The total market citrus distribution

(Source: CGA, 2021a)

Citrus was the major exported fruit from the total fruit exported from SA for the 2020 season, with a contribution of 62% as depicted in Figure 2.4 below (FPEF, 2021). Loading ports for citrus exports in Southern Africa include Durban, Cape Town, Ngqura (Coega) and Port Elizabeth (CGA, 2020). Citrus is exported to various countries globally with the major destinations for the 2020 season being Europe (36%), the Middle East (17%), South East Asia (13%), the United Kingdom (UK) (10%), Russian

Federation (8%), North America (8%) and Asia (6%) (CGA, 2021a). The EU and UK received 44,3% of citrus exported from Southern Africa for the citrus season 2020 that represented 64,9 million cartons, which is a significant increase from the 2014 season's 41,7 million cartons (CGA, 2021b).

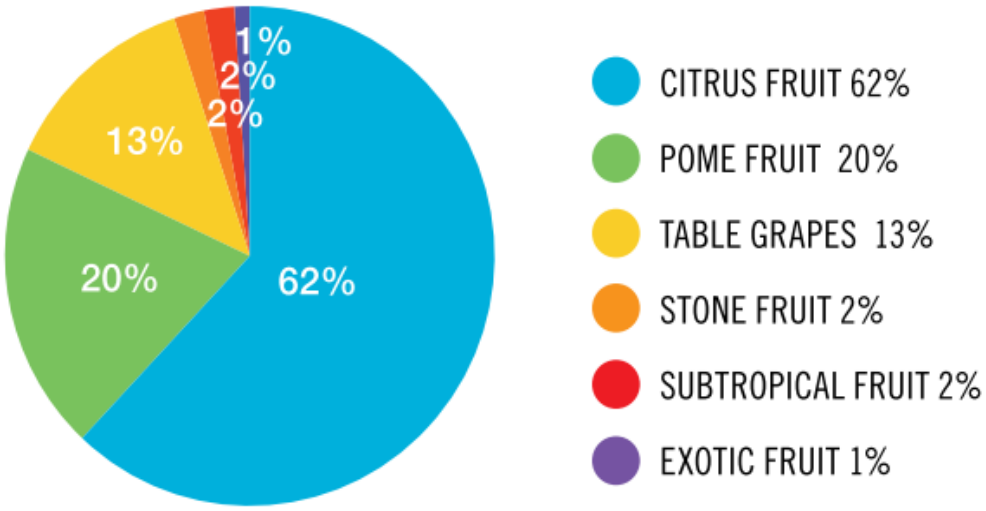

Figure 2. 4: Fruit exported for the production season 2020
(Source: FPEF, 2021)

The exportation of citrus has increased significantly from 2011 to 2020 (CGA, 2021a). Oranges, with a contribution of 58%, were the biggest contributor to the total gross value of production from 2011 until 2019, followed by lemons and limes, grapefruit and soft citrus (naartjies). Figure 2.5 below shows how the total gross value of production from 2010 until 2019 has increased. The total gross value for citrus exports is driven by various factors such as the production volume, the exchange rate, international prices and volumes exported (DALRRD, 2020).

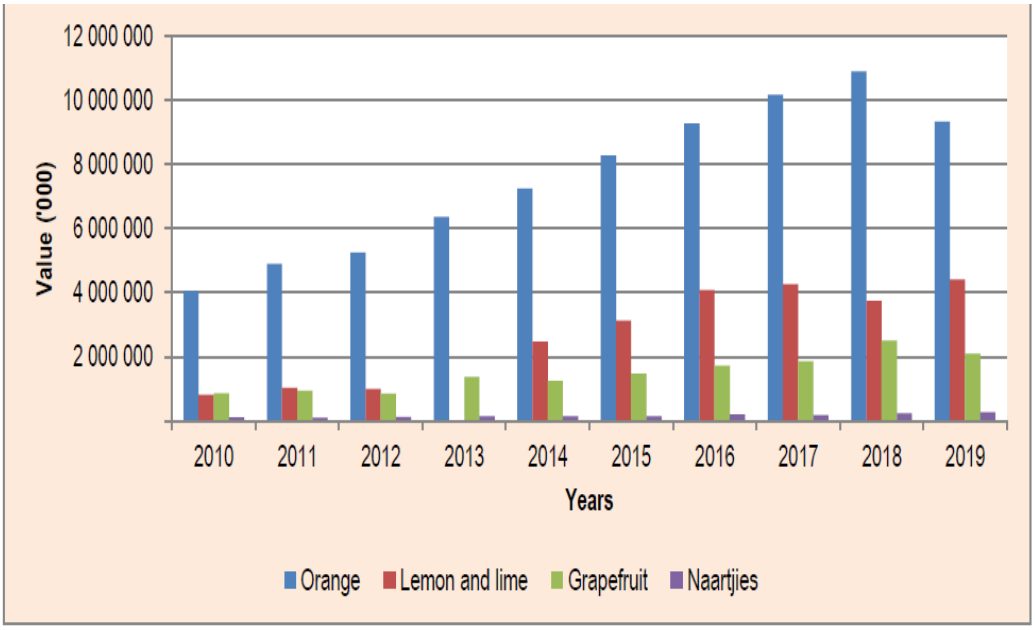

Figure 2. 5: The total gross value of production for citrus from 2010 to 2019 (Source: DALRRD, 2020)

2.4 False Codling Moth Risk Management System (FMS)

In order to provide more insight on the specific risk management (RM) system implemented by the citrus growers in the Western Cape, the following section presents an overview of the system as per the latest publically available approved FMS document (approved November 2020) and other relevant information. It should be noted that the FMS protocol is amended each year to ensure continuous improvement. Chapter Three will elaborate on the systems approach as a phytosanitary risk-mitigating measure concerning current research, trends and practices employed internationally.

The FCM, *Thaumatotibia leucotreta* is indigenous to Sub-Saharan Africa and is widely distributed in the region (Hattingh et al., 2020). The moth is an extremely polyphagous pest that feeds on a wide range of host plants, such as avocado, citrus, coffee, corn, cotton, mango, peppers and pomegranate among others (Mutyambai, Mbeche, Onamu, Kasina, Nderitu & Mweke, 2020). FCM populations vary considerably as a function of crop production area and the type of host, moreover such variation can also exist within a specific crop (Moore & Hattingh, 2016). Among different citrus types, there is a wide range of host susceptibility levels varying from non-host status such as lemons and limes to more susceptible citrus types such as Navel oranges (Moore, 2019; Moore & Hattingh, 2016). The FCM can cause primary and secondary damage

to citrus. The former is damage caused by the larvae burrowing and feeding inside the fruit resulting in premature ripening and fruit dropping. The latter is damage caused as a result of larval entry wounds resulting in secondary infections facilitated by fungi and bacteria, subsequently causing decay and affecting the quality of the fruit (EPPO, 2013; Malan et al., 2018).

The RM system provides risk mitigating measures for the FCM at numerous phases along the export chain, namely “production, harvesting, handling, packing, inspection, certification and in-transit transport during export” (CRI, 2020), by implementing variable levels of intervention or control (Carstens, 2021). Moreover, these risk-mitigating measures are implemented pre-harvest and post-harvest based on a citrus orchard and consignment basis (Carstens, 2021).

2.4.1 FMS components

The FMS consists of the following components that the respective stakeholders at various phases of the citrus production process must comply with to be able to participate in the exportation of citrus to the EU (Carstens, 2021; CRI, 2020).

- Registration of orchards.
- Monitoring of pheromone traps for the FCM infestation in orchards, with the associated thresholds to determine the need for extra pre-harvest control measures and the applicable handling option under the FMS.
- Orchard sanitation and the use of registered pre-harvest control measures.
- Monitoring fruit infestation at 12 weeks and again at four weeks before the start of harvest.
- In-orchard culling and grading of fruit.
- Post-harvest delivery inspection at the packhouse to determine the applicable handling options under the FMS.
- Packhouse grading.
- Inspections conducted by PPECB of a two per cent sample per pallet for citrus packed for export.
- Verification of the orchard status using the inspection data of PPECB under the FMS.
- Conditions for shipping.
- Phytosanitary certification of consignments complying.
- Corrective actions and voluntary withdrawal (Carstens, 2021; CRI, 2020).

2.4.2 Stakeholders

There are various stakeholders along the citrus export cold chain participating in the exportation of citrus under the FMS to the EU, namely citrus growers or producers, packhouses, exporters, loading establishments, freight forwarders and third parties. All these stakeholders are required to register with the DALRRD via the PhytClean system (Carstens, 2021; CRI, 2020). The PhytClean system is an electronic system to enhance export and phytosanitary certificates by providing evidence for the relevant pre-requisite steps in the certification process (Hardman, 2016: Online). The DALRRD makes use of the system to facilitate and improve the integrity and compliance of the export certification process (Hardman, 2016: Online).

Besides the aforementioned stakeholders, other important stakeholders supporting, facilitating and enforcing the requirements of the FMS include PPECB and DIS's inspectors (CRI, 2020). All stakeholders must perform their duties effectively along the supply chain to ensure overall compliance with the EU requirements (South African Government Gazette, 2014). Citrus growers are required to register each participating orchard and Production Unit code (PUC) with the DALRRD via the PhytClean system annually. This includes the grower's undertaking to comply with all the requirements of the FMS, provide accurate data, implement procedures for Good Agricultural Practices (GAP) for the management of the FCM, conduct trap monitoring and orchard sanitation, and implement the correct number of data trees per orchard as prescribed by the FMS (CRI, 2020). Packhouses must undertake to comply with the FMS by providing accurate data, conducting packhouse delivery inspections and grading, providing training to employees and ensuring PPECB FCM detections and their inspection results are reported to the citrus grower (CRI, 2020). The CRI Production guidelines for the control of the FCM recommend the appointment of separate individuals, for instance third parties to perform certain duties in the RM system such as orchard sanitation on both the tree and the orchard grounds (Carstens, 2021; Moore, 2019). During loading, exporters must ensure all requirements of the applicable shipping conditions as prescribed by the FMS are adhered to. This process includes ensuring temperature monitoring tools are available for installation, temperatures are recorded and verifying the appropriate shipping condition option for each consignment via the PhytClean system (CRI, 2020).

PPECB as mandated by the DALRRD inspect a two per cent sample of citrus per pallet and rejects pallets if any fruit is found to be infested with live FCM during an inspection.

Rejected pallets are not allowed to be repacked or sent to a FMS market, and must be re-directed to a FCM-tolerant market (CRI, 2020). DIS's inspectors are responsible for phytosanitary certification (or rejection) for export consignments complying with the various requirements of the FMS subject to the appropriate shipping option provisions. DIS's inspectors also conduct audits on PUCs, packhouses, loading facilities and exporters according to the DIS's auditing procedures or by a party mandated by the department per a risk profiling system (CRI, 2020).

2.4.3 The FMS export process

The RM system consists of orchard registration, monitoring procedures and compliance thresholds, and a variety of control criteria. The system makes provision for an endpoint categorisation of phytosanitary status for consignments of citrus, individual orchards and pallets packed with citrus destined for export. Furthermore, the phytosanitary status of citrus such as Option A, B or C prescribes the specific handling conditions to be applied during shipping (CRI, 2020). Tables 2.1 and 2.2 below indicate the specific compulsory requirements and thresholds for each phytosanitary status option (Options A, B or C), to qualify to export citrus to the EU according to the FMS regulations.

Table 2. 1: Mandatory requirements for different phytosanitary status options (CRI, 2020)

ACTION	REQUIRED FOR OPTION?	
	C	A & B
Registration of orchard	Yes	Yes
Trap monitoring	Yes	Yes
Orchard sanitation	Yes	Yes
Fruit infestation monitoring to determine need for control measure (last 12 weeks before start of harvest)	No	Yes & apply treatment if threshold surpassed
Fruit infestation monitoring to determine export option (last 4 weeks before start of harvest)	No	Yes & must not exceed threshold
Packhouse delivery inspection	Yes & must not exceed threshold	Yes & must not exceed threshold
PPECB 2% inspection sample per pallet, no live FCM detected in pallet	Yes	Yes

Only listed cold sensitive citrus types qualify for Option B

Table 2. 2: Overview of the various thresholds applied to different phytosanitary status options (CRI, 2020)

THRESHOLDS APPLYING TO OPTIONS A, B & C

MEASUREMENT	THRESHOLD (live larvae)	CONSEQUENCE OF EXCEEDING THRESHOLD
Pheromone trap catches (A, B & C)	None	None
Fruit infestation (A & B)	During the 12wk pre-harvest period Any fruit/tree/week	Apply a registered control measure, as listed on PhytClean.
	4-week average any fruit/tree/week in last 4 weeks before start of harvest.	Orchard defaults to Option C.
Packhouse delivery inspection (A, B & C)	Category A: More than 2 infested fruit in sample	Orchard defaults to Option C
	Category B: More than 1 infested fruit in sample	Orchard defaults to Option A (if compliant with A) or C
	Category C: More than 5 infested fruit in sample	Orchard defaults to "Not Permitted" and cannot be exported under FMS
PPECB 2% Sample	One or more infested fruit	Pallet cannot be exported under FMS (Options A, B & C).

Figure 2.6 below depicts the RM system along the export supply chain from the registration of orchards per phytosanitary status Option A, B or C to export or shipping. As shown by Figure 2.6 below if, during fruit infestation monitoring, the live FCM larvae infestation exceeds the prescribed threshold in the last four weeks before the start of harvest, Option A and B registered orchards will default to Option C (CRI, 2020).

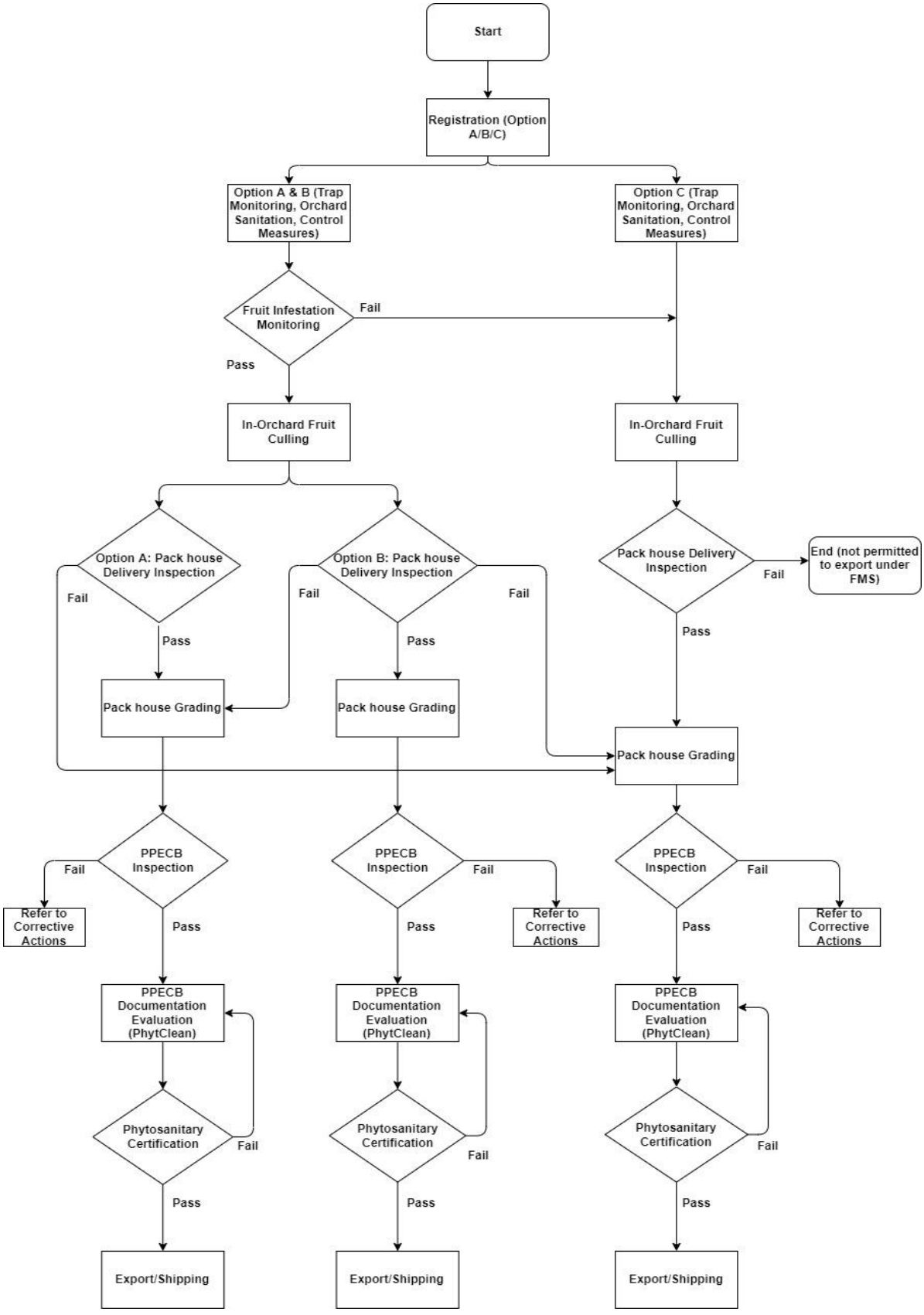

Figure 2. 6: Flowchart of the FMS process (Source: adapted from CRI, 2020)

2.4.4 Corrective action and voluntary withdrawal

The FMS includes appropriate corrective action to be implemented when live FCM larvae are detected by PPECB inspection or in the EU (interception or non-compliance). Corrective action includes temporary suspension pending investigation of the implicated orchard and associated packhouse, automatic suspension in cases of EU detection for the remainder of the season, and voluntary withdrawal or de-registration of orchards from exporting to the EU by producers under the FMS (Carstens, 2021).

2.5 EU interception notification data (EU non-compliances)

Non-compliance or interception notifications are regularly published by the EPPO as reported by the various EU countries, and these notifications are reported to the implicated exporting countries' competent authority or contact point (European Commission, 2022: Online). Non-compliance notifications are recorded and maintained on the SPS notification database of SA by the DFIES (DALRRD, 2022: Online).

For the citrus season 2020, the total FCM interceptions or non-compliances for citrus imported from SA was 14 interceptions (EFSA, 2021). Despite being considered very high for South African citrus imported this is a significant improvement from the official 21 FCM interceptions for the 2019 citrus export season (CGA, 2021b). Furthermore, in comparison with other developing countries' imports to the EU, the South African non-compliances were much fewer than that of Kenya with 51 interceptions and Uganda with 129 interceptions. In addition, these countries export much smaller volumes of citrus compared to SA whose combined export tonnage to the EU and UK was over 921 K tonnes of citrus (CGA, 2021b). Even if the performance of the FMS is considered good (CGA, 2021b) the EU have a zero-tolerance for the detection of live FCM (Moore, 2021). The interception of even one FCM is considered non-compliance with the EU import requirements and can result in a whole shipment being rejected (Moore, 2019).

Figure 2.7 below illustrates the EU non-compliance notifications received by SA for the citrus export season of 2016 until 2020. From the figure, it is evident that FCM non-compliances or interceptions have significantly increased from 2016 to 2019 and

decreased in 2020 (CGA, 2021b). The EU import requirements and how it relates to developing countries will be elaborated on in Chapter Three.

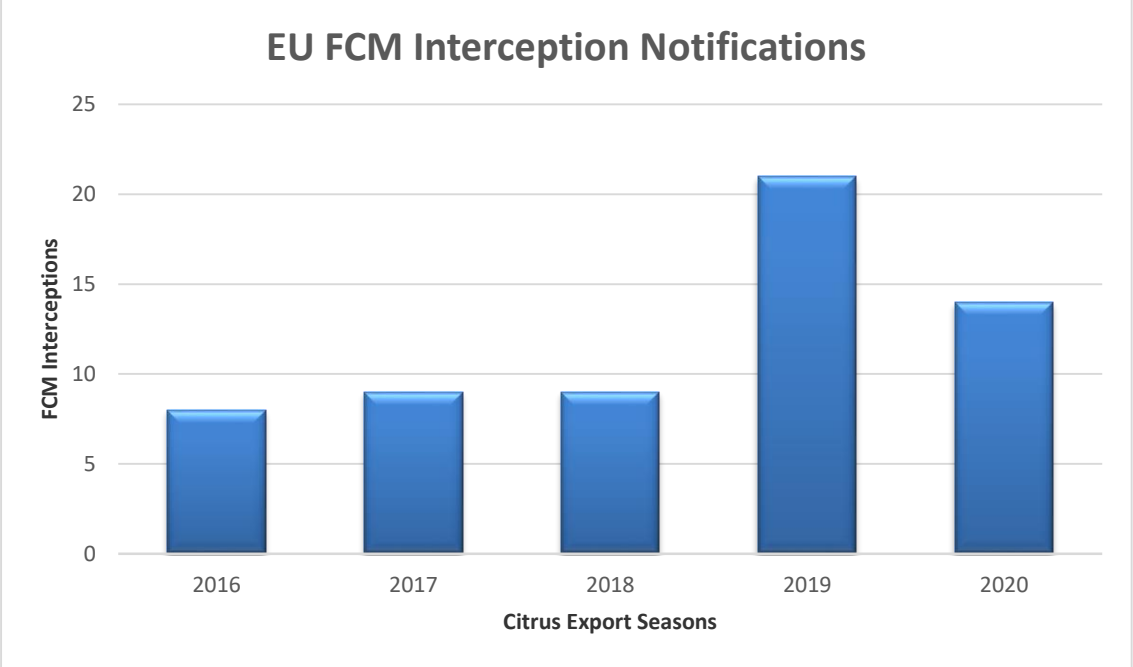

Figure 2. 7: EU FCM interception notifications for South African citrus exported, for the citrus seasons from 2016 until 2020

(Source: adapted from CGA, 2021b)

2.6 Conclusion

Chapter Two described the research environment and illustrated the importance of this research study. Furthermore, the chapter provided an outline of the South African plant health legislative framework, an overview of the citrus export industry, insight into the RM system and interception notifications received from the EU for non-compliance. Additionally, the chapter demonstrated that it is imperative for citrus growers to comply with the RM system through effective integration and implementation, to enhance compliance with the EU import requirements to ensure sustainable access to the lucrative market. Since non-compliance as emphasised by the problem statement can result in more stringent and expensive SPS requirements that may have harmful economic consequences for SA. Hence, this study sought to contribute an effective way of integrating the RM system into the existing quality management system (QMS). Chapter Three provides a literature review to evaluate and analyse previous research and trends to establish a theoretical framework related to the research problem and the investigative questions. Therefore, creating the academic framework to achieve

the research objectives that will enable this study to provide sound recommendations to address the research problem.

CHAPTER THREE: LITERATURE REVIEW

3.1 Introduction

Chapter Three provides a pertinent literature review by assessing and reviewing previous research and emerging trends obtained from several sources such as peer-reviewed journals, the internet, national and international guidelines and books. Moreover, based on the research questions highlighted in Chapter One, the key concepts for integrating risk management (RM) and quality management system (QMS) will be explored to build a sound understanding to construct the theoretical framework of the study. The following topics will be discussed:

- Risk Management in the Agri-food Export Sector
- Quality Management System Practices in the Agri-food Export Sector
- Regulatory Non-compliances in the Agri-food Export Chain
- Difficulties in integrating Risk Management into a Quality Management System
- Common approaches to integrating Risk Management into Quality Management System

In Chapter Three, the primary research question “How to effectively integrate risk management practices into the existing quality management system to improve compliance with EU import requirements for citrus growers?” is addressed by answering the following investigative research questions.

- What are the main non-compliances in the agri-food export chain from developing countries to the EU market?
- What is an effective way of integrating risk management and a quality management system?

3.2 Risk management

3.2.1 What is risk management?

Risk management (RM) can be defined as “coordinated activities to direct and control an organisation with regard to risk”. Furthermore, risk can be defined as the “effect of uncertainty on objectives”, where the effect can be either negative or positive and is any deviation from the expected outcomes impacting the objectives (ISO 31000, 2018). Hardy (2014) states that there are various definitions for risk across different industries but the common theme in all the definitions is that risk is the “uncertainty of

outcomes". According to Hopkin (2017), the main principle of RM is to ensure the "best possible outcomes" and to decrease the unpredictability of outcomes. The author further states that RM should be proportionate (RM actions should be equivalent to the level of organizational risk), aligned (RM activities should be in line with other organizational activities), comprehensive (RM should be all-inclusive), embedded (RM should be entrenched in all organizational processes) and dynamic (RM activities should be vigorous to allow adaptation to upcoming changes in risks).

3.2.2 Risk management in the agri-food export sector

The unintended consequences of trading in plant and plant products have seen the introduction of non-native pests and pathogens causing a detrimental impact on the environment, industries and the general public (Hantula, Müller & Uusivuori, 2014). It, therefore, is the collective responsibility of the international community to manage the risks associated with trading in these commodities. Phytosanitary or pest RM has been identified as the most viable framework to manage the destruction caused by pests introduced through trade (Yoe, Griffin & Bloem, 2020).

The Food and Agriculture Organization of the United Nations (FAO) and the International Plant Protection Convention (IPPC) (ISPM 5, 2007) defines pest RM as the assessment and selection of measures to reduce the risk of introducing and spreading new pests posed by international trade. According to Quinlan et al. (2020), the risk will never be zero, however the level of risk must be tolerable to the importing country. Additionally, the risk should be equivalent to the benefits of trade and measures available to reduce the probability or impact of the introduction of a quarantine pest. The authors further state that the purpose of pest RM in trade is to reduce the likelihood of introducing new pests into a region, which is different to other types of pest management which aim to minimize economic losses to the grower and ensure food security for the general public.

Yoe et al. (2020) propose three distinct phases of RM linked to the international trade of plant and plant products. Figure 3.1 below illustrate the phases, the first phase is opportunity risks taken by exporters to gain potential benefits of trade, that include economic gains, new markets and higher prices. Secondly, the pest RM phase is represented by the sanitary and phytosanitary (SPS) RM responsibilities of the various National Plant Protection Organisations (NPPO) globally, that are facilitated by the collective work of the international plant health organisations. Thirdly, the RM taken by

the importer also assumes opportunity risks such as economic gains, product variety and lower prices (Yoe et al., 2020).

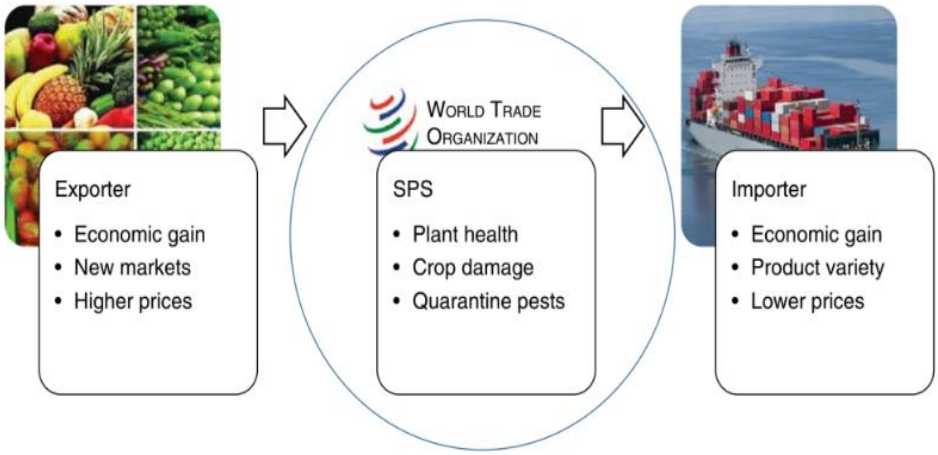

Figure 3. 1: Risk management along the international trade of plant and plant products (Source: Yoe et al., 2020)

3.2.3 International plant health organisations

The WTO contains various international trade agreements that include the Application of the Sanitary and Phytosanitary Agreement (WTO-SPS Agreement). The objective of this agreement is to regulate the application of measures to protect human, animal and plant life or health that may directly or indirectly impact international trade (WTO-SPS Agreement, n.d). According to the agreement, member states are allowed to refuse imports and set their own import regulations or standards provided these are based on science and applied to the degree required for its intended purpose (WTO, 2022: Online). Furthermore, these standards may not be applied in a manner that is inconsistent or unjustifiably discriminate between countries in which the same conditions occur or used as tools for hidden protectionism (WTO-SPS Agreement, n.d).

In addition, the agreement encourages member states to align or harmonize their SPS policies with international standards and measures as prescribed by standard-setting bodies such as the Codex Alimentarius Commission on food safety, the Office International des Epizooties (OIE) on animal health and the IPPC on plant health (Van der Meer & Ignacio, 2011). Therefore, harmonization in the context of the agreement is to reduce the variability of import regulations and requirements among member states (Engler, Nahuelhual, Cofré & Barrena, 2012). Based on an assessment of acceptable risks, member states are allowed to set an appropriate level of protection

(ALOP) and impose stricter requirements, provided these are based on adequate scientific evidence determined through a pest risk analysis (PRA) process (Alam & Tomossy, 2017; Van der Meer & Ignacio, 2011).

The IPPC is an intergovernmental agreement overseen by the FAO to safeguard plant and plant products globally from the introduction, spread and establishment of pests (IPPC, n.d.). The IPPC developed the International Standards for Phytosanitary Measures (ISPMs) as a tool for achieving its objectives, making the organisation the only standard-setting body for the protection of plant resources globally (IPPC, n.d.). The IPPC and its standards are recognized by the WTO-SPS Agreement as an organisation that guides plant health regulations or phytosanitary measures which are non-discriminatory, based on scientific justification, and enhance safe and fair trade (Yoe, Griffin & Bloem, 2021).

3.2.4 Sanitary and Phytosanitary (SPS) measures and international trade

SPS measures according to the WTO-SPS Agreement Annex A (n.d.) include: “all relevant laws, decrees, regulations, requirements and procedures including, inter alia, end product criteria; processes and production methods; testing, inspection, certification and approval procedures; quarantine treatments including relevant requirements associated with the transport of animals or plants, or with the materials necessary for their survival during transport; provisions on relevant statistical methods, sampling procedures and methods of risk assessment; and packaging and labelling requirements directly related to food safety”. These measures according to the United Nations Conference on Trade and Development (UNCTAD) are classified as non-tariff measures (NTMs), hence they are considered measures other than general customs tariffs with the potential to have an economic impact on international trade (UNCTAD, 2019).

Federica, Sophie and Pasquale (2021) state there are two types of SPS measures for fresh produce, namely measures to protect human health and measures to protect plant health. The former includes for example food safety standards such as maximum residual limits (MRLs) that are set by the importing country for contaminants. The latter includes phytosanitary RM measures that are determined independently by each country and can vary in complexity over time and differ among countries, including between domestic and foreign growers (Federica et al., 2021). El-Enbaby, Hendy and

Zaki (2016) claim that to fully comprehend NTMs one must understand their characteristics and effect on trade. Moreover, the authors claim that NTMs are widely implemented to address market failures and to enhance public welfare such as protecting consumer health and safety.

3.2.5 The impact of SPS measures on international trade

While the trade in plant and plant products has increased globally the implementation of SPS measures has become important in managing pest risks in the agri-food sector (Hajdukiewicz, 2018; Hantula et al., 2014; Orefice, 2017). This practice has resulted in an ongoing debate in the trade literature regarding the impact of SPS measures and whether they act as a barrier or a catalyst to international trade (Boza & Muñoz, 2017; Kinzius, Sandkamp & Yalcin, 2019; Maertens & Swinnen, 2015; Santeramo & Lamonaca, 2019, 2022). Furthermore, the focus on SPS measures is also due to the decrease of international tariffs over the past few years, resulting in research shifting from trade policy measures to having a better understanding of the effect of NTMs (Arita, Mitchell & Beckman, 2015).

Some studies have found that SPS measures negatively impact trade by reducing imports, particularly from developing countries to developed countries due to stringent import standards, that can be perceived as using SPS measures as tools for hidden protectionism (Grundke & Moser, 2019; Webb, Gibson & Strutt, 2019). Beckman and Arita (2017) assert that NTMs mainly SPS measures and tariff-rate quotas hinder agricultural trade and their interaction limits trade liberalisation. Orefice (2017) claims there is a significant correlation between high tariff reductions and a high increase in SPS concerns raised to the WTO's SPS dispute settlement committee. Additionally, the author found that exporting countries raised specific trade concerns (STCs) when the underlying NTMs become an impediment to trade, due to a reduction in tariff protection in the specific country. Other studies found that there is a reputational effect to the impact of NTMs, where importing countries not only implement these measures on current risks but also on previous refusals or past risks that can be based on an exporting country's refusals or that of a neighbouring country (Jouanjean, Maur & Shepherd, 2015; Taghouti, Martinez-Gomez & Marti, 2016). Moreover, Jouanjean et al. (2015) state that reputation is a natural determinant of refusal or more stringent detection for non-compliance.

On the other hand, studies have demonstrated that these measures can also be a catalyst for trade, where requirements result in improvements in production systems and closing the gap between suppliers and consumer requirements (Maertens & Swinnen, 2015). Studies found that NTMs have a quality-enhancing effect on imported products (Curzi, Schuster, Maertens & Olper, 2020; Ghodsi & Stehrer, 2022). There are also studies that state the SPS measures have a dual effect on trade, being both a barrier and a catalyst (Santeramo & Lamonaca, 2022). Crivelli and Gröschl (2016) argue that while SPS measures reduce trade to more restrictive markets due to fixed trade costs, there is a positive effect to trade flows if the exporters manage to overcome such market access costs. Hence, exporting companies that manage to adhere to stringent SPS measures gain an advantage in the market share which outweighs the costs of meeting requirements (Crivelli & Gröschl, 2016). Grant, Peterson and Ramniceanu (2015) found that SPS measures only hindered trade when the United States (US) exporters had less experience in the early years of implementing measures. Further, as exporters gain more experience the restrictiveness of requirements reduces and ultimately disappears when exporters reach a threshold level of exporting for two to three years (Grant et al., 2015).

3.2.6 SPS measures among countries with different economic development levels

The impact of SPS measures has been studied for both developed and developing countries, that includes trading between and among these countries with different economic development levels (Arita et al., 2015; Triwibowo & Falianty, 2018; Winchester, Rau, Goetz, Larue, Otsuki, Shutes, Wieck, Burnquist, Pinto de Souza & Nunes de Faria, 2012). Santeramo and Lamonaca (2022) claim that there is a net effect among SPS measures applied being obstacles to trade versus being catalysts to trade, and this net effect is impacted by the economic development position of the countries involved. According to Boza and Muñoz (2017), the main determinant for countries to raise STCs to the WTO is the “legal and scientific resources and capabilities” required to provide scientific evidence per the WTO regulatory framework. The authors argue that this further emphasises gaps between countries with different economic development levels, such as African countries that lack such resources and, therefore, are less active in raising concerns. In contrast, according to Hajdukiewicz (2018), STCs raised to the WTO against SPS measures are increasing from developing countries, specifically against the EU and concerns raised by the EU are mostly against developing countries. Further, the author claims that based on the

analysis conducted the EU's SPS measures most probably act as a tool for trade protectionism (Hajdukiewicz, 2018).

Jouanjean, Maur and Shepherd (2016) found that the import regulatory system of the US is primarily associated with a restrictive market access environment for fresh produce, specifically for emerging countries who commonly have insufficient compliance resources. Santeramo and Lamonaca (2019) argue that NTMs are generally impediments to trade, with African exporters mostly affected by higher compliance costs and lower profits compared to their domestic counterparts.

3.2.7 Risk management measures or practices in the agri-export sector

The ISPM 5 (2007) defines a phytosanitary RM measure as: "any legislation, regulation or official procedure having the purpose to prevent the introduction and/or spread of quarantine pests, or to limit the economic impact of regulated non-quarantine pests". Furthermore, the standard defines a phytosanitary treatment as the "official procedure for the killing, inactivation or removal of pests, or for rendering pests infertile or for devitalization". Hennessey, Jeffers, Nendick, Glassy, Floyd, Hansen, Bailey, Winborne, Bartels, Ramsey and Devorshak (2014) claim phytosanitary treatments or measures can be single simple processes or complicated time-consuming operations. Phytosanitary measures include 'standalone' single treatments (cold treatments and fumigation), non-host status, pest-free areas and the systems approach (Hennessey et. al., 2014).

Many export markets require phytosanitary treatments that can demonstrate an explicitly distinct level of statistical confidence that fruit is free from any live pests (Moore & Manrakhan, 2022). The most ideal level of efficacy is equal to or greater than Probit 9 efficacy, that is a 99.9968% efficacy or mortality at a 95% confidence level (Hennessey et al., 2014; Moore, Kirkman, Stephen, Albertyn, Love, Grout & Hattingh, 2017). Primarily single treatments with a Probit 9 level efficacy have been considered an effective phytosanitary treatment and have become the standard for treatment effectiveness even though it is not an international standard or the preferred outcome for treatment effectiveness (Hennessey et. al., 2014).

According to Jang (2016), conventional single phytosanitary treatments are coming under increased scrutiny because they have undesirable consequences, such as contributing to the ozone layer (e.g. methyl bromide used for fumigation) or having

unwanted effects on the commodity treated (e.g. heat or cold treatments). Studies have demonstrated that the standalone cold treatment can have adverse effects on the quality of citrus. This deterioration is due to the variable sensitivity of citrus varieties to cold temperatures, making certain citrus varieties more susceptible to the development of chilling injury, therefore, making such a treatment mostly unsustainable (Hattingh et al., 2020). Jang (2016) argues that alternative strategies are needed to adapt to the changing phytosanitary regulations and needs. One alternative is a systems approach, that is a multi-tier approach encompassing the entire system from production to export, and considers the whole system when determining risk-mitigating measures against a quarantine pest in export commodities (Jang, 2016).

3.2.8 Systems approach

The systems approach concept stems from the realization by researchers and regulators that attaining near-zero mortality to reduce pests' risks, usually achieved by using standalone single treatments can also be achieved by applying sequential risk-mitigating measures. These measures form part of a holistic effort to reduce risks, where each component in the system has some part in decreasing risks (FAO/IAEA, 2010). According to Jang (2016), this concept was mainly developed to support biologically based risk analysis and mitigation within a wider operation of combined activities that collectively comply with the import regulations. Further, the approach integrates various aspects, namely biological, operational and physical to influence pest reproduction, occurrence and viability into an operational system. The achievement of the required phytosanitary protection necessitates in-depth knowledge of the targeted pest (Jamieson, DeSilva, Worner, Rogers, Hill & Walker, 2013).

More than anything, the systems approach is a methodology to RM that facilitates its design so that it can be relative to the estimated pest risks it intends to reduce, therefore, providing importing countries with a flexible alternative to achieving the ALOP (FAO/IAEA, 2010). Certain bilateral agreements between trading partners have allowed trade to continue using the systems approach with prearranged threshold pest detection requirements (Quinlan et al., 2020).

3.2.9 Components of a systems approach

According to van Klinken et al. (2020), there are four broad risk reduction aims to reduce pest risk when implementing a systems approach, these are "(i) minimising

exposure to pests when fruit are vulnerable; (ii) minimising host vulnerability; (iii) reducing infestation rate and (iv) reducing establishment likelihood". However, the risk reduction measures employed in publically available systems approach protocols address only two of the risk reduction aims, namely decreasing exposure to pests and reducsing infestation rates (van Klinken, Fiedler, Kingham & Barbour, 2021). Quinlan, Leach and Mumford (2021) agree with van Klinken et al. (2020) however, they argue that additional risk reduction objectives should be included such as "(a) to minimize uncertainty and (b) provide information for decisions".

Pest RM measures are deployed along the supply chain and production stages and can be categorised as pre-harvest, harvest and post-harvest against these risk reduction objectives in a systems approach (Moore et al., 2016; Quinlan et al., 2020; van Klinken et al., 2020, 2021). It should be mentioned, however, that these stages are a broad categorisation of the various production and supply chain stages as studies have various classifications (Jang 2016; Quinlan et al., 2020; van Klinken et al., 2020). According to Moore (2021), the South African systems approach for the pest FCM involves three pest risk measures, namely (i) "pre-harvest controls and measurements and post-picking sampling, inspection, and packinghouse procedures", (ii) "post-packing sampling and inspection", and (iii) "shipping conditions".

Figure 3.2 below depicts a systems approach for a theoretical commodity whereby the associated pest threat is reduced in the final exported commodity through the application of various RM measures along the export supply chain (Quinlan et al., 2020).

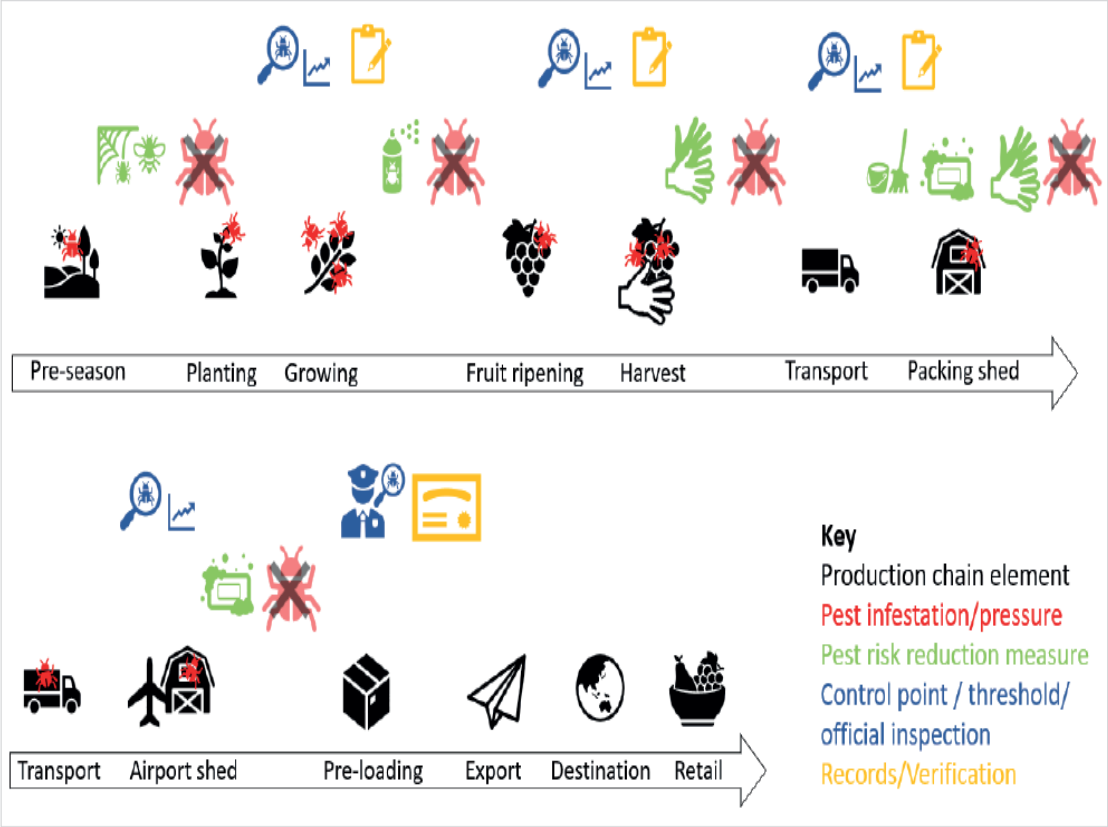

Figure 3. 2: A pictorial presentation of a systems approach
(Source: Quinlan et al., 2020)

The systems approach is officially defined as: “the integration of different risk management measures, at least two of which act independently, and which cumulatively achieve the appropriate level of protection against regulated pests” (ISPM 5, 2007). Quinlan et al. (2021) state that a systems approach consists of a collection of independent measures to directly decrease risk or to provide additional data that can support decision-making. In other words, an independent measure aims to reduce the number of pests. The dependent measure may not directly or greatly reduce risk, however, it is needed to support or verify the efficacy of the independent measure. It can also be used in combination with other dependent measures to create an independent measure (ISPM 14, 2019; Jamieson et al., 2013).

3.2.10 Major, safeguard and non-technical components of a systems approach

The systems approach usually consists of independent measures, redundancy and safeguard measures (Hennessey et al., 2014). Independent measures are major components, for example less than Probit 9 post-harvest treatments (heat or cold

treatments), poor host status and pest-free production sites (FAO/IAEA, 2010). The use of less than Probit 9 cold treatments in combination with other major components can achieve the required level of phytosanitary protection (Jang, 2019). According to Moore and Manrakhan (2022), in SA the only post-harvest disinfection treatments used in the export of citrus for FCM and fruit flies are the stand-alone cold treatment and the partial cold treatment part of the systems approach RM system.

Dependent measures can include safeguard measures, redundant measures or non-technical measures (FAO/IAEA, 2010; Hennessey et al., 2014; ISPM 14, 2019; Jang, 2016;). Redundant measures can be viewed as overlapping measures, in other words, if one fails at a specific section of the production chain another aimed at the same section will assure the risk is still minimised (Hennessey et al., 2014). Safeguarding measures do not kill or decrease pest occurrence but limit the potential entry of pests, therefore, reducing the introduction of new risks into the system, examples include selected harvest, shipping periods or restricted distribution (ISPM 14, 2019). Furthermore, other dependent measures can include training, grower registration, field controls, phytosanitary certification, traps and field sanitation (FAO/IAEA, 2010). Non-technical measures are additional measures that can be included in the event of system failure depending on the cause of failure, such as employee training, public awareness promotions and improved record-keeping (FAO/IAEA, 2010).

Moore (2021) emphasises that every single measure or part of a systems approach must be optimally applied to be successful, hence pre-harvest control measures are the most essential component and must be highly effective. Further, Moore (2021) states the pre-harvest control for FCM involve three tiers with orchard sanitation as the foundation. Then an area-wide control technique (e.g. mating disruption) and finally the application of orchard-particular control measures (e.g. biological or chemical control). Orchard sanitation entails frequently collecting, removing all visibly injured and infested fruit, both that on the trees and fallen on the ground, from the orchard and destroying it (Hattingh et al., 2020). Past studies by Moore and Kirkman (2009) demonstrated that weekly removal and destruction of infested or injured fruit can reduce the FCM population by an average of 75%, hence illustrating orchard sanitation as an effective control strategy.

Additionally, to effectively implement orchard sanitation it should be applied promptly, prior to the development of larvae in infested citrus to prevent the completion of their life cycle and to reduce the size of the next generation (Moore & Kirkman, 2009). All

FCM infested fruit should be properly destroyed (EFSA, 2021). Another important component of monitoring the FCM population in a systems approach is pre-harvest monitoring (e.g. trapping), that assists in the precise timing of treatment applications (Moore, 2019).

3.2.11 Challenges and benefits of a systems approach

Despite the advantages of the systems approach its development and implementation can be complex (Mengersen, Quinlan, Whittle, Knight, Mumford, Wan Ismail, Tahir, Holt, Leach, Johnson & Sivapragasam, 2012). The range of complexity of a systems approach may vary due to the efficacy of individual measures applied, the measures available to incorporate, the intrinsic variability and uncertainty of the system, and the intended aim of the RM system (FAO/IAEA, 2010; ISPM 14, 2019). Furthermore, many importing countries' NPPO prefer single treatments due to the perception that the combined impact and effectiveness of the systems approach measures are complicated to determine compared to a single treatment's impact on pest risk that is well-documented (Mengersen et al., 2012). More recent studies have demonstrated that the systems approach provides an effective alternative to the standalone cold treatment for the FCM (Hattingh et al., 2020; Moore et al., 2016). Another challenge to the adoption and implementation of the systems approach is the required infrastructure and resources needed that many NPPOs with fewer resources and small-scale growers lack (Quinlan et al., 2020).

The advantage of the systems approach is its flexibility that provides for the modification of measures in relation to their quantity and strength, with the aim of enhancing individual measures or improving the overall system to achieve an ALOP (ISPM 14, 2019; Yoe et al., 2021). In addition, the flexibility of the systems approach allows one to make changes to requirements over time by adding or removing measures based on recent technical and statistical evidence (Mengersen et al., 2012). Moreover, in the event that system failure happens, adding or improving a component or measure by its design or application can be used to increase the phytosanitary protection (FAO/IAEA, 2010).

An RM system based on the systems approach design should be verified over time against preset control point outcomes (to determine if a certain action was performed or if the system performed at that point as anticipated) and endpoint performance objectives (FAO/IAEA, 2010; Quinlan et al., 2021). According to Quinlan et al. (2021),

the application of control points is another key benefit of the systems approach as it enables one to react to real-time data and accordingly adapt measures if the system performs inadequately, as illustrated by Figure 3.2 below. Furthermore, these authors suggest that systems approaches can become learning systems as new data arises (Quinlan et al., 2021).

3.3 Quality management system practices in the agri-food export sector

3.3.1 What is a quality management system?

According to the ISO 9001:2015, a QMS is a collection of interrelated components to establish policies, goals and processes to reach an organisation's quality objectives. The ISO 9001:2015 further states that these objectives can be realized through "quality planning, quality assurance, quality control and quality improvement".

Ismyrlis, Moschidis, and Tsiotras (2015) assert that a QMSs' aim is to improve organisational performance and pursue continuous quality improvement. According to Ebrahimi and Sadeghi (2013), implementing a QMS effectively can result in substantial improvement in organisational performance. Further, the authors state that the key variables for an effective QMS are employee resource management (employee development, participation, empowerment), customer focus and satisfaction (meeting and exceeding customer requirements and needs, assessing customer feedback) and top management leadership and commitment (involvement, establishing systems to improve organisational performance and meet customer requirements, creating a conducive working environment) (Ebrahimi & Sadeghi, 2013).

3.3.2 Good Agricultural Practices (GAP)

To understand QM practices in the agricultural sector one needs to understand that most private standards are based on hazard analysis and critical control points (HACCP) and good practices, such as good agricultural practices (GAP) and good manufacturing practices (GMP) (van der Meulen, 2011). According to Okpala and Korzeniowska (2021), GAP within the agri-food sector aims to safeguard the production process, and quality assurance is integral to this protection to ensure activities operate effectively and sufficiently. The authors further state that the purpose of a QMS within the agri-food sector is to "improve food product quality, as underpinned by such attributes as food safety, value, package, process, and nutrition" (Okpala & Korzeniowska, 2021).

The FAO (2016) defines GAP as: “a collection of principles to apply for on-farm production and post-production processes, resulting in safe and healthy food and non-food agriculture products, while taking into account economic, social and environmental sustainability”. The concept of GAP has advanced considerably over the years to address various stakeholders’ concerns regarding food quality and safety, food production and security and the sustainability of agricultural resources (Mushobozi, 2010). These stakeholders include consumers, farmers, the retail sector and governments seeking to achieve particular objectives that GAP provides a means to attain (Mushobozi, 2010). According to Burrell (2011), principles of GAP have been extended beyond farm production to both upstream and downstream processes along the supply chain and this has mainly been driven by the development and establishment of voluntary private standards. Squatrito, Arena, Palmeri and Fallico (2020) state that agricultural companies are increasingly obligated to adopt production activities that meet the demands and expectations of consumers, who are becoming progressively aware of product quality and safety.

Figure 3.3 below represents a pictorial illustration of a typical supply chain for an agricultural product, in which the movement of goods flows downstream and information from consumers moves upwards from the end of the supply chain. Furthermore, Figure 3.3 below illustrates how information such as consumer preferences and specific requirements enable various parts of the upstream chain to plan the required inputs needed (Costa-Font & Revoredo-Giha, 2020).

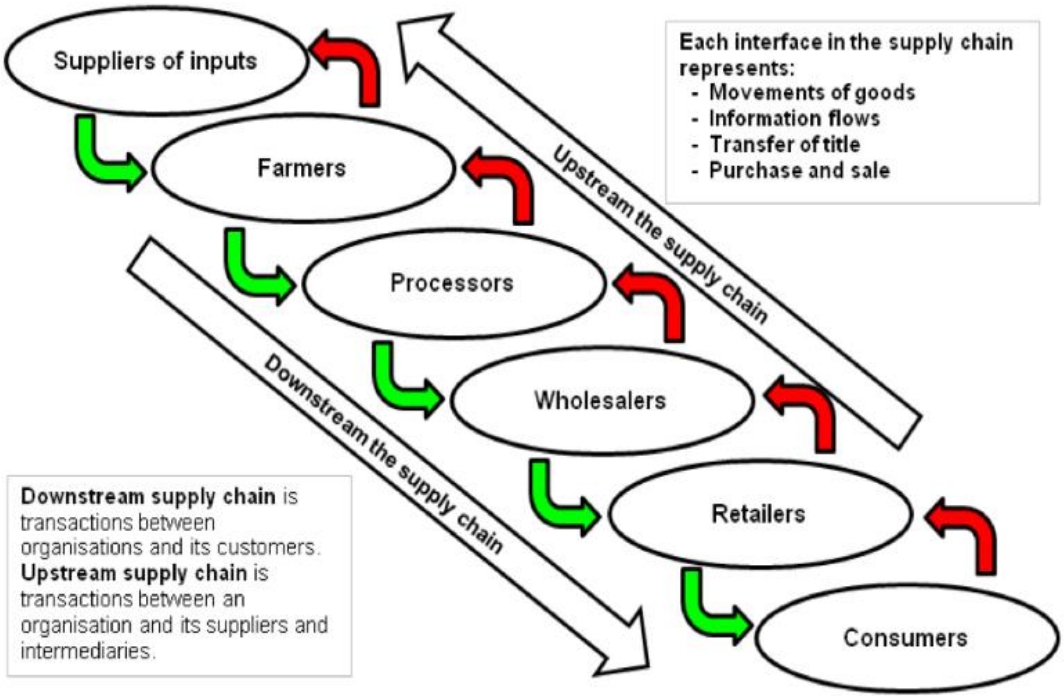

Figure 3. 3: Pictorial representation of a typical agricultural product in a agri-food supply chain

(Source: Costa-Font & Revoredo-Giha, 2020)

3.3.3 Private standards

3.3.3.1 The development of private standards

The formalization of private food certification organisations began in the 1980s with the establishment of Fair Trade Certification (Mook & Overdevest, 2021). The first broadly implemented private food safety standard was introduced in the late 1990s by European retailers in response to food safety scares (Hu, Zheng, Woods, Kusunose & Buck, 2022). The commonly adopted private certification scheme was established by a consortium of UK retailers, formerly named EurepGAP, later renamed GlobalG.A.P. as the standard expanded globally (Tennent & Lockie, 2012). Over the years the prominence of these standards in the international trade of agricultural goods has significantly increased, with buyers in several countries requiring various food safety and quality requirements to be met (Elamin & de Cordoba, 2020; Handschuch, Wollni & Villalobos, 2013).

According to Santacoloma (2014), the development and proliferation of private standards have been driven by numerous factors such as the evolution of the international and national regulatory systems, the globalization of food supply chains

and a rise in consumer concerns about social and environmental issues. Public health concerns due to food-borne disease outbreaks were the main reason for more stringent national regulations, mainly by developed countries such as the EU and US (Fiankor, Flachsbarth, Masood, & Brümmer, 2017; Santacoloma, 2014). Despite the increase in stringency and various inter-governmental agreements, a regulatory gap remained in the global regulation of food, that was another driving factor for the development of private standards (Lin, 2014). Soon and Baines (2013) state that while private standards were originally developed in response to food safety concerns the aim has advanced to include ethical and environmental factors. Further, the authors state that private standards were partially designed to ensure producers comply with public regulations. Increased consumer awareness and expectations have also fueled the adoption of private standards as a means to minimize reputational risks, that in turn also ensures customer loyalty is obtained and maintained while improving the company's overall quality reputation (Du, 2018).

Another contributing factor to the adoption of private standards was the reduction of international trade tariffs and restrictions that resulted in the expansion of agri-food chains globally (Fiankor et al., 2017). This practice, subsequently, increased the flexibility of large retail chains to source huge volumes, low priced and diversified products from various countries throughout the year, while incorporating various agri-food regulatory systems (Lee, Gereffi & Beauvais, 2012). Hu et al. (2022) state that the ability to source from multiple stakeholders has greatly improved supply chain reliability in some aspects but has also made it more difficult to monitor the various supply chain actors to ensure the best practices for food safety are applied and maintained. Hence, the development of private standards also stems from retailers' efforts to enhance their control over the supply chain by imposing numerous quality assurance standards, to reduce associated risk while addressing consumer and government issues (Tennent & Lockie, 2012).

3.3.3.2 The need and motives for private standards

The terms 'private standards' and 'voluntary standards' are often used interchangeably in the reviewed literature (Henson & Humphrey, 2011). Furthermore, private standards are also known as private food safety management systems in the agri-food industry (Hu et al., 2022). Private standards are voluntary standards developed and set by non-governmental bodies with the absence of regulatory authority. However, due to their expanded reach globally, they have become an industry norm (Du, 2018; Jacxsens et

al., 2015; Lin, 2014). According to Irshad, Ali, Imran, Masood and Akhtar (2021), numerous private standards provide a form of internal control such as a QMS or customer-supplier agreements set by industry stakeholders. Tarnagda, Karama, Yaguibou, Ouattara-Sourabié, Kaboré, Goungounga, Zoungrana, Zongo and Savadogo (2020) state that private standards are specific tools for the practical application of a QMS, that functions as a framework for management and advancement, and ensures the trust and satisfaction of all stakeholders.

Rincon-Ballesteros, Lannelongue and Gonzalez-Benito (2019) claim private standards are the application of appropriate quality assurance guidelines and legislation that contains organisational measures, programmes, equipment, tools, procedures and the employees needed to control and perform quality assurance activities. According to Hu et al. (2022), private standards were established to achieve the following three fundamental functions: “(1) risk reductions across multiple entities in food supply chains, (2) product differentiation among input providers along reliability and quality dimensions, and (3) consumer confidence in and demand for end products”.

3.3.3.3 Private standards versus public regulations or standards

Andersson (2019) states public regulations or standards are generally mandatory and are enforced by legislation, and private standards are voluntary standards established by private entities. According to Henson and Humphrey (2011), the distinction between these standards is unclear, as countries can promulgate standards that may require mandatory or voluntary compliance. Further, the authors state there is a range of various combinations of voluntary/mandatory and private/public standards. Table 3.1 below indicates the various combinations and functions of such standards across private and public sectors.

Table 3. 1: Functions associated with mandatory/voluntary and private/public standard schemes (Henson & Humphrey, 2011)

Function	Regulations	Public voluntary standards	Legally-mandated private standards	Private voluntary standards
Standard-setting	legislature and/or public regulator	legislature and/or public regulator	commercial or non-commercial private body	commercial or non-commercial private body
Adoption	legislature and/or public regulator	private firms or organisations	legislature and/or public regulator	private firms or organisations
Implementation	private firms and public bodies	private firms	private firms	private firms
Conformity assessment	official inspectorate	public/private auditor	public/private auditor	private auditor
Enforcement	criminal or administrative courts	public/private certification body	criminal or administrative courts	private certification body

Private standards are commonly stricter than public regulations (Maertens & Swinnen, 2015; Vandemoortele & Deconinck, 2014). Private standards are also broader in scope than public regulations and international standards, they are market driven and hence more economically efficient, require less time to develop, provide more flexibility in application, and are more dynamic and responsive to varying requirements (Du, 2018; Henson & Humphrey, 2010; Santacoloma, 2014). Moreover, private standards are often more exact about how to achieve results that can include how to implement a process based on specific attributes (Henson & Humphrey, 2010; Hou, Grazia & Malorgio, 2015). Therefore, private standards are commonly referred to as "process standards" (Irshad et al., 2021). Public regulations are viewed as "performance standards", that stipulate the expected attributes the product should have at a specific phase within the supply chain (Hou et al., 2015).

According to Burrell (2011), private standards generally define their requirements and enforce them through a certification process. Whereas public regulations are applied to all actors within a specific sector of the supply chain, and inspections are used to determine compliance to deter non-compliance and maintain public confidence (Burrell, 2011). Even though public regulations and private standards have different approaches on how to achieve specific outcomes they do target the same aspects to ensure sufficient quality control of food safety (Andersson, 2019; Henson & Humphrey, 2010; Melo et al., 2014).

Additionally, private standards and public regulations have progressed parallel to each other over the years (Melo et al., 2014). Moreover, they interact in many ways with several private standards being based on international standards and national legislation, thus forming the framework in which private standards are developed (Du, 2018; Santacoloma, 2014). This framework provides a foundation of legal compliance whereby private standards with their extended scope can establish their particular goals (Santacoloma, 2014), that can include both environmental protection and social concerns as shown in Figure 3.4 below (Elamin & de Cordoba, 2020). In addition, governments can also base public regulations on private technical specifications and initiatives and, in certain instances, can rely on private institutions to implement their public legislation (Du, 2018; Lambin & Thorlakson, 2018).

Figure 3. 4: An illustration of the interactions between public regulations and private standards

(Source: Santacoloma, 2014)

3.3.3.4 Classification of private standards

The global trade of food and agricultural commodities is governed by two groups. One group comprises countries imposing regulations on commodities imported based on national legislation, intergovernmental agreements and international standards. The other group consists of private standards developed by several major retailers, wholesalers and food companies (Herzfeld, Drescher, & Grebitus, 2011). International and national standards developed by public authorities or intergovernmental

agreements include Codex Alimentarius, ISO-based standards and HACCP (Herzfeld et al., 2011; Okpala & Korzeniowska, 2021).

According to the reviewed literature, there are various classifications of private standards (Rao et al., 2021). Burrell (2011) state that private standards can be classified into two schemes, namely mainstream and niche schemes. This author further states that the main difference between the schemes pertains to the attributes of their respective standard assurances. Santacoloma (2014) claims that the two primary categories of private standards are those focused on food safety issues and those focused on consumer environmental and social issues. Furthermore, this author states the former focus on RM that requires producers to adhere to the minimum food safety requirements, and does not prescribe a label or premium prices (e.g. BRC and GlobalG.A.P.). Whereas, the latter standards aim for product differentiation that often includes a label and premium price to access lucrative markets (e.g. organic and fair trade standards).

Moreover, as shown by Table 3.2 below private standards have been classified as individual firm standards and collective standards. The former are standards set by an individual company that are exclusive to that company, these standards mainly apply to large food retailers and are adopted along their supply chain. The latter are standards set by collective organisations that can be applied nationally and internationally (Du, 2018; Henson & Humphrey, 2010; Hu et al., 2022).

Table 3. 2: Examples of various types of private standards (adapted from Du, 2018; Henson & Humphrey, 2010; Hu et al., 2022)

Individual Firm Standards	Collective National Standards	Collective International Standards
• Field-to-Fork (Marks & Spencer) • Carrrefour Filière Qualité • Tesco Nature's Choice • Shared Planet (Starbucks)	• British Retail Consortium (BRC) Global Standard • Assured Food Standards	• International Organization for Standardization (ISO) • Global working group for Good Agricultural Practice (GlobalG.A.P.) • Safe Quality Food (SQF) • Global Food Safety Initiative (GFSI) • Rainforest Alliance • International Food Standard (IFS)

Private standards can also be further categorized as pre-farm gate (e.g. GlobalG.A.P.) and post-farm gate (e.g. BRC) (Hu et al., 2022; Huige, 2011; Soon & Baines, 2013). Table 3.3 below shows how standards can be classified according to public standards and private standards, and further categorised according to types.

Table 3. 3: Public and private standards as per different types of standards (Soon & Baines, 2013)

	Public Mandatory	**Private**		
		Collective		Company assurance standards
National	HACCP	Pre-farm gate Freshcare Code of Practice (Australia) [3] New Zealand GAP [4, 5] Hygiene codes	Post-farm gate Qualitat und Sicherhei (QS) (Germany) IntegraleKetenBeheersing (IKB) US's Pork Quality Assurance Programme [2]	Nature's Choice (Tesco Stores, UK) Field-to-Fork (Marks&Spencer, UK) Filière Agriculture Raisonnée (Auchan, France) FilièreQualité (Carrefour, France) Terre et Saveur (Casino, France)
International	Codex Alimentarius EU Regulations	Good Agricultural Practices SQF Code 7th Edition GlobalGAP ISO 9000; IS0 22000 (voluntary)	Good Manufacturing Practices (GMP) BRC Global Standard Dutch HACCP International Food Standard SQF Code 7th Edition ISO 9000; IS0 22000 (voluntary)	

Some studies classify private standards as business-to-business standards and consumer-facing certification standards. Business-to-business standards ensure assurance of the minimum standards of producers and are generally not communicated to consumers (Kariuki, Loy & Herzfeld, 2012; Mook & Overdevest, 2021). Whereas, consumer-facing certification standards such as Fair Trade market directly to consumers via a label or logo, to establish product differentiation by promoting process or product attributes that appeal to interested consumers (Henson & Humphrey, 2010; Mook & Overdevest, 2021).

Essentially most private standards are predominately founded on process control grounded on the HACCP system, while monitoring and enforcement are generally conducted through third-party certification audits (Huige, 2011). Certification entails an independent audit of a farm or processing company, that the interested producer or

company pays for (Herzfeld et al., 2011). Third-party certification bodies are accredited by the standard and are private companies that provide independent verification that the producer adheres to the standard requirements (Mohammed & Zheng, 2017). Traceability is a crucial component of certification and involves the ability to link products to a particular stage of the value chain (Burrell, 2011; Henson & Humphrey, 2010). According to Olsen and Borit (2013), a key aspect of traceability is record keeping that defines traceability as the "ability to access any or all information relating to that which is under consideration, throughout its entire life cycle, by means of recorded identifications".

3.3.3.5 Global working group for Good Agricultural Practice (GlobalG.A.P.)

GlobalG.A.P. is a GAP standard consisting of high agricultural practices founded on HACCP principles, to minimise risks associated with agricultural inputs while considering environmental protection and enhancement (Annor et al., 2016; Kassem, Alotaibi, Aldosari, Herab & Ghozy, 2021). The long-term goal of the GlobalG.A.P. standard is to establish one single standard for GAP globally with a wide range of product applications (van der Meulen, 2011). The standard covers a variety of aspects such as food safety and traceability, employee welfare, safety and health, environmental protection, animal welfare, integrated crop management, HACCP, integrated pest management and QMS (GlobalG.A.P., 2022: Online). Furthermore, the standard is recognised by the Global Food Safety Initiative (GFSI), that is a global industry initiative to harmonise food safety systems by facilitating the benchmarking of private standard schemes to decrease multiple certifications (GFSI, 2022: Online; Mook et al., 2021; Soon & Baines, 2013).

The GlobalG.A.P. standard is the most widely adopted globally by primary producers (Hu et al., 2022; Irshad et al., 2021), with over 200 000 certified producers in 134 countries (GlobalG.A.P., 2022: Online). In addition, the standard is also the most accepted as a reference for GAP on the international market (Ganpat, Badrie, Walter, Roberts, Nandlal & Smith, 2014), and even though the standard is voluntary it has become a mandatory requirement for many retailers in the EU (Andersson, 2019; Holzapfel & Wollni, 2014; Handschuch et al., 2013). The standard has also been the most extensively studied private standard in the trade literature (Rao et al., 2021).

Certification with the GlobalG.A.P.standard is crucial to access certain markets. Therefore, concerns have been raised that the standard can lead to the marginalization of small and medium-scale producers particularly in emerging countries from the international trade of agricultural products (Handschuch et al., 2013; Maertens & Swinnen, 2015; Rao et al., 2021). However, studies have demonstrated that certification with GlobalG.A.P. can have a positive trade outcome for emerging countries (Andersson, 2019, Henson, Masakure & Cranfield, 2011; Kariuki et al., 2012). Regardless of the increasing importance of this standard to access the EU market specifically there is an uneven distribution of GlobalG.A.P. certification among countries, with EU countries leading in certification (Flachsbarth, Grassnick & Brümmer, 2020). Certain countries have pursued GlobalG.A.P. accreditation of their existing certification schemes and national GAP programmes through a benchmarking process (Santacoloma, 2014; Tennent & Lockie, 2012).

To become GlobalG.A.P. certified there are two options, option one is when an individual farmer applies for certification and the other option is when a group of farmers applies for group certification (Fiankor et al., 2017). The Integrated Farm Assurance (IFA) is the core GlobalG.A.P. standard and most widely adopted, this sub-standard is also required for most markets. In addition, the sub-standard applies to a variety of products (fresh produce, livestock and floriculture) (GlobalG.A.P., 2022: Online). The IFA consist of a range of requirements with various compliance criteria, that are categorised into major 'musts' (100% compliance), minor 'musts' (95% compliance) and recommendations (advisable) (DALRRD, 2021). GlobalG.A.P. also makes provision for the addition of extra modules (add-ons) for retailers requiring more vigorous quality assurance concerning particular supply chains or agricultural production features, such as Tesco's Nurture Programme (GlobalG.A.P., 2022: Online). Moreover, the standard also recognises the financial burden of compliance experienced by small and medium-scale farmers in emerging countries. Hence, they have introduced the localg.a.p. initiative to assist these farmers in overcoming market access challenges (Fiankor et al., 2017). The localg.a.p. is designed to facilitate capacity building by assisting farmers to implement GAP and improve their overall farm management practices, adhere to domestic legislation and reduce food safety risks (GlobalG.A.P., 2022: Online). However, this type of scheme is limited because it only provides for the Primary Farm Assurance (PFA) sub-standard of the GlobalG.A.P. standard and not the IFA that is required for more demanding markets (GlobalG.A.P., 2022: Online). Figures 3.5 and 3.6 below illustrate the various GlobalG.A.P. standard products, including the potential progression from PFA to IFA certification.

Figure 3. 5: The GlobalG.A.P. standard product

(Source: GlobalG.A.P., 2022: Online)

Figure 3. 6: GlobalG.A.P. potential progression to IFA certification

(Source: GlobalG.A.P., 2022: Online)

According to Fiankor, Martínez-Zarzoso and Brümmer (2019), the GlobalG.A.P. standard is secondary to state regulations in countries where the state requirements exceed the standard. Further, these authors state that the opposite is also true when the state regulations are too weak to provide confidence to trading partners, then the standard provides food quality and safety assurances. Lockie et al. (2015) assert that regardless of the standard's claims about social and environmental responsibilities there are very few of these requirements in its verification and inspection procedures

to ensure these objectives are met by farmers. They argue that such requirements mostly focus on the establishment of risk assessments and plans. Furthermore, demonstrating domestic legal compliance is not required by certified farmers that means adherence to national legislation is ineffective if domestic enforcement is weak (Lockie et al., 2015).

3.3.3.6 The effect of private standards on international trade

The growing significance of private standards in the international trade of agri-food products has sparked a debate about whether these standards behave as an obstacle or facilitator to trade (Elamin et al., 2020; Andersson, 2019; Maertens & Swinnen, 2015). According to Du (2018), the effects of private standards on trade can either come from the content of the standard or the exporter's ability to comply with the standard requirements. Hence, the author argues that one can expect that private standards would have similar types of trade effects than those that may arise from public regulations.

Many developing countries have expanded their export commodities to horticulture produce to pursue economic growth and alleviate rural poverty (Annor et al., 2016; Irshad et al., 2021). Hence, the effect of these standards on emerging countries have raised concerns, specifically small-holder farmers being left out from export value chains and, more importantly, high-value markets (Du, 2018; Elamin et al., 2020; Henson, Masakure & Cranfield, 2011; Holzapfel et al., 2014;). There are claims to obtain certification requires a substantial investment for items such as farm equipment, infrastructure upgrades, amendments to farm management practices, training requirements, recurrent and non-recurrent fees, and fees associated with third-party audits (Burrell, 2011; Holzapfel et al., 2014; Rao et al., 2021). Small-scale farmers in developing countries usually lack the aforementioned resources and managerial skills to adopt and pursue certification (Gichuki, Han, & Njagi, 2020; Handschuch et al., 2013; Irshad et al., 2021).

Studies have demonstrated that various aspects can negatively impact trade by acting as a barrier. For example, the number of certification bodies present in a country and the distance from lucrative markets (EU and USA) (Mohammed & Zheng, 2017), historical trade relations creating a barrier for new entrants (Herzfeld et al., 2011), the procurement practices of exporters when sourcing from small scale farmers (Henson, Jaffee & Masakure, 2013), lack of access to credit, and high labour and inputs cost

(Annor et al., 2016). Furthermore, Gichuki et al., (2020) found more financially secure farmers affiliated with GlobalG.A.P. farmer groups are expected to embrace certification more than poor farmers, since the former have a significantly better wealth index and can more easily raise the capital investment required for certification. Moreover, some studies have found that certification is more likely to be achieved by large-scale farmers compared to small and medium-scale farmers, a practice that can be attributed to the farm size, type of crop, the type of standard adopted and associated costs, and the ability to access credit (Irshad et al., 2021; Meemken, 2021). Kassem et al., (2021) assessed the degree of compliance with GlobalG.A.P. and the associated barriers experienced by Egypt's small-scale orange farmers. These authors found the rate of compliance with the standard was moderate, and the main barrier was institutional support followed by personal and economic barriers.

On the other hand, it is also widely recognised that to participate in international trade one needs to gain access to the supply chain of buyers which private standards provide (Du, 2018). Andersson (2019) claims private standards have a trade-enhancing effect by providing quality assurance of imported commodities, that subsequently provides information, reduces transaction costs and enhances both the likelihood of trade and import volumes. Furthermore, this author claims the enhanced trade effects are higher for developing countries than developed countries. Studies have also found that private standards such as GlobalG.A.P. can reduce trade barriers originating from institutional differences among countries when there are major variances between the quality of state establishments (Fiankor et al., 2019).

Moreover, studies have demonstrated that various GlobalG.A.P. aspects such as product traceability, certification, supply contracts, enhanced access to networks, direct procurement, competition for supplies and various amount of suppliers have a positive impact on farm gate prices for small-scale farmers (Kariuki et al., 2012). In addition, Colen, Maertens and Swinnen (2012) found that the working conditions of employees of GlobalG.A.P. certified farms have improved compared to non-certified farms. Further, they claim certification is associated with improved incomes and extended periods of employment. In contrast, Oya, Schaefer, Skalidou, McCosker and Langer (2017) found there is no substantial evidence that the well-being or living standards of agricultural farmers or workers improve significantly through certification. They did find positive impacts on higher produce prices, however, these did not reflect in workers' incomes.

According to Jacxsens et al. (2015), private standards are perceived as having a dual impact, firstly for the adoption of structured food management systems and secondly as a non-tariff barrier to trade. These authors found there is a perception that adoption and certification costs are mostly shifted to producers. Rao et al. (2021) state that private standards allow the retail industry to exercise considerable power over the supply chain without being liable for any of the additional associated costs. Handschuch et al. (2013) claim that once small-scale farmers can overcome barriers related to implementation and certification there is a significant improvement in their quality performance and income. According to Henson, Masakure and Cranfield (2011), to maintain access to lucrative export markets and gain significant export revenue, investment in the certification of GlobalG.A.P. is required. Furthermore, they claim that companies that were certified first accrued greater gains compared to companies that were certified later.

Figure 3.7 below illustrates the various channels through which private standards can potentially impact trade (Elamin et al., 2020).

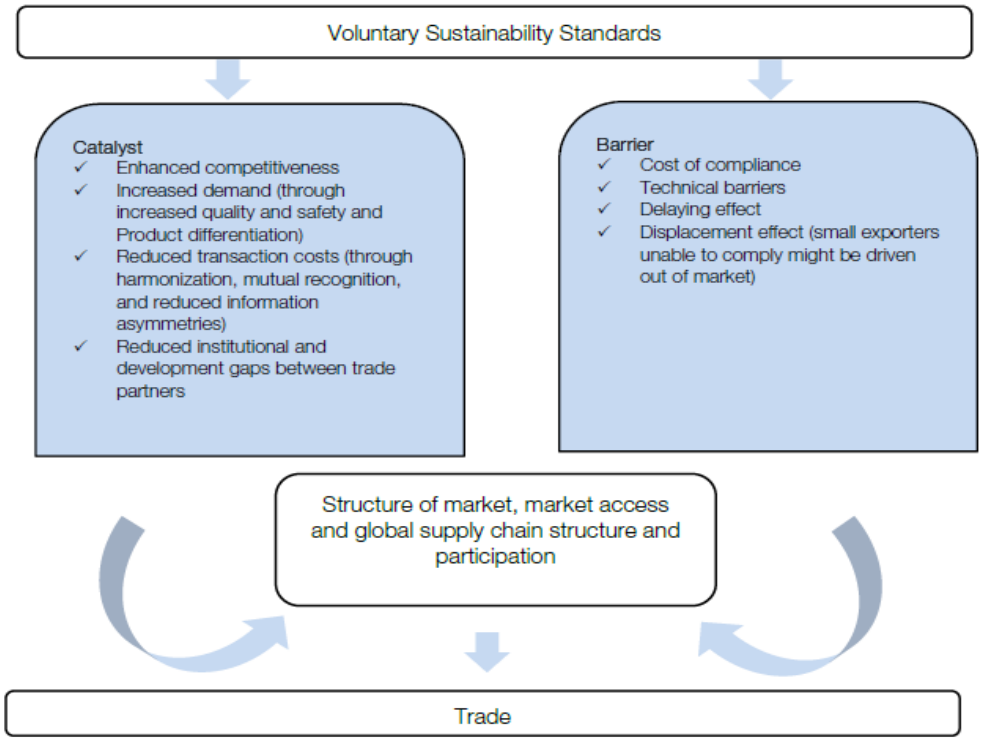

Figure 3. 7: The various potential trade effects of private standards
(Source: Elamin et al., 2020)

3.3.4 Private standards in the South African context

After the deregulation and liberalisation of the South African citrus industry in 1997 producers were exposed to global market forces without government protection, and there were growing concerns regarding the safety and quality of citrus exported from SA (Mather & Greenberg, 2003). Furthermore, citrus producers were finding it difficult to adapt to the quality standards of importers while, at the same time, adapting to the changing national policy environment (Ndou & Obi, 2013). The aftermath of deregulation created a gap that was quickly filled by large retailers from developed countries, changing the sector from an exporter-driven to a buyer-driven chain, consequently, moving from a quantity-based to a quality-oriented operation (Bitzer, Obi & Ndou, 2016).

Producers who wished to maintain access to international markets, therefore, were forced to adapt to ensure compliance with quality standards. Further, the government was required to ensure the legislation applied was aligned to international markets (Fréguin-Gresh & Anseeuw, 2014). In response to the global explosion of private standards and the need to maintain access to high-value markets, there was a significant increase in GlobalG.A.P. certification by South African producers from 2003 to 2004 and since that date most export producers have been certified (Barrientos & Visser, 2013). While many producers pursued quality upgrades and became certified, many small-scale producers were excluded from the international supply chain. This limitation was because of poorer quality citrus, insufficient resources, smaller production quantities, lack of access to credit and the inability to comply with the growing stringency of export standards (Mather & Greenberg, 2003). Figure 3.8 below shows an outline of several developments in quality, that have impacted the South African citrus industry over the years (Bitzer et al., 2016).

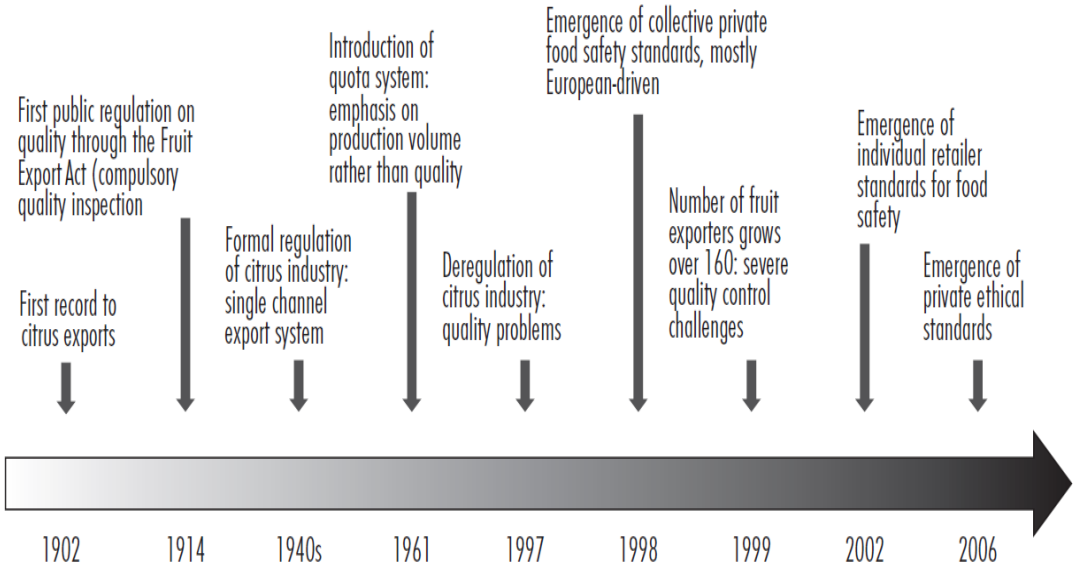

Figure 3. 8: Historical quality developments in the South African citrus industry (Source: Bitzer et al., 2016)

The main private standards (pre-farm and post-farm gate) employed by the citrus industry of SA are GlobalG.A.P., Tesco Nurture, Field to Fork, Leaf Marque, Albert Hejin PPP Protocol, HACCP, BRC and GlobalG.A.P. Produce Handling (Table 3.4 below) (Bitzer et al., 2016). Furthermore, the DALRRD encourage farmers to become GlobalG.A.P. certified as a proactive strategy to implement pest management programmes and to ensure compliance with the MRLs of export markets (DALRRD, 2021b). The DALRRD also recommends producers pursue GlobalG.A.P. certification since it is the minimum requirement for export readiness. This private standard ensures that key processes are in place regarding record keeping, hygiene practices, crop management, employee working conditions and important environmental requirements (DALRRD, 2021b). Additionally, the DALRRD recognises the importance of traceability and has put requirements in place to ensure all citrus fruit produced in South Africa can be linked to the original source. According to the DALRRD, an effective traceability system should be able to tie a food safety concern to a specific produce orchard, packhouse and country. Further, the DALRRD requires all export produce cartons to be labelled with accurate and relevant information pertaining to their origin as per the importing country's requirements (DALRRD, 2021a).

Table 3. 4: Main private standards in the citrus industry of South Africa (Bitzer et al., 2016)

Pre-farm gate				Post-farm gate	
Food safety standards	Demanded by	Social and environmental standards	Demanded by	Pack house standards	Demanded by
GlobalGAP	All UK and EU retailers; some buyers in other export markets; some domestic retailers in SA	Ethical Trading Initiative (ETI) base code	All UK retailers	HACCP (SANS 10330)	All EU and UK retailers
Nurture	Tesco	Business Social Compliance Program (BSCI)	Growing number of EU retailers	British Retailer Consortium (BRC) global standards	All UK retailers
Field to Fork	Marks & Spencer	Fairtrade	Small number of mostly UK retailers as niche market products	GlobalGAP produce handling	Several EU retailers
LEAF Marque	Waitrose and other UK retailers	GRASP (GlobalGAP risk assessment on social practices)	Some EU retailers		
Albert Heijn PPP Protocol	Albert Heijn	Organic	Small number of UK and EU retailers as niche market products		
		Carbon footprint	Tesco		

According to Bitzer et al. (2016), in the South African context, the different quality requirements citrus producers need to pursue can be translated to a “ladder of market access”. These authors claim that producers are required to undertake certain efforts concerning private standards to move from domestic markets to more lucrative international markets, as demonstrated by Figure 3.9 below.

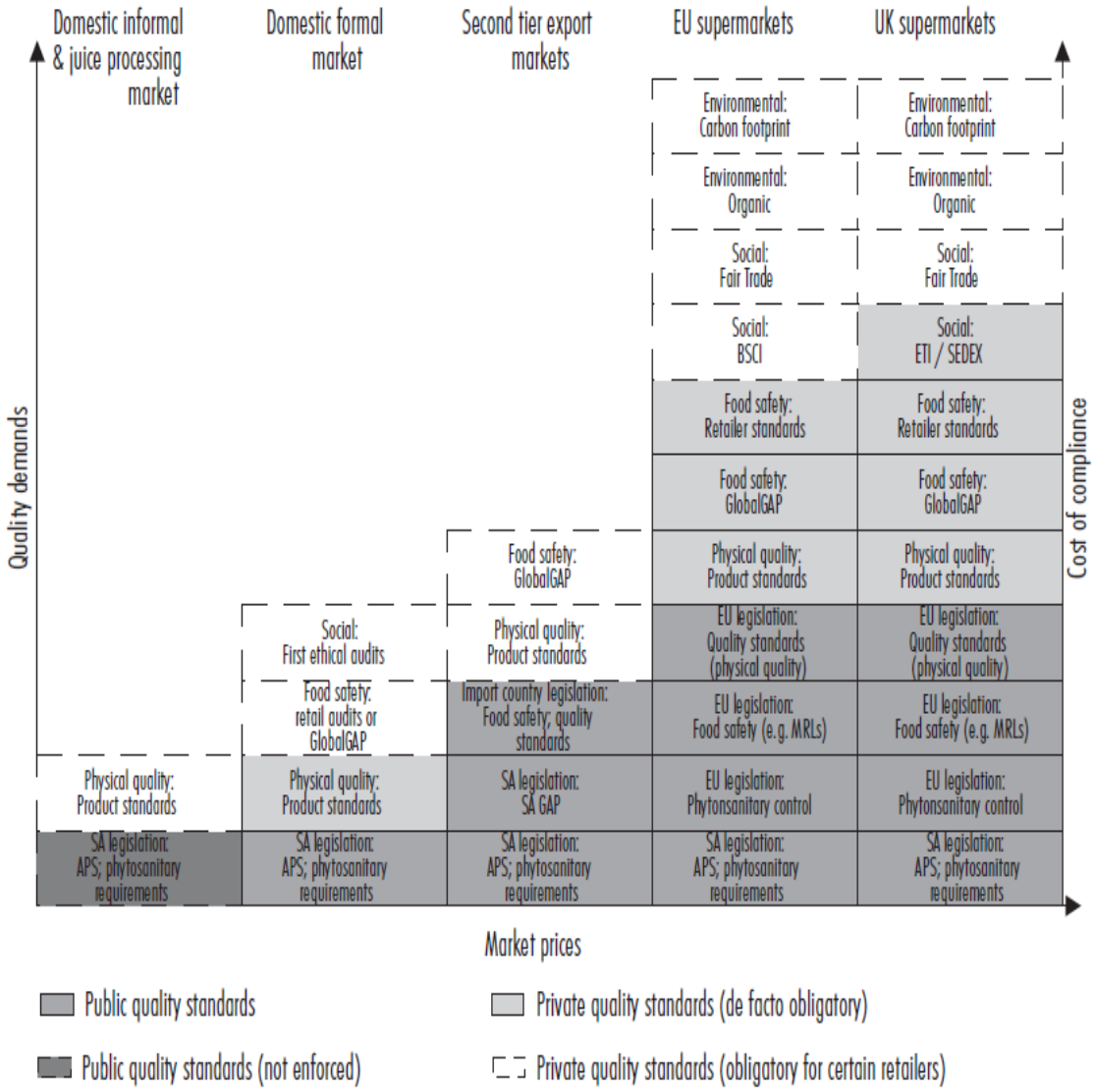

Figure 3. 9: The ladder of market access, to gain access to lucrative international markets (Source: Bitzer et al., 2016)

3.4 Regulatory non-compliances in the agricultural food export chain

3.4.1 What is non-compliance?

Non-compliance is defined according to the Oxford Learner's Dictionary (2021) as "failing or refusing to obey a rule". Day, Tambi and Odularu (2012) state that the general meaning of compliance is to behave per instruction, and further claim that compliance may have a particular meaning about a specific standard that can be either private or public. The focus of this study is on the South African citrus growers' non-compliance with the EU import regulations when exporting citrus fruit to the EU.

According to the ISPM 13 (2021), significant instances of non-compliance include: “failure to comply with phytosanitary import requirements, detection of regulated pests, failure to comply with documentary requirements, prohibited consignments, prohibited articles in consignments [and] evidence of failure of specified treatments”. Furthermore, the ISPM 13 states the importing country should notify the exporting country of significant occurrences of non-compliance with its phytosanitary requirements, even if a phytosanitary certificate is not required. Exported consignments must be accompanied by the relevant documentation as per the compliance procedures of the importing country (Lengai, Fulano & Muthomi, 2022). A phytosanitary certificate is considered the most important aspect of compliance procedures because it provides an official assurance that the consignment is free from quarantine pests. It also indicates that the consignment complies with the present phytosanitary requirements and that the prescribed RM options have been implemented and, in some instances, includes an additional declaration that a specific measure has been followed (ISPM 11, 2017).

3.4.2 The EU import regulations

Agricultural products imported into the EU must comply with two sets of co-existing regulations, one set comprises the national regulations that also apply to domestic products and the second set covers specific import requirements (Kühn, 2020). The set of SPS regulations specific to agricultural imports is comprehensive and complex to reduce associated risks and ensure a high level of safe imported products (Murina et al., 2017). It is the responsibility of the EU member states to implement and enforce import regulations (Iliyasu & Zainalabidin, 2018). If a consignment is found to be non-compliant the responsible authority would employ measures such as rejection, destruction abd re-direction or arrange for special treatment to be conducted (Fulano, Lengai & Muthomi, 2021). The Rapid Alert System for Food and Feed (RASFF) enables information to be shared between EU member states regarding actions taken about immediate risks posed to public health, that applies to the internal market in terms of imports from outside countries (European Commission, 2022: Online; Henson & Olale, 2011). Further, the EU also conducts regular audits, inspections and other non-related activities in countries outside of the EU that export products into the EU, to ensure the EU’s food safety regulations are sufficiently implemented and enforced (Yanai, 2021).

Fresh fruits and vegetables imported into the EU must comply with the European Plant Health Directive 2000/29/EC, that requires plant health inspections to be conducted and the consignment to be accompanied by a phytosanitary certificate before shipping (European Commission 2017/1279, 2017). Furthermore, the directive states citrus fruit (except for certain varieties) imported from the African continent should be sourced only from countries, areas and places of production recognised as being free from the pest FCM (*Thaumatotibia leucotreta*). However, the directive also makes provision for an effective cold treatment or another similar treatment approved by the EU to ensure the imported citrus is free from the FCM (European Commission 2017/1279, 2017). The various RM measures for the FCM provided for by the EU regulations include pest-free areas of production, single post-harvest treatments, places of production free from pests such as greenhouses and glasshouses, and systems approaches (Mutyambai et al., 2020). The systems approach is a risk-mitigating measure accepted by the EU for the pest FCM, for citrus fruit imported from SA (Moore, 2021).

Moreover, the EU regulations require all imported produce to comply with technical requirements that include traceability, product conformity and MRLs of pesticides allowed as per the European Commission Directive 396/2005 (Camanzi et al., 2019; Fulano et al., 2021). Pesticides used on produce pose a substantial risk to humans and the environment. Hence, governments regulate the application of pesticides by using the maximum residue levels (MRLs) of the pesticide substance on produce to determine the stringency level, thus MRLs is a unit of measure for pesticide regulations (Kareem, Brümmer & Martinez-Zarzoso, 2017).

3.4.3 World perspective

SPS and quality requirements have become more trade restrictive as the international regulations and systems governing trade have evolved (Idris et al., 2015). High-income countries are commonly known for adopting more stringent SPS regulations because of their citizens' higher degree of awareness of food safety and quality issues (Ferro, Otsuki & Wilson, 2015). The EU specifically has introduced food safety legislation more rapidly than most countries (Rincon-Ballesteros, Lannelongue & González-Benito, 2021), and is perceived as having the most stringent regulations that often exceed international standards (Beestermöller, Disdier & Fontagné, 2018; Camanzi et al., 2019). Murina and Nicita (2017) claim that to access the EU market agricultural products must comply with a significant number of SPS regulatory measures and the greater the international value of these products, the more they are subjected to SPS

measures. Therefore, these authors argue that access to the EU market depends upon the compliance capability of the exporting country. An empirical study conducted by Camanzi et al. (2019) from the viewpoint of Italian importers and stakeholders importing from Southern Mediterranean Countries, found the main challenge of complying with the EU import regulations is the lack of harmony among the regulatory systems of EU members and the inadequate checks in the countries that export produce to the EU. A survey conducted by Jacxsens et al. (2015) elicited the views of supply chain specialists working with producers from developed countries (e.g., EU and US) and developing countries (e.g., Kenya and SA), regarding four kinds of food safety and quality standards and regulations (EU legislations, Codex Alimentarius, domestic legislation and private standards). From the analysis of the survey, it was found the most challenging requirements for developed countries were the MRLs compliance, risk analysis of water and soil, and recording and administration. Whereas, for developing countries, the most challenging requirements were complying with the MRLs standards for "recording and administration, infrastructure costs and hygiene requirements" (Jacxsens et al., 2015).

Engler et al. (2012) found that Chilean fresh fruit exporters' perceptions concerning SPS and quality measures of the 16 countries they export to, indicate Mexico's standards as the most stringent and those of Saudi Arabia as the least stringent. In addition, it was found that factors influencing perceived stringency include enforcement capabilities in importing countries, perceived difficulty of the compliance process, general stringency perception of a country, perceived rigour of private standards and the ability to obtain information concerning regulations and standard requirements (Engler et al., 2012). Moreover, it was found that the number of regulations among countries differs which results in a lack of coordination between their regulatory systems, requiring Chilean growers to adopt multiple standards to access these markets (Engler et. al., 2012). Melo et al. (2014) also confirm that while Chilean fresh fruit exporters perceive Mexico in general across various SPS and quality requirements as the strictest and Saudi Arabia as the least, there are certain requirements such as MRLs and pest regulations where specific countries (e.g. EU and Brazil) are perceived as more stringent. Kareem (2022) found that while the EU SPS regulations seem as challenging to African exporters in their decision to consider the EU market as those required by the US, once compliance is achieved the EU market becomes accessible.

Differences in food safety and quality regulations between importing and exporting countries have an impact on trade flows since countries with existing high regulations

will more easily export to countries with similar or lower regulations while the opposite is less likely (Crivelli & Gröschl, 2016). Federica et al. (2021) and DeMaria, Lubello and Drogué (2018) found that Chilean apple exporters can better comply with the phytosanitary requirements of international markets compared to French apple exporters. Besides the geographical advantage of Chile in terms of compliance capacity (distance and off-season production), there are no significant differences in the phytosanitary requirements imposed when exporting to the same destinations (DeMaria et. al., 2018). According to Federica et al. (2021), a possible reason for the difference in compliance is that Chile is part of a group of countries that applies more complex phytosanitary national legislation while France is part of the EU that has less demanding phytosanitary requirements. This difference gives Chilean exporters an advantage when complying with similar complex SPS requirements of their export markets and having less associated compliance costs compared to French exporters who find it difficult to comply with more demanding requirements (DeMaria et al., 2018).

3.4.4 Developing countries' perspective

The capacity to effectively adhere to SPS regulations of trading partners is viewed as one of the important elements of sustainable and increased trade in agriculture products, that can result to the enhancement of economic development and livelihoods (Day et al., 2012). Developing countries that are often seen as standard takers have insufficient resources to effectively comply with SPS regulations generally imposed by developed countries, and usually have no options or lack alternative decisions concerning compliance in reaching their trade goals (Curzi et al., 2020; Henson & Jaffee, 2008).

3.4.4.1 Response strategies of developing countries

Past studies proposed a conceptual framework to identify attributes of strategic responses taken by developing countries and exporters to new or changes to SPS regulations imposed by trading partners. These options are "exit", "loyalty/compliance" and "voice" (Henson & Jaffee, 2008). Furthermore, these strategic options can be further categorised as proactive and reactive, indicating when the compliance efforts are undertaken, as shown in Table 3.5 below (Henson & Jafee, 2008; Neeliah & Neeliah, 2014).

According to Neeliah and Neeliah (2014), compliance or loyalty as a response strategy that is often taken by most developing countries, is commonly the only option. These authors state that this action will include complying proactively ahead of time or reactively once the new changes come into effect. Furthermore, the authors state that developing countries also use the strategy “voice” to air their concerns to the SPS committee or, alternatively, use the WTO dispute settlement process to negotiate or partake in the standard-setting process. Additionally, these authors state developing countries may also decide to select the strategy “exit”, that entails leaving the export market for a less stringent market (Neeliah & Neeliah, 2014).

Table 3. 5: Strategic responses to changes or new SPS regulations (adapted from Henson & Jafee, 2008)

	Reactive	Proactive
Exit	Wait for standards and give up	Anticipate standards, leave particular markets or market segments, and make other commercial shifts
Loyalty	Wait for standards and then adopt measures to comply	Anticipate standards and comply ahead of time
Voice	Complain when existing standards are applied or new measures are adopted	Participate in standard creation and/or negotiate before standards are applied

Assoua, Molua, Nkendah, Choumbou and Tabetando (2022) assessed the compliance strategy employed by the Cameroon government in response to changes in the SPS regulations from the EU on the coco export sector. These authors found that the government both employed proactive and reactive compliance strategies. These practices included implementing a range of facilitation measures to harmonize and comply with SPS measures and investment in food safety infrastructure. Sithamparam, Devadason and Chenayah (2017) assessed the strategic responses of Malaysian exporters to NTMs imposed by their main export markets, from the perspective of exporting companies. These authors found that most companies adopted the strategy of compliance and the general approach taken was reactive regardless of the response strategy. Nguyen and Jolly (2020) examined the compliance of Vietnamese fish exporters to changes to the EU and US’s quality and food safety standards. They found that the response to stricter standards resulted in exporters searching for alternative

markets or re-directed exports to less stringent markets. Curzi et al. (2020) claim that in response to the very stringent NTMs imposed on Peruvian exporters most small companies choose to exit the export market.

Hou et al. (2015) analysed the Moroccan food safety legislative framework and actions taken in a predicted effort to enable compliance with the EU market requirements. These authors illustrated how the Moroccan legislative framework "evolved towards harmonization with the EU regulatory system" in a proactive manner to facilitate anticipated compliance capacity. According to Yanai (2021), every time the EU imposed changes or new import regulations in the fishery export industry of developing countries such as Tanzania, Madagascar and Mauritius, these countries would adapt their domestic legislation to harmonize with EU requirements to ensure continued access. Further, Yanai (2021) states that the actions of developed countries when introducing new regulations, greatly influence developing countries that accept these regulations (Yanai, 2022). Hatab, Hess and Surry (2019) surveyed 89 Egyptian small and medium-sized companies exporting fresh produce to the EU. These authors found that farmers complying with the EU requirements experienced great improvements in their export performance due to a decrease in border non-compliances, that reduced the likelihood of redirecting exports to less strict markets. The farmers' response strategy to changes to EU safety and quality standards was to reduce border rejections, however, farmers did redirect exports to other markets if traditional markets became too strict (Hatab et al., 2019).

3.4.4.2 Non-compliances of developing countries with the EU import regulations

Henson and Olale (2011) claim that border rejections due to non-compliances provide useful insights into the type of compliance challenges experienced by exporters in developing countries who export to the EU. The main non-compliances for interceptions or rejections with the EU import requirements in 2018 from non-EU countries were the absence of a phytosanitary certificate, non-conformance with wood packaging material requirements (requirements provided by the ISPM 15), detection of harmful organisms (e.g. quarantine pests), problems with additional declarations on phytosanitary certificates, prohibited goods and incomplete, forged or unreadable phytosanitary certificates (European Commission, 2019).

Engler et al. (2012) assert that the most pertinent SPS and quality requirements Chilean exporters must comply with to export fresh fruit can be categorised into seven groups, as shown in Table 3.6 below. Idris et al. (2015) state that the SPS requirements set by the EU and US, such as zero tolerance for pests and certification concerns, are significant compliance challenges for Indian horticulture exporters. Further, the authors state port of entry inspections and rejections have financial consequences, cause delivery delays, decrease the quality of products and have reputational consequences for Indian exporters. Hou et al. (2015) claim that from the perspective of Moroccan produce exporters to the EU, the most perceived difficulties of compliance were infrastructure and equipment and the benefits were enhanced customer relations and access to profitable markets. Lengai et al. (2022) claim the detection of pests, microbial contaminates (e.g. *Escherichia* and *Salmonella*) and MRLs are phytosanitary concerns for Kenya's horticulture export sector, and further state compliance with MRLs are the greatest challenge.

Fulano et al. (2021) conducted a review to explore the phytosanitary and technical difficulties encountered by Kenyan snap bean smallholder farmers when exporting to the EU. These authors found the main non-compliances and issues are the detection of regulated and quarantine pests, harmful organisms, MRLs and nonconformity with technical standards. Mutyambai et al. (2020) claim the detection or interception of the pest FCM is the main cause of non-compliances for peppers and cut flowers exported from Kenya to the EU. Hatab et al. (2019) stated the main reasons for the rejection of fresh produce from Egypt to the EU include insects, chemical residues, damaged packaging and microbial contaminates. Furthermore, studies found other causes for rejections or non-compliances with the EU import requirements include instances of exceeding the maximum levels of regulated substances (or contaminates), such as aflatoxin (produced by the mould *Aspergillus flavus*), cadmium and polycyclic aromatic hydrocarbon concentrations (Assoua et al., 2022; Triwibowo & Falianty, 2018).

Table 3. 6: SPS and quality requirements categorised for fresh fruit exports (Engler et al., 2012)

Category	Item of regulation
Phyotsanitary measures	Number of pest, diseases and weeds regulated Quarantine treatment requirements
Tolerance limits for pesticide residues and contaminants	Maximum Residue Limits
Hygiene requirements	Microbiological requirements
Labeling, marking and packaging	Packing materials for quarantine treatment Labeling requirement
Product and process standards	Good Agricultural Practices requirements Quality standards
Registration procedures and other import requirements	Registration of production sites Registration of export firm and producer Registration of phytosanitary inputs Import permission requirement Bioterrorism inspection/24 h. Law

3.4.5 South African perspective

According to Zdráhal, Verter and Lategan (2020), despite the preferential trade agreement between SA and the EU and, even though SA is the leading trading partner of the EU in Africa, there have been complaints that the requirements imposed on the South African agriculture export sector are too strict. Vinti and Makapela (2016) assessed the EU's imposition of stricter SPS regulations on citrus exported from SA based on a pest risk assessment for the pest citrus black spot (CBS) and a high level of CBS interceptions. These authors highlight SA's response that included amending the CBS RM system and establishing the CBS-RM scheme, resulting in a decrease in interceptions. Additionally, the authors demonstrate that while SA's response was "compliance" by implementing measures to enhance compliance, they also used the "voice" strategy. Firstly, to approach the IPPC to invoke the dispute-resolution mechanism and secondly to notify the WTO dispute settlement committee of its concerns in an attempt to request assistance to resolve the specific trade concern (Vinti & Makapela, 2016).

According to Moore (2021), due to the phytosanitary status of the FCM, the international market has no lenience for the detection of live larvae, including the EU and the US. This author further adds that it is important the pest is controlled to such

an extent that it is “as close to a nondetectable level as possible in the country of origin, before fruit are exported”. Moreover, the author emphasises that because of the significant economic contribution of the citrus industry in Southern Africa alone, the importance of compliance is taken very seriously by SA (Moore, 2021). The detection of the pest FCM can result in the ban of the host fruits exported to markets such as the EU and US, where the pest has been listed as a quarantine pest (Adom et al., 2021). According to the DALRRD’s SPS notification database from March 2020 until October 2022 the type of non-compliances for citrus fruit exported to the EU (including the UK) includes the detection or interception of harmful organisms (FCM, CBS, fruit fly), absent or incomplete phytosanitary certificate (PC), a missing, inadequate or invalid additional declaration on the PC, contaminates (*Aspergillus*), wood packaging material requirements and Production Unit code (PUC) numbers present but not listed on PC (DALRRD, 2022).

3.5 Integrating risk management into a quality management system

According to Samani, Ismail, Leman and Zulkifli (2019), RM and QMS are key performance elements of management and integrating these systems will result in enhanced collaborations and benefits. They further state that while QM is an organisation’s commitment to quality products and services and meeting customer requirements, RM mitigates and addresses uncertainties that can impact or cause deviations from meeting those requirements.

Many studies about integration have focused their research on standards related to MSs such as the QMS, Environmental MS (EMS), and Occupational Health and Safety MS (OHSMS), that are most compatible with the ISO standards (Barbosa et al., 2021, Nunhes & Oliveira, 2020). According to Field (2019), an IMS does not have to be associated with any specific standard and organisations can create processes and policies to establish an IMS.

The benefits of integrating MSs have been well documented in the literature. These include improved internal and external reputational image, enhanced alignment of strategic, operational and tactical policies and goals, removal of redundancy across MS standards, increased capability to achieve objectives, improved organisational culture, enhanced productivity, reduction in management costs, and well-defined managerial responsibilities and authorities (Talapatra, Santos, Uddin & Carvalho, 2019). Other benefits are optimization of audits conducted internally and externally,

decrease in documentation efforts, elimination of unnecessary processes and benefits attained from synergy (von Ahsen, 2014).

Samani et al. (2019) state that there is a difference between integrating different MSs and developing an IMS, and such development is generally the aim of standard developing organisations such as the ISO. The focus of this study is on how to effectively integrate MSs (RM and QMS) and not the development of an IMS. However, previous research on the development of an IMS is reviewed to determine how to achieve effective integration, including guidelines on integration, best practices, benefits to be achieved and lessons learned from the establishment of an IMS.

3.5.1 Difficulties of integrating different management systems

While there are many benefits from integrating MSs the process of integration can be challenging (Blasco-Torregrosa, Perez-Bernabeu, Palacios-Guillem & Gisbert-Soler, 2021). According to a literature review and study conducted by Almeida et al. (2014), the most important critical success factors for effectively incorporating different MSs include adequate, motivated and suitable workers, access to consultants with appropriate experience in effective integration, financial resources, top management participation and sufficient employee training. Furthermore, the authors found that many of the identified challenges were associated with the absence of a previous organisational structure and organisational culture changes. Domingues, Sampaio and Arezes (2015) suggest resistance to organisational changes occurs because of the inadequate distribution of information about the new system and associated duties, inadequate participation of key workers, and the insufficient understanding and motivation of the integration process. Further, these authors state that when integrating MSs the main issues are inadequate financial and human resources.

Nunhes, Barbosa and de Oliveira (2017) conducted a qualitative study of 14 case studies. These authors found that the most challenging aspect of integration was the "high demand of human and financial resources" required for implementation and the difficulty of the integration process. Furthermore, these authors argue the excessive requirement of human and financial resources was because of the integrated approach adopted by most companies, that was to integrate the individual MSs at different times assisted by different consulting companies. Blasco-Torregrosa et al. (2021) found that when comparing how Spanish companies operating in Spain implement and integrate different MSs compared to Spanish companies operating in the Czech Republic, that

the lack of human resources is one of the main internal difficulties highlighted by these companies. Gianni and Gotzamani (2015) conducted a single case study to identify the constraints experienced by a company that ultimately lead to its abandonment of integration. These limitations include a lack of adequate and skilled human resources, insufficient training (only medium-level employees were trained), the lack of integrated audits and the withdrawal of top management commitment (workers indicated without their commitment an IMS would not be sustainable). Moreover, the study found top management withdrawal had a substantial impact on the abandonment of the IMS and the cause for their withdrawal comes from the approach and level of integration taken.

Abad, Cabrera and Medina-León (2016) analysed the difficulties of integrating MSs of a sample of 102 Spanish companies and explored several difficulties. These include insufficient top management involvement, poor staff participation, inadequate resources, differences among MS standards and workers' resistance to change. These authors found the most perceived difficulty by the companies was workers' resistance to change. They argue that this is more evident when MSs are integrated simultaneously or partially that can be viewed by workers as a sudden change in daily operations, as opposed to gradual integration (Abad et al., 2016). A survey conducted with 79 companies by Simon, Karapetrovic and Casadesús (2012) found integration difficulties can be categorised into four groups. These groups are inadequate integration resources, challenges with the implementation and certification of standards, internal organisational challenges, and problems with workers assigned duties related to standards. Further, these authors emphasise workers' attitude and motivation in the group concerning internal organisational difficulties as an essential element in MS's effectiveness (Simon et al., 2012).

3.5.2 Important factors when implementing a pest RM system related to difficulties

Critical to the implementation of a systems approach is the inclusion of stakeholders in the design and application process, this fact has been highlighted in a project undertaken with various developing countries in South East Asia (Mengersen et al., 2012). Furthermore, past studies have demonstrated that education, effective planning and outreach are essential in the sustainability of an area-wide pest management programme, including empowering stakeholders to be able to make informed decisions based on knowledge and skills obtained (Mau, Jang & Vargas, 2007). Mutyambai et al. (2020) emphasise the importance of capacity building and training of Kenyan

growers to detect and identify the pest FCM with regard to the horticulture export sector's trading with lucrative markets such as the EU. Additionally, Moore (2019) states appropriate training and experience is essential in the correct identification of signs associated with FCM infestation since the citrus fruit may also be infested with other pests such as fruit fly. In the South African context farm workers lack the appropriate skills needed to implement export markets' complex requirements (Barrientos & Visser, 2013). Furthermore, these authors state the training provided by the government and private sector is insufficiently resourced to create an adequate pool of skilled workers.

Studies have highlighted the importance of a collaborative approach between the government and the private sector to effectively manage pests risk associated with trade (Yoe et al., 2021). Other studies have found farm workers in developing countries lack knowledge and awareness regarding export requirements and lack state support and collaboration compared to institutional support provided to their counterparts by the EU government (Kirezieva, Luning, Jacxsens, Allende, Johannessen, Tondo, Rajkovic, Uyttendaele & van Boekel, 2015). According to Handschuch et al. (2013), to be able to comply with export standards farmers must be able to adequately manage comprehensive records and the documentation of all processes. This practice may be challenging for small farmers in developing countries because they often lack the skills needed to perform these tasks (Handschuch et al., 2013).

3.5.3 Common approaches to integrating MSs

Integrating different MSs is a strategy adopted by organisations to meet stakeholders' requirements more effectively and sufficiently, as opposed to operating parallel MSs separately (Nunhes & Oliveira, 2020; Abad, Dalmau & Vilajosana, 2014). Integration is combining all internal management practices in a manner that links all elements in one single system which ultimately creates one essential part of the organisation's MS (Olaru, Maier, Nicoară & Maier, 2014). Samani et al. (2019) claim that MSs are considered integrated if one or both MSs lose their independence. According to Poltronieri, Gerolamo, Dias and Carpinetti (2018), integration can happen in various ways on different levels. Almeida et al. (2014) state that with an IMS more stakeholder requirements are achieved with fewer resources compared to a non-integrated system. Furthermore, the authors assert that when integrating MSs some requirements can be integrated and shared among the MSs, while other requirements are specific to a MSs and cannot be integrated. De Oliveira (2013) states that there are structural elements,

namely policy, objectives, responsibilities and scope, that should be integrated first to guide other integration activities. Nunhes et al. (2017) found other common elements that have been efficiently integrated include: “objectives and targets; manuals; policies; structure and responsibilities; the management representative; work instructions; document and record control; formation; internal communication; emergency plans; performance indicators; acquisition; non-compliance treatment; inspection equipment control; measuring and testing; preventive and corrective actions; internal and external audits; and critical analysis meetings”.

Algheriani, Kirin and Spasojevic Brkic (2019) state when studying the integration process there are four principal elements that should be considered. These include implementation strategy, level of integration, integration methodology and auditing systems, including the difficulties and benefits of the implementation. The difficulties and benefits have been discussed above, the following section will explore the four principles of the integration process.

3.5.4 The integration process

The implementation strategy refers to the scope and order in which the MSs are integrated, for example with the most common MSs it is first the QMS then the EMS or the EMS then the QMS (Bernardo, Gotzamani, Vouzas & Casadesus, 2018). Asif, Fisscher, de Bruijn and Pagell (2010) explored the degree of integration on a strategic, tactical and operational level in which integration is either fully, partially or not integrated. Table 3.7 below illustrates the various tasks at the level of integration, in which the strategic level includes the incorporated resources and planning distribution, the tactical level entails the design and assessment of the IMS implementation and the operational level includes the execution of the IMS tasks in an integrated manner (Asif et al., 2010).

Additionally, Asif et al. (2010) claim there are two types of integration strategies, namely the “systems approach” and the “techno-centric approach”. The former method achieves more overall integration benefits because its approach is firstly on a strategic level that filters down to tactical and operational levels. The latter method is based on the analysis of the common elements and achieves more benefits on an operational level, as shown in Figures 3.10 and 3.11 below (Asif et al., 2010; Gianni & Gotzamani, 2015).

Table 3. 7: Degree of integration at different levels of the organisation (Asif et al., 2010)

Degree of integration
Strategic level
Full integration:
An integrated policy exists. The organisational objectives relate to effective management of stakeholder requirements – such as quality, environment, health and safety, and social responsibility
Organisational plans are clear to achieve stated goals and objectives.
There is complete alignment between organisational policy, goals, and plans to achieve these goals
Partial integration:
Organisational policy, objectives, and plans are mutually aligned to some degree
They describe to some extent how the organisation will achieve its objectives
No integration:
Organisation has policies, objectives, and plans, which are aligned neither to each other nor to the operations
They give no clue to how the organisation will achieve its goals regarding various stakeholder requirements
Tactical level
Full integration:
Managers have combined duties for various functions
Managers develop integrated management manual and procedures
Managers emphasise the need of integrated operations, documentation, records, and overall working in their directions, training, and other formal/informal means of communication and implementation
Most of the time the managers from various functions interact, collaborate, and arrive at mutually acceptable outcomes
Integrated audits are carried out.
Partial integration:
Managers have combined responsibilities to some extent. They are primarily concerned with getting their specific job done well. Only sometimes do managers interact, collaborate, and arrive at mutually acceptable outcomes
Performance evaluation is based on getting their specific job done well (such as meeting production targets or savings in procurement) rather than integrated functioning
Audits and corrective action reports are partially integrated
No integration:
Most of the time managers do not interact, collaborate, nor do they reach mutually acceptable outcomes
There are separate procedures for each department which promote little collaboration
In general individual functions are considered the responsibility of separate departments
Separate auditing is carried out for each function
Operational level
Full integration:
Most of the work instructions, records, checklists, and data collection sheets are integrated
Various aspects of processes – representing stakeholder requirements such as quality, sustainability, health and safety, etc. – are considered jointly and in an integrated manner during the execution
Partial integration:
Some of the work instructions, records, checklists, and data collection sheets are integrated.
The execution of operational processes considers relevant stakeholder requirements in a partially-integrated manner
No integration:
Separate records, work instructions, checklists, and data collection sheets for various MSs or various aspects of processes
No integration among various aspects of processes

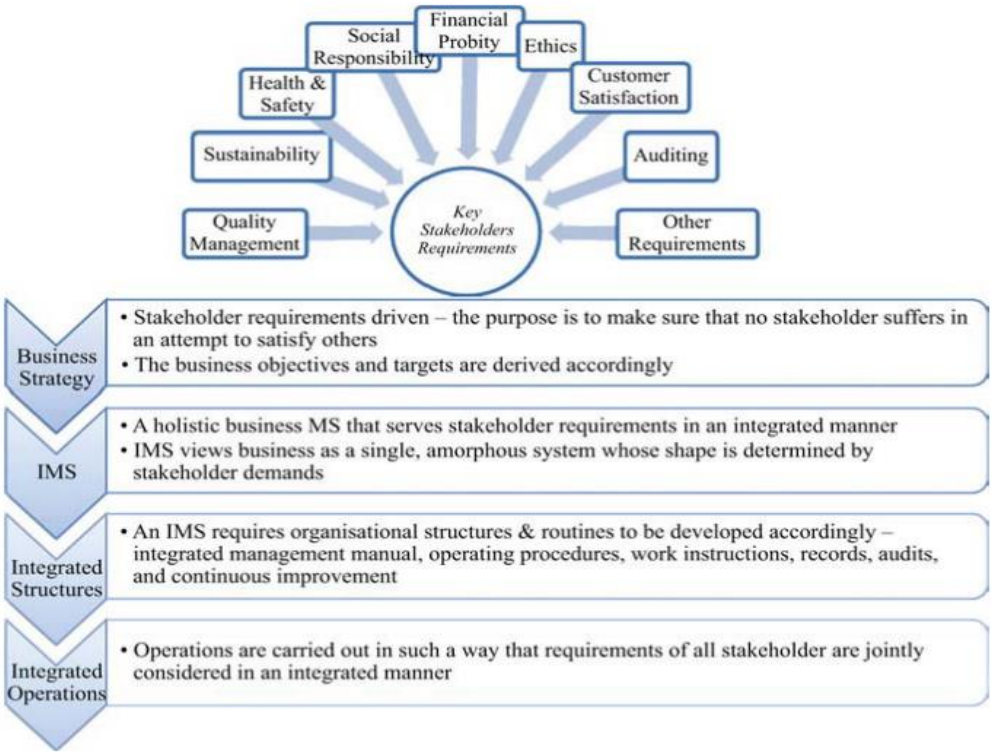

Figure 3. 10: The systems approach to integration

(Source: Asif et al., 2010)

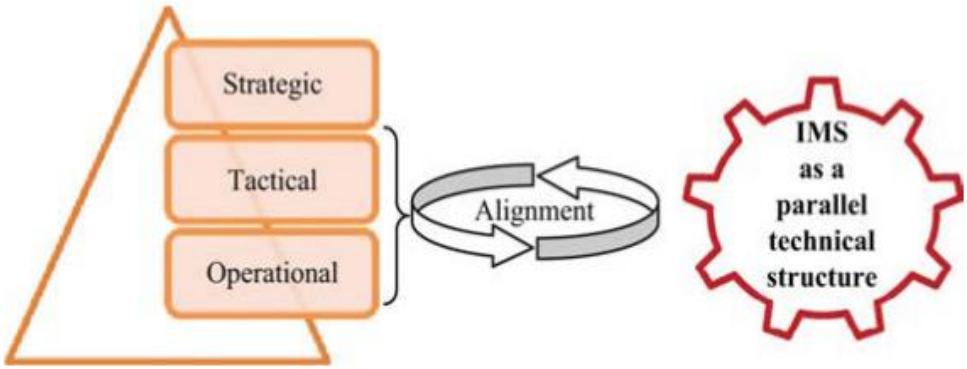

Figure 3. 11: The techno-centric approach to integration

(Source: Asif et al., 2010)

Based on the findings a literature review by Nunhes, Bernardo and Oliveira (2019) the most commonly used and effective approach is the top-down strategy, that entails starting with more strategic decisions and, subsequently, operating on a tactical and operational level. Further, these authors argue that starting on a strategic level lays the foundation for cultural and integration practices to be diffused on a tactical and

operational level. Moreover, they propose six key guiding principles for the development and maintenance of an IMS, namely "(1) Systemic Management; (2) Standardization; (3) Strategic, tactic and operational integration; (4) Organisational learning; (5) Debureaucratization and (6) Continuous Improvement", as shown in Figure 3.12 below (Nunhes et al., 2019).

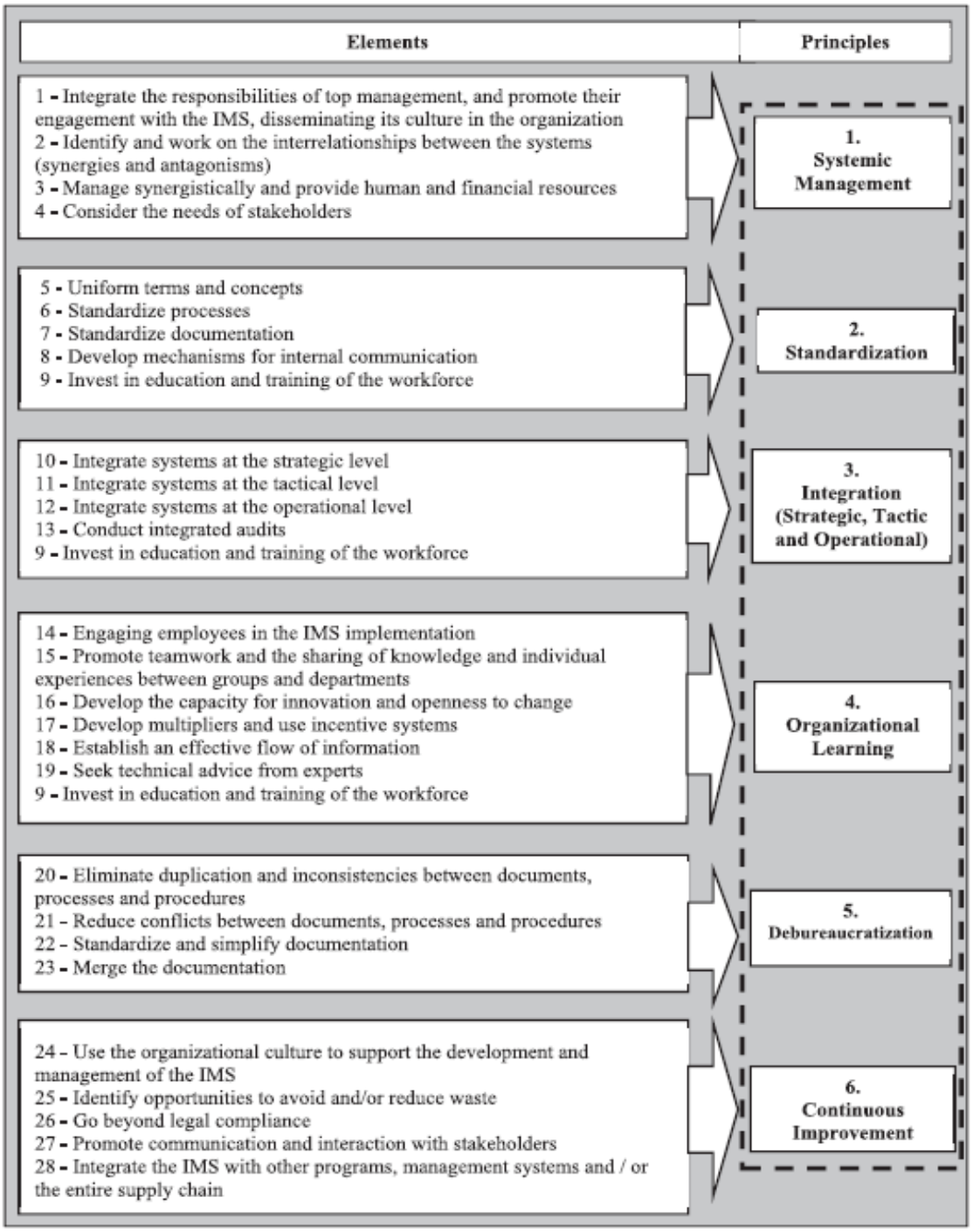

Figure 3. 12: Guiding principles for the development and maintenance of an IMS (Source: Nunhes et al., 2019)

De Oliveira (2013) proposed guidelines for integrating certifiable MSs and assert that these guidelines should be applied with the aim of removing unnecessary paperwork from the organisational processes (as shown in Figure 3.13 below). In addition, these guidelines were based on 14 case studies and a theoretical framework. From the case studies, De Oliveira (2013) found that the companies which started the integration approach with strategic decisions, such as integrating policies, objectives, manuals and goals, had a more well-structured integration format compared to the other companies that implemented a different approach. Moreover, according to the author's guidelines, the presence of adequate and skilled workers is a critical component to the realization of the integration process because this section ensures the sufficient planning, execution and control of tasks required for integration. Additionally, this author states that to ensure an effective IMS great effort should be made to ensure the integration of documentation.

Figure 3. 13: Integration guidelines for certifiable management systems
(Source: De Oliveira, 2013)

Domingues et al. (2015) assert that generally all integration processes implement the same steps and described them as follows: (1) step one, combine (non-integrated subsystems used simultaneously), (2) step two, capable of being integrated (identify common elements of individual subsystems), (3) step three, integrating (integrate common elements into a single system) and (4) step four, integrated (having a single system with common elements integrated).

The integration level refers to the extent to which the IMS has been achieved and can be classified as fully, partially or not integrated (Algheriani, 2019). Sampaio, Saraiva and Domingues (2012) state there are four evolution levels of integration towards full

MSs integration, namely documentation integration (level 1), management tools integration (level 2), common policies and goals (level 3), and common organisational structure (level 4). Abad et al. (2014) proposed three integration levels based on key aspects of integration (documentation, process map and organisational structure). These three integration levels are as follows:

- "Level 1 (Documental harmonization): This practice is achieved when only the documentation structure is integrated (i.e., the system's written procedures).
- Level 2 (Partial integration): Businesses integrate the documentation structure and one or two of the components (system support processes, strategic processes, audit processes) that comprise the process map.
- Level 3 (Full integration): At this level of integration, both the documentation structure and the three components of the process map are fully integrated" (Abad et al., 2014).

Integration methodology refers to the methods and tools used for the integration process, with the most commonly used being analysis of common elements, process map, PDCA cycle and the company's own model (Algheriani, 2019). Gianni and Gotzamani (2015) claim that despite the development of many IMS models, a significant number of companies use simple tools such as process maps and common elements analysis of MSs for integration. The design, implementation and assessment of most integration models were earmarked for the ISO standards, and numerous models were founded on the PDCA methodology and the ISO high-level structure (Nunhes et al., 2019). Integrating auditing systems describes the extent to which internal and external audits are incorporated (Algheriani, 2019). Audit integration can be categorised into three levels, namely (1) fully integrated (all the MSs are audited by the same team), (2) partially integrated (certain MSs are audited by the same team) and (3) not integrated (each MS are audited by a different team) (Bernardo, Gianni, Gotzamani & Simon, 2017). Additionally, integrated internal and external audits should be conducted systematically and regulatory to determine the implementation of MSs' requirements and focus should be placed on their integrated aspects (De Oliveira, 2013).

Blasco-Torregrosa et al. (2021) used different integration aspects to assess the integration process, namely the integration plan, integration model, and workers and procedures involved. The integration models proposed for the investigation were process map, PDCA cycle (all integration system processes), common elements analysis of standards, the companies' model and the Management Systems UNE 66177 standard (Guide for the Integration of Management Systems). The authors

found in both countries that most companies' integration plan include the "degree of compliance" among MSs and compliance required for integration. The integration method was process mapping and analysis of common elements, and fully integrated procedures (Blasco-Torregrosa et al., 2021). To analyse the implementation of an IMS in Spanish and Greek companies, Bernardo et al. (2017) analysed four integration process aspects, namely strategy, methodology, level and audit. These authors found that integrated internal audits were achieved more often by Spanish companies, and that for Greek companies the number of integrated internal audits were higher than integrated external audits. Further, the authors found for most companies the similar integration aspect was the integration strategy – to first implement the QMS and then the EMS. Moreover, the main method for integration was the analysis of common elements and the level of integration tended to be full integration. Nunhes et al. (2017) found, based on a qualitative study, that the functions and components that are mostly integrated include "high management responsibility, work instructions, control of documents and records, internal communication and structure and accountability". Furthermore, these authors state in the context of integration the tools and programmes most commonly used included a Pareto chart, brainstorming and histograms.

3.6 Conclusion

Chapter Three discussed the relevant literature on risk management and quality management in the agricultural export context, including the non-compliances with the export market requirements. Furthermore, this chapter also provided a review of literature relating to the difficulties, benefits and approaches to integrating multiple MSs to ensure stakeholder requirements are met sufficiently. This chapter aimed to provide a review of the literature relevant to this study to create a theoretical framework, but also in an effort to answer the investigative research questions. Chapter Four will describe this study's research design and methodology.

CHAPTER FOUR: RESEARCH DESIGN AND METHODOLOGY

4.1 Introduction

Leedy and Ormrod (2015) state that “research is a systematic process of collecting, analyzing, and interpreting information—data—in order to increase our understanding of a phenomenon about which we are interested or concerned”. According to Adams, Khan and Raeside (2014), research is a meticulous search, investigation or experimentation to collect information, realize, discover, learn or understand new facts or findings. Furthermore, these authors state that the research methodology is the science and philosophy underpinning all research which is different from the research method that refers to the manner in which one conducts and implements research.

The literature review discussed in Chapter Three above emphasized the importance of compliance with the import requirements of the European Union (EU) for continued access to this lucrative market, and the need for empirical data to investigate the factors impacting citrus growers’ ability to effectively comply with these requirements. Chapter Four outlines the research approach and strategy underpinning the research design and methodology selected for this study to answer the research question. Furthermore, it describes the data collection methodology applied and the data analysis approach used to analyze data and present findings. Additionally, data reliability and validity, assumptions, constraints and ethical considerations are also described in this chapter.

4.2 Research Design

According to Creswell (2009), the research design pertains to plans and procedures specific to a study that leads to detailed methods for collecting, analysing and interpreting data. Mouton (2002) claims the research design provides a set of instructions to enable the researcher to maximise the validity of the research findings in its pursuit to answer the research question.

For this study, the case study research approach was selected. According to Yin (2009), case study research is “an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident”.
Farquhar (2013) claims that the case study approach enables a researcher to study a phenomenon within its actual context allowing insight into how it occurs within a

specific situation. Further, this author argues this method can be beneficial when studying a phenomenon within a specific company, department or industry. Additionally, Farquhar (2013) states that the research approach entails investigating single and multiple cases utilizing data collection methods such as interviews and surveys. A single case study focuses on an individual case due to its extraordinary characteristics that can be applied to similar situations. A multiple or collective case study, however, occurs when a researcher focuses on two or more cases, in which the cases in certain aspects are either different or alike, with the purpose of making generalisations, comparisons or building theory (Leedy & Ormrod, 2015). According to Neuman (2014), case study research can examine various types of cases, such as individuals, organisations, movements and events. Additionally, case study research can be both quantitative and qualitative (Neuman, 2014). Case study research enables the researcher to address the "how" and "why" questions regarding the phenomenon being investigated (Yazan, 2015).

The criteria for case study research provided by both Yin (2009) and Farquhar (2013) applies to this study because the phenomenon – the integration of the FMS – was investigated within the real-life context of the citrus growers (producers), to explore how it can be conducted effectively to enhance compliance with the EU requirements. Furthermore, one of the research objectives was *"To identify the difficulties experienced by citrus growers with the integration of the RM system into their existing QMS",* which this study sought to investigate by determining the difficulties citrus growers experience within the actual context of the growers' real-life situation when implementing the FMS requirements.

Moreover, the citrus export industry consists of numerous growers and each grower is required individually to adhere to the Department of Agriculture, Land Reform and Rural Development's (DALRRD) regulatory requirements and, producers exporting to the EU, as a collective, is required to comply with the EU import requirements. Therefore, the citrus growers can be viewed as a single entity with multiple stakeholders or cases. Hence, a multiple or collective case study approach was adopted because the study aimed to address how to effectively integrate RM to enhance the compliance of the citrus growers as a collective.

4.3 Research Method

According to Dawson (2002), the research method is the specific tools used to collect data, such as focus groups and questionnaires which is different to the research methodology that is the overall plan of the study. Leedy and Ormrod (2015) state that data and methods are connected and, therefore, the method selected to solve a specific problem must consider the nature of the data, because certain data may only be appropriate for a specific method. Creswell (2018) states that there are three types of research methods that direct the specific procedures selected in the research design, namely quantitative, qualitative or mixed methods.

Christensen, Johnson and Turner (2015) state that qualitative research is based on an interpretive approach that uses various forms of subjective data and investigations of participants' circumstances in their natural habitat. Further, these authors claim that there are three main components to the qualitative approach which one must understand. These components are that the approach is interpretive, the data entails non-numerical information such as words, documents and pictures and, lastly, throughout the gathering of data the researcher consistently attempts to gain an understanding of the problem from the perspective of the participants (Christensen et al., 2015).

Moreover, qualitative research is less about numerical demonstrations and more about acquiring an in-depth understanding the research problem to afford understanding from several dimensions (Queirós et al., 2017). Lapan et al. (2012) claim that because qualitative research does not focus on exploring cause-and-effect and rarely needs to do so, the researcher finds it difficult and, in some instances impossible, to make inferences that can be applied outside the specific research environment. According to Saunders et al. (2016), qualitative data collection techniques are non-standardised to allow for amendments and the formation of natural and interactive questions and processes during the research process. Further, the authors state that such methods may include semi-structured interviews, in-depth interviews and diary entries, using corresponding qualitative analytical techniques. Eriksson and Kovalainen (2011) claim that qualitative research is generally founded on the assumption that reality is understood subjectively which means that the research is founded on the various, and possibly different, views and experiences of the individual participants.

The mixed research method entails incorporating quantitative and qualitative data collection methods and analytical processes in a research study (Creswell, 2018). According to Leedy and Ormrod (2015), the integration of these methods not only applies to the collection and analysis of data but also to the integration of conclusions from the collected data to provide a cohesive whole. The combinations of qualitative and quantitative methods can be conducted in several ways from simple parallel forms to more complex consecutive forms (Saunders et al., 2016).

4.3.1 Quantitative research method

For this study, the quantitative research method was selected as the most suitable method. This method was chosen because the study sought to investigate the phenomena identified by the research problem concerning the experiences and views of the citrus growers regarding the integration of the risk management (RM) system. Additionally, this research method was applied because the primary objective of the study was to determine *"How to effectively integrate risk management practices into the existing quality management system to improve compliance with EU import requirements for citrus growers."* that is quantitative in nature because it relates to "how" the citrus growers can implement this practice. Furthermore, it was applied to make inferences about the population (citrus growers) based on the sample, using statistical tools to analyse the data (Arghode, 2012).

According to Lapan and Quartaroli (2009), quantitative research "is empirical, using numeric and quantifiable data". Maree (2016) defines quantitative research as a systematic and objective process that uses numerical information from a sample representing a population to make generalisations about the population being studied. This author further claims that the three vital components of the definition are objectivity, numerical information and generalisability. Arghode (2012) states quantitative research entails using numbers to study an occurrence or phenomenon with the purpose of quantifying respondents' responses and to understand them in order to take decisions. This research approach places emphasis on objectivity and is particularly suitable when one collects quantifiable measures of variables and inferences from samples collected. Further, structured procedures and formal data collection tools are applied for this approach, with data collected impartially and systematically (Queirós, Faria & Almeida, 2017).

Saunders, Lewis and Thornhill (2016) claim that the method is predominately linked to survey and experimental research strategies. Additionally, these authors state that one or more data collection techniques, with their corresponding analytical procedures, may be used for this research method. Moreover, quantitative researchers aim to remain independent from the phenomena being researched in order to make generalisations about the data analysed (Lapan, Quartaroli & Riemer, 2012). Cooper and Schindler (2014) claim that the quantitative research approach aims to count occurrences and views and refer to this practice as the "frequency of response". Further, these authors state that quantitative data entails collecting participant responses that are then coded, categorised and translated to numbers to enable the use of statistical analysis.

4.4 Data collection design

The case study approach was applied with the survey strategy as the data collection strategy. Leedy and Ormrod (2015) claim survey research is a type of descriptive research that entails posing questions to one or more groups about their views, experiences, attributes and attitudes to collect data about them and presenting their responses. Further, the aim of a case study according to these authors, is to obtain information about the larger population by surveying a representative sample. Christensen et al. (2015) define survey research as a non-experimental research method that depends on interview practices and questionnaires. Saunders et al. (2016) claim that a researcher can use the survey strategy within a case study since case study research can be linked to both quantitative and qualitative research, or even to a mixed design in which both are combined. This study applied the survey strategy as it allowed the researcher to collect quantitative data using a sample representing the larger population that could be then analysed and interpreted using statistical analysis.

4.4.1 Target Population

The South African citrus industry has been exporting citrus to the European Union (EU) for many years (Moore & Hattingh, 2016) and has a vast amount of experience and knowledge. The target population for this study was the citrus growers or producers situated in the Western Cape Province exporting citrus to the EU. The use of a systems approach as an RM measure is a 'first' for the whole citrus export industry (since 2018). However, for the Western Cape producers this will be the first RM system they implement for a quarantine pest as opposed to growers or producers in other regions

of the country that had to implement a RM system for the quarantine pest citrus black spot (CBS) (Carstens, Schutte, Fourie, Hattingh, Le Roux, Holtzhausen, Van Rooyen, Coetzee, Wentzel, Laubscher & Dawood, 2012; Vinti & Makapela, 2016). Therefore, it was good to use the Western Cape producers as the study population since they were never required to implement such a RM system.

The target population when conducting a survey is a set of units from which a sample will be drawn to make inferences about the collective units or population (Lavrakas & Cox, 2011). According to Sarstedt and Mooi (2019), the unit of analysis is the "level at which a variable is measured" and identifying this level will determine what can be learned from the analysed data. These authors further add that it is best to collect data at the lowest level possible because it provides more information. Levels of investigation in which data can be collected include departments, organisations, work groups, objects or respondents (Adams et al., 2014).

Citrus growers or producers were selected because they are the primary stakeholder within the citrus export cold chain. These primary stakeholders are at the lowest level of the investigation and, thus, have the required experiences and views about the integration of the RM needed for this study. Furthermore, the citrus producers must demonstrate compliance with the RM system to be able to export citrus to the EU. To achieve compliance, the citrus producers are compelled to implement the RM requirements and to demonstrate effective implementation of the said requirements. Exporting citrus producers are required to integrate the RM requirements into the daily operations of their existing quality management systems (QMS). Compliance, implementation and integration, therefore, are intrinsically connected, demonstrating that the citrus producers are at the lowest level of investigation from which to collect data, (see Figure 4.1 below).

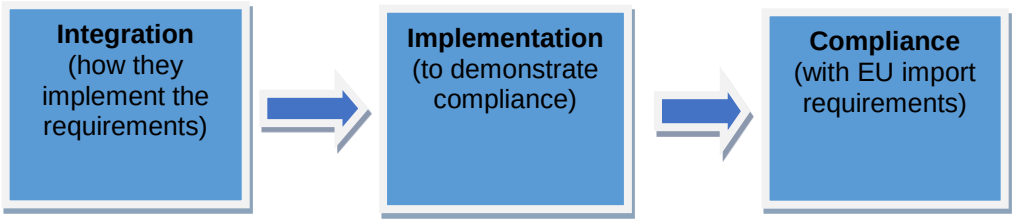

Figure 4. 1: Intrinsic relationship between compliance, implementation and integration of the risk management system (Source: own)

4.4.2 Sample technique and sample size

The sample is a subset of individuals representing the population of interest and is selected to attain a holistic view of the topic being researched (Lapan & Quartaroli, 2012). The sampling frame for this study was a list containing all the cases of the population. The target population is listed on the DALRRD's 2023 database for registered citrus producers exporting citrus to the EU. The researcher obtained the list from the DALRRD.

Adams et al. (2014) assert that the two basic sampling techniques are probability and non-probability sampling. These authors further explain probability sampling as a method whereby the chance of selecting each case from the population is equal for all cases. The non-probability sampling technique is "arbitrary or subjective", hence the sample is drawn based on the researcher's judgement (Cooper & Schindler, 2014). Saunders, Lewis and Thornhill (2009) state that probability sampling allows researchers to answer the research questions, meet objectives and estimate the statistical characteristics of the population based on the sample.

The sample for this study was selected using the probability sampling method. The sample was selected from a sampling frame, therefore, each citrus producer in the Western Cape Province had an equal probability of being selected. Furthermore, it allowed the researcher to use statistical analysis to make inferences about the population based on the sample. The farm owner, manager or any senior person specifically dealing with the citrus supply chain on the farm(s) was requested to complete the questionnaire. It should be noted that a registered citrus producer or grower can have one or more Production Unit code (PUC) registered for the current export season. Moreover, on the registered PUC there can be numerous orchards registered for export under the FMS to the EU. Therefore, the questionnaire was sent to the citrus producers and not to an individual citrus farm or PUC.

Saunders, Lewis & Thornhill (2007) define confidence level as the "level of certainty that the characteristics of the data collected will represent the characteristics of the total population". Saunders et al. (2016) state that to obtain a confidence level of 95% for a sampling frame of 300, a sample size of 168 should be drawn, provided the collected data are obtained from all the cases in the sample.

According to the DALRRD's database for 2023, there are 522 citrus producers in the Western Cape registered to export citrus to the EU and from that list, there are 352 persons representing these producers. In other words, one contact person may represent several citrus producers (or farms registered) as part of a large commercial farming group, hence the 352 contact persons. Therefore, these representatives served as the study population for the citrus growers in the Western Cape. It should be noted that the representative may be a production manager, farm owner, quality manager or any senior employee responsible for compliance with the requirements of the FMS. For this study the sample size consisted of 205 representatives of the citrus growers. The specific probability sampling method used was the simple random sampling technique. This sampling method provided every case in the sampling frame with the same chance of being selected, thus, allowing direct generalisations about the target population (Christensen et al, 2015).

4.4.3 Data collection instrument

For this research study, the data collection instrument selected was a questionnaire survey. Grover, Vriens and Malhotra (2011) define a questionnaire as a "formalized set of questions" used to obtain information from participants. These authors further state that questionnaires allow the collection of "internally consistent and coherent" quantitative data in a systematic manner for statistical analysis. Mills, Durepos and Wiebe (2012) are of the view that case study surveys are used to obtain information about a group of individuals representing a specific population related to the topic of interest, with interviews and questionnaires as the most common research instruments used for data collection.

A closed-ended questionnaire was chosen as the specific data collection method. This type of structured questionnaire provides respondents with a list of predetermined statements or questions to choose from (Hair et al., 2016). The method was selected to elicit the views and experiences of the population concerning the integration of the risk management system into their existing QMS. This collection method has both disadvantages and advantages, the former includes a low response rate and results that may be distorted due to a lack of comprehension by respondents who primarily depend on their own reading and writing skills. The latter includes the fact that the questionnaire can be distributed to a large number of people, if participants live far apart it is extremely cost-effective and less time-consuming in relation to travelling and respondents can respond with anonymity that enables them to answer questions freely

(Leedy & Ormrod, 2015). This collection method was selected as the most suitable because of the population size and the fact that the citrus producers are situated on farms throughout the Western Cape would have made it difficult for the researcher to reach all of them. Further, this method allowed the citrus producers to participate anonymously, therefore, they could respond without the perceived fear of the information being used against them when exporting citrus because the researcher is employed by the DALRRD.

Additionally, the questionnaire was presented to participants in two languages to accommodate both Afrikaans and English-speaking participants, and, thus, enabled them to answer the questionnaire in their preferred language. The reason for this was that most farmers situated in the Western Cape are Afrikaans speaking. Therefore, translating the questionnaire ensured participants understood the questionnaire in the manner it was intended and the responses were valid, thus, ensuring accurate data was collected. The questionnaire was designed using the online programme 'Lime Survey' and was distributed to respondents via email and WhatsApp. Furthermore, the Citrus Growers Association (CGA) was requested to distribute the link to the questionnaire to the citrus producers.

The questionnaire was designed using the 5-point Likert measurement scale. Gracyalny and Allen (2018) claim that the Likert scale is the most used scale for measuring human perspectives, attitudes and opinions about a research topic. The scale involves a collection of items with an equal number of negative and positive statements requiring respondents to answer the question based upon the extent to which they agree or disagree with the statement (McIver & Carmines, 2011). Most Likert scales range from 1 to 5 whereby 1 represents strongly agree and 5 represents strongly disagree (Salkind, 2010). This Likert scale range was adopted for this study.

In addition, this measurement scale was selected because of its advantages, namely it is fairly easy to design, administer and adapt for various research topics. It is also easy for participants to complete, thus, making it suitable for online questionnaire surveys (Gracyalny & Allen, 2018; Grover et al., 2011). The drawback of using the Likert scale is that it requires participants to read the entire statement before making their response and so can take longer to complete compared to other itemized rating scale measurements (Grover et al., 2011). Other limitations of the Likert scale include acquiescence bias (participant's tendency to agree with a statement without really considering its content), social desirability bias (the need to portray themselves in a

manner they believe is socially desirable) and central tendency bias (the need to avoid extreme positions when responding to statements) (Gracyalny & Allen, 2018).

4.4.4 Pilot study

Saunders et al. (2016) claim that a pilot study aims to refine the questionnaire to ensure respondents understand the questions when completing the survey and to prevent any problems when data is recorded. Furthermore, these authors claim that a pilot study allows the researcher to assess to some extent the soundness of the questions asked and the trustworthiness of the data gathered. Leedy and Ormrod (2015) state that conducting a pilot study for a questionnaire determines to some degree the questionnaire's validity, that is does it truly measure what it set out to measure. These authors also state that a researcher at least should request friends and colleagues to read the questionnaire to determine if there are any aspects that are difficult to understand. Cooper and Schindler (2014) claim that a pilot study enables the researcher to identify flaws in the design and composition of the research instrument, and when choosing a probability sample, it provides proxy data. Additionally, these authors state that the pilot study's participants should be chosen from the target population and the protocols and procedures selected to gather the research data should be used.

For this study, the questionnaire was sent to two inspectors at the DALRRD: Directorates Inspection Services (DIS) enforcing the RM system and to an expert in the citrus export industry who were requested to read the questionnaire and to highlight any ambiguous statements or questions that might be confusing or difficult for citrus producers to understand. These individuals were selected because they have the necessary knowledge and experience in exporting citrus to the EU and could provide valuable input. The questionnaire was then revised and subsequently translated into Afrikaans. The English and Afrikaans questionnaires were then sent to ten individuals (consultants, citrus production managers and an employee at the CGA) from the same target population to identify any ambiguities in the questionnaire and to determine if the questions or statements were understood as intended. Two production managers, three consultants and the CGA employee completed the questionnaire and provided their respective feedback. The questionnaire was then revised accordingly. The specific sections of the questionnaire that were improved were the information letter to provide a simpler version of the purpose of the study and the Likert-scale statements

to improve the manner in which the questions were posed to enhance the producers' understanding. The pilot study, therefore, added value to the main study.

4.4.5 Breakdown of the questionnaire

The questionnaire was based on the variables identified through the relevant literature review in line with the research questions. An information letter and the link to both the Afrikaans and English questionnaire was send to respondents that briefly explained the aim of the study and included how responses would be confidentially analysed and recorded. The questionnaire consisted of three sections. Section A was compulsory to ensure participants provided their consent before completing the rest of the questionnaire. Section B requested demographic data and information related to the research environment. Section C was a decision-making section that consisted of 36 statements related to the integration of the FMS into the existing QMS. Participants were requested to respond to statements by selecting the statement that most suitably described their views and experiences in relation to the FMS. (See Appendix A attached to this report containing both the English and Afrikaans information letter and questionnaire).

4.5 Data analysis

Cooper and Schindler (2014) claim that data analysis consists of reducing collected data to a manageable size to allow the researcher to make summaries, search for trends and conduct a statistical analysis. As previously mentioned, data was collected from the citrus producers in the Western Cape exporting citrus to the EU.

According to Christensen et al. (2015), there are two primary groups of statistics, namely descriptive and inferential statistics. For this study, both descriptive and inferential statistics are presented. The Statistical Package for the Social Sciences (SPSS) software program was used to generate descriptive and inferential statistics with the assistance of a statistician from the Centre for Postgraduate Studies at the Cape Peninsula University of Technology. The data of the survey questionnaires was transferred from the Lime Survey program to the SPSS program through which responses were translated to numbers for capturing to enable statistical analysis. Descriptive statistics describe and summarize collected data to understand the data set and to provide a simple way of displaying the main attributes (Christensen et al., 2015). This type of statistics was used to establish the frequency, mean, median,

standard deviation and percentages of the statements from the questionnaires received. This practice was completed to summarize, explain and identify the similarities and differences among the participants' responses to the presented statements. Inferential statistics is a type of statistical analysis that enables the researcher to make statistical observations about the population of interest based on the sample data (Gayle, 2011). The inferential statistics performed on the data set include reliability tests such as Cronbach alpha and factor analysis, and a one-way analysis of variance (one-way ANOVA) test.

4.6 Data validity and reliability

Validity refers to the degree to that the research instrument has truly measured what it intended to measure (Golafshani, 2003). This study applied content and construct validity. O'Gorman and MacIntosh (2014) state that the commonly used validity types are face validity, content validity, construct validity and criterion validity. Bolarinwa (2015) states that content validity refers to the extent to which the research instrument adequately assesses the concept or construct of interest. This author further adds that construct validity alludes to the level to which the research instrument gauges the theoretical underpinning of the construct. Moreover, according to Christensen et al. (2015), content validity is founded on the judgment of the degree to which the research questions sufficiently represent the construct's domain.

Collis and Hussey (2009) state reliability pertains to the research findings and considers these to be reliable when others can duplicate the research process and produce similar results. Mills et al. (2012) likewise claim reliability evaluates the degree to which research findings and conclusions drawn from a case study can be reproduced if someone else repeats the study. The three common strategies for estimating reliability are test re-test reliability, equivalent (or parallel) forms of reliability and internal consistency reliability (Brown, 2002). This study applied internal consistency reliability using Cronbach's alpha coefficient. Internal consistency involves calculating the reliability estimate by administering a test using a single form only once (single occasion), using one of the internal consistency equations (Brown, 2002).

In addition, the types of reliability estimates include split-half adjusted, Kuder-Richardson formulas 20 and Cronbach alpha (Cooper & Schindler, 2014). The internal consistency measure most commonly used is the Cronbach alpha, the estimate is also viewed as the most appropriate when using Likert scales as a measurement scale

(Taherdoost, 2016). Further, the Cronbach alpha coefficient requires the test to be administered only once and the formula can be applied to dichotomously scored items or polytomous items (Multon & Coleman, 2010).

Golafshani (2003) emphasises that even if the researcher can demonstrate that the research instrument is reliable due to its being repeatable and internally consistent, it does not mean the research instrument itself is valid. Therefore, to ensure the quality of the research findings and to measure the actual situation, content and construct validity with the internal consistency reliability (Cronbach alpha) were applied for this study. Moreover, as indicated in the above literature review the internal consistency reliability analysis is a more practical type of reliability compared to other reliability tests because it only requires respondents to complete the questionnaire once. Hence, this method was deemed the most suitable option for this study because the citrus producers might be reluctant to complete more than one questionnaire. Furthermore, during the pilot study the questionnaire was sent to multiple persons in the citrus export industry with considerable experience and insight to determine if each statement posed represented the construct it aimed to gauge, to ensure content validity. In addition, the questionnaire was presented to respondents in both Afrikaans and English thus providing them with the option to complete the survey in their preferred language. This further contributed to the validity of the data by ensuring the questionnaire was understood in the manner it was intended.

4.7 Ethics

Research ethics refers to a set of guidelines a researcher is expected to follow to ensure ethical research is conducted (Christensen et al., 2015). Thomas and Hodges (2013) state that research ethics are the “standards of professional conduct” that researchers are required to uphold when engaging with research participants, funders or sponsors, colleagues and the broader community.

According to Leedy and Ormrod (2015), the most ethical matters fit within one of the categories mentioned below, these categories are as follows.

- **Protection from harm:** Both human or animal participants should be protected against unnecessary physical or psychological harm, Also the risk of participating in the research should not exceed the normal day-to-day existence of the participant.

- **Voluntary and informed participation:** Participants should be made aware of the overall purpose of the research and should be given the option to participate voluntarily. Participants should be informed that if they agree to participate they can withdraw at any moment, and should not feel coerced by others to participate regardless of their position. Written informed consent must be obtained from all participants.
- **Right to privacy:** Participants' right to privacy should be respected at all times. How a participant behaved or responded should under no circumstances be reported in a way that such information is revealed to other people unless written permission to do so is granted. The outcomes of participants' performance concerning the quality and nature of their responses and actions should be kept private at all times.
- **Honesty with professional colleagues:** Researchers should report research results completely and honestly. They should not intentionally misrepresent or distort research findings, or fabricate data to substantiate a specific conclusion because such action "constitutes scientific fraud" (Leedy & Ormrod, 2015).

To expand on and add to the above list, the ethical issues of "voluntary participation" and "anonymity and confidentiality" as explained by Collis and Hussey (2009) will be elaborated below.

- **Voluntary participation:** Coercion should not be applied to force individuals to partake in the research process. Rewards or financial offerings to entice individuals to participate should be avoided because they can lead to biased findings.
- **Anonymity and confidentiality:** Participants should be assured that their responses and demographic information will be protected and not shared in a manner that can be used to identify them. This practice includes ensuring that participants are protected by not disclosing sensitive information or that the research data can be linked to any organisation or individual.

Based on the aforementioned ethical considerations, this study was conducted according to the following guidelines:

- To protect participants against harm. The researcher considered all possible situations that could cause harm to participants and acted accordingly to avoid such incidents.
- All participants were made aware of the overall aim and the main objectives of the study.

- Citrus producers were asked to partake in the study voluntarily and were informed that they could discontinue at any moment without providing a reason.
- Written consent to partake in the study was attained from all participants. This consent included permission to store and analyse participant information and responses. Furthermore, once a participant opted to not give participatory consent the link to the survey was automatically closed, preventing further participation.
- Participants were not coerced or offered any rewards or financial compensation to partake in the study.
- The researcher has not disclosed or presented any information or responses about participants in a manner that could be used to identify the participants' names or their associated citrus producer or grower. The researcher respected participants' right to privacy and confidentiality.
- The researcher has completely and honestly reported the research objectives, methods and findings, and has not intentionally misrepresented, falsify or mislead research findings or procedures.

The Faculty Research Ethics Committee of the Faculty of Engineering and the Built Environment at Cape Peninsula University of Technology approved the ethical clearance for this research.

4.8 Research assumptions

Leedy and Ormrod (2015) claim that research assumptions are so integral to research that without them there would be no reason for the study. These authors further assert that it is important to disclose all assumptions that could affect the problem to prevent any misinterpretations because if others know the assumptions made they can better assess the conclusions made from such assumptions.

The following research assumptions were made for this study:

- The individuals selected for the sample were willing and available to partake in the research study.
- All research participants provided reliable responses honestly and truthfully.
- All research participants understood the questionnaires.
- All citrus growers or producers involved in the research had the necessary knowledge about the EU import requirements.

- All citrus growers or producers involved in the study had a basic understanding of RM and QMS.

4.9 Research constraints

Limitations can be defined as a “weakness or deficiency” in the research study and de-limitations can be defined as establishing the scope and boundaries of the research study (Collis & Hussey, 2009).

The following limitations and de-limitations applied to this study:

Limitations:

- The unwillingness of some potential participants to partake in the research study resulted in not obtaining the desired sample size.
- Participants not answering truthfully due to the belief that their responses might result in them not being able to export citrus to the EU for the current export season.

De-limitations:

- The study was limited only to citrus growers or producers situated in the Western Cape Province and did not cover other provinces in South Africa.
- The research study only focused on citrus fruit exported to the EU market under the FMS.

4.10 Conclusion

Chapter Four described the research design and methodology employed for this research study. Furthermore, it elaborated on the data collection approach and strategy applied. This information included a discussion of the pilot study conducted, how the collected data was analysed and presented, data validity and reliability, research assumptions and constraints, and ethical considerations. To summarise, a case study approach was adopted, with the quantitative research method being applied to collect data. A closed-ended survey questionnaire was employed as the data collection strategy that sought to elicit the experiences and views of the citrus growers in the Western Cape about the integration of the RM system to export citrus to the EU. The next chapter provides a comprehensive discussion of the analysis and interpretation of the data collected, including the presentation of key aspects and findings.

CHAPTER FIVE: DATA PRESENTATION, ANALYSIS AND RESULTS

5.1 Introduction

Kozinets and Hughes (2013) assert that data analysis entails "the detailed examination of a whole by breaking it into its constituent parts and comparing them in different ways". The previous chapter presented a comprehensive outline of and reasons for the selected research design and methodology applied to this study. This chapter aims to describe and analyse the survey results and compare them with the literature review findings to answer research question one (RQ 1) "*What are the difficulties experienced by citrus growers with the integration of RM practices into their existing QMS?*". As indicated above, the data was collected using the responses to an online questionnaire received from citrus growers (producers) in the Western Cape province registered with the Department of Agriculture, Land Reform and Rural Development (DALRDD) for the export of citrus fruit to the European Union (EU). The purpose of the survey was to elicit the views and experiences of the growers on the difficulties encountered when integrating the RM system into their daily operations (QMS) and the integration measures taken. Furthermore, it aimed to explore their views on the main non-compliance issues when exporting to the EU compared to those highlighted in the literature review findings.

The SPSS programme was used to generate descriptive and inferential statistics that are presented in a structured manner in this chapter. The demographic data are presented descriptively using pictorial representations such as bar graphs and pie charts. The Likert scale responses are presented twofold, firstly grower's responses to each construct, namely non-compliances, integration measures and difficulties are described along ongoing analysis. Secondly, a summary of the survey results is compared against the literature review findings. The empirical data are presented and analysed using frequencies, percentages, means, standard deviation and pictorial representations. Reliability tests and a one-way analysis of variance (ANOVA) test were conducted and the results are presented.

5.2 Survey results in the context the of research environment

To appreciate the survey results and the significance of this study it is important to place the empirical data in context. The increasing stringency of sanitary and phytosanitary (SPS) risk-mitigating regulations in the international trade of fresh

produce and the demanding requirements of private standards (Melo et al., 2014; Murina & Nicita, 2017; Tennent & Lockie, 2012) created the need for the researcher to investigate the factors impacting growers' ability to comply, and how their compliance can be enhanced. The citrus export industry was selected to explore these factors because it is under threat due to the increasing strict EU import requirements for citrus exported from SA, that may have detrimental economic consequences to both the industry and the country (EPPO, 2013; Iliyasu & Zainalabidin, 2018; Moore, 2021; South African Government Gazette, 2014). It is within this context that this study sought to investigate how to effectively integrate RM into the existing QMS of citrus growers to maintain their access to the EU market. It also aimed to identify the challenges experienced by growers with such integration.

5.3 Distribution and response rate of questionnaire

The questionnaire was sent to respondents via email and WhatsApp in two rounds. Initially the questionnaire was sent to satisfy statistical analysis while the purpose of the second round was to encourage citrus producers to complete the survey. Four reminders were sent during the first round and two reminders during the second.

From a population of 352 citrus producers, the researcher approached 235 representatives to participate in the survey and at the end 205 participated, therefore, the sample size was 205. However, many of these participants did not respond to all the statements presented in the survey, hence, for each statement there was a different sample size. A total of 85 surveys were fully completed and 120 were partially completed. The partially completed surveys included those that were only partially completed by respondents and those that were opened but no responses provided. The fully completed surveys provided a response rate of 41,46% of the sample and 24% of the target population. While the survey response rate is relatively low it falls within the range for online surveys for agricultural research surveying farmers as found by Zahl-Thanem, Burton and Vik (2021), that was 21,4%. Furthermore, the response rate for an online survey is in line with an examination conducted by Saunders et al. (2016) that found that the response rate for online business surveys can be as low as 10% to 20%.

Regardless of the low response rate, the sample is relatively representative of the overall citrus producers in the Western Cape in relation to the classification types of producers. From the sample size of 205, 119 indicated their classification according to

the annual turnover. The largest share of the participants was medium-scale producers (40,3%), followed by small-scale producers (39,5%) and large-scale producers (20,2%), as indicated in Appendix B attached to this report. The distribution indicates that most participants are small and medium-scale producers and is in line with the assertion made by Kirsten and Van Zyl (2019) that most commercial farms in SA can be classified as small and medium-scale companies. Thus, the sample is fairly representative of the citrus producers in the Western Cape. Moreover, the questionnaire was sent during the citrus season that was the most ideal time for such an action since the implementation of the FMS and the difficulties experienced by producers were still “fresh” in their minds as they were experiencing these in real time. However, during this period the growers are extremely busy exporting citrus and this could have contributed to the low response rate.

5.4 Descriptive statistics

Leedy and Ormrod (2015) assert that descriptive statistics: “describe what the data look like − where their center or midpoint is, how broadly they are spread, how closely two or more variables within the data are intercorrelated”.

The questionnaire used in this research study consisted of three sections. Section A entailed respondents providing consent and is not included in the statistics below. It should be noted that once a potential respondent indicated “no” to providing participatory consent the questionnaire was automatically closed and further participation was not allowed. Section B comprised demographic data and information related to the research environment. Section C was a decision-making section that consisted of 36 statements relating to the integration of the RM system into their QMS (see Appendix A attached to this report).

5.4.1 Demographical and research environment results

Section B consisted of eight statements that will be presented and discussed respectively below. Furthermore, this information relates to the three constructs (non-compliances, integration measures and difficulties) that aim to answer the investigative research questions of this study. The specific frequencies and percentages for this section can be found in Appendix B attached to this report.

5.4.2 Job title or position

Figure 5.1 below illustrates the job title or position of the respondents. From the 205 participants, 121 of them responded to this statement. This figure illustrates that most of the participants (48,8 %) are farm owners, followed by farm managers (25,6 %) and production managers (11,6 %) and the rest consist of senior managers (3,3 %), senior employees (3,3 %) and other (7,4 %). The “other” option included technical manager, technical advisor, quality manager, operational manager, packhouse manager, exporter and administrator. It should be noted that the questionnaires filled in by the two administrators were only answered up until B8 and B6 respectively, hence these responses had no impact on Section C (Likert scale results). This is significant since it was desirable that a person dealing with the citrus supply chain on the farm(s) should have completed the questionnaire.

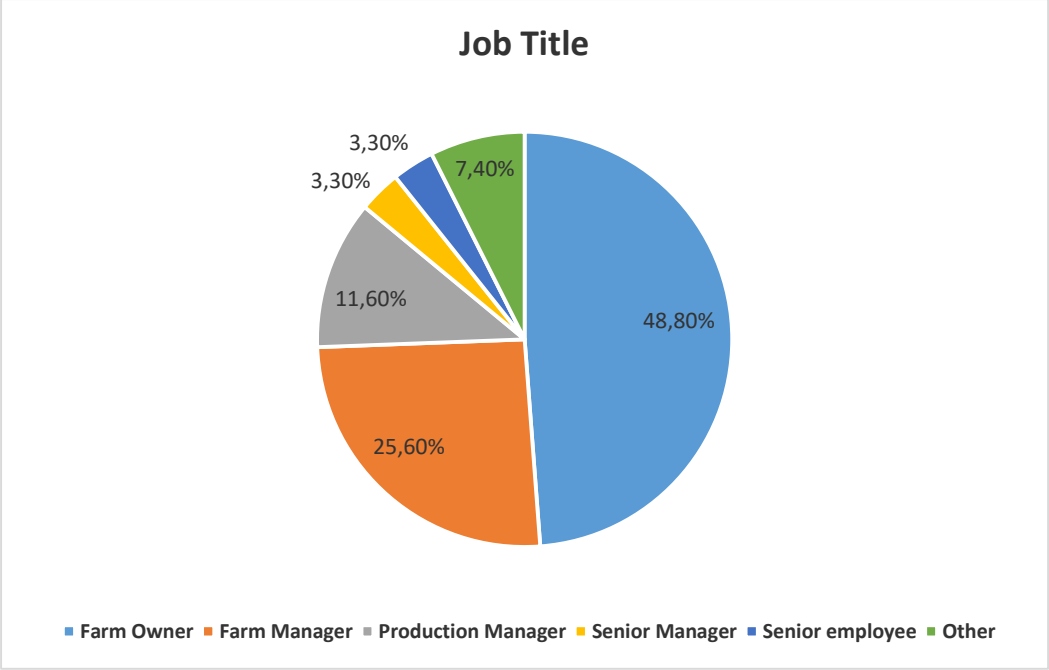

Figure 5. 1: Job title or position of respondents (Source: own)

5.4.3 Classification of the citrus producers

Figure 5.2 below shows the classification of citrus producers according to annual turnover in relation to the various farm types. From the 205 sample, 119 participants responded. The figure illustrates that most respondents are medium-scale producers (40,3%) followed by small-scale producers (39,5%) and large-scale producers (20,2%). The overall classification of the respondents indicates that the sample is fairly representative of the population. This further demonstrates that most of the citrus

producers who participated in the research process are small and medium-scale producers in the Western Cape, and, thus, aligns with the argument made by Kirsten and Van Zyl (2019) that most commercial farm types in SA are small and medium-scale farms.

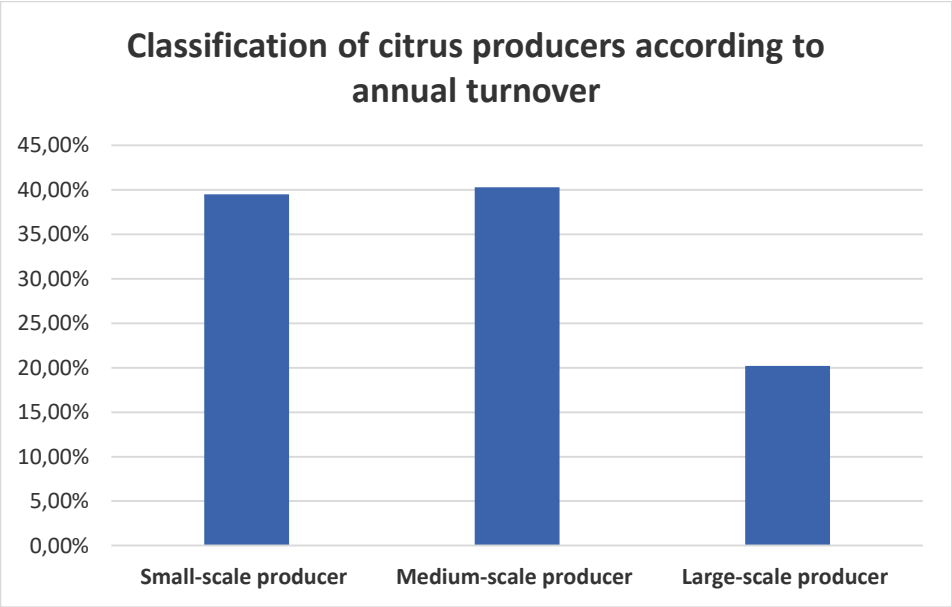

Figure 5. 2: Classification of citrus producers according to annual turnover (Source: own)

5.4.2 Producer's years of experience in farming fresh produce

Figure 5.3 below shows the respondents' years of experience in farming fresh produce. From the 205 sample, 121 participants responded to this statement. The majority of them have more than 15 years experience (67,80%) followed by 10 to 15 years (20,7%) and less than 10 years experience (11,6%). This finding illustrates that most respondents had sufficient experience in implementing farming management systems in relation to fresh produce to respond effectively to the survey.

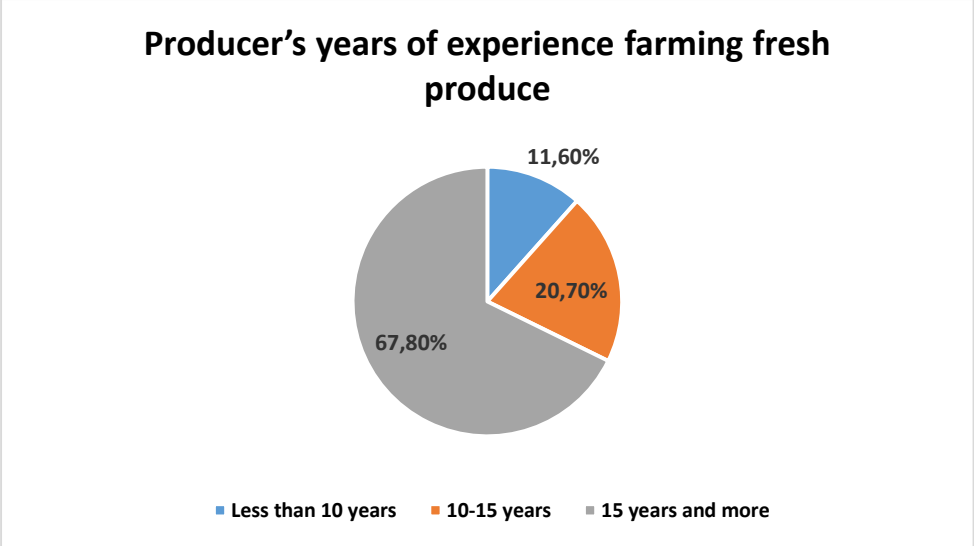

Figure 5. 3: Citrus producer's years of experience farming in fresh produce (Source: own)

5.4.3 Producer's years of exporting citrus fruit to the EU

Figure 5.4 below shows the respondents' years of exporting citrus to the EU. A total of 121 of the 205 participants responded to this statement. The majority of them have been exporting citrus for 15 years and more (49,6%) followed by three to 10 years (30,6%), 10 to 15 years (14%) and new entrants (5,8%). These figures indicate that most respondents have adequate knowledge and experience of the EU import requirements and processes for exporting citrus.

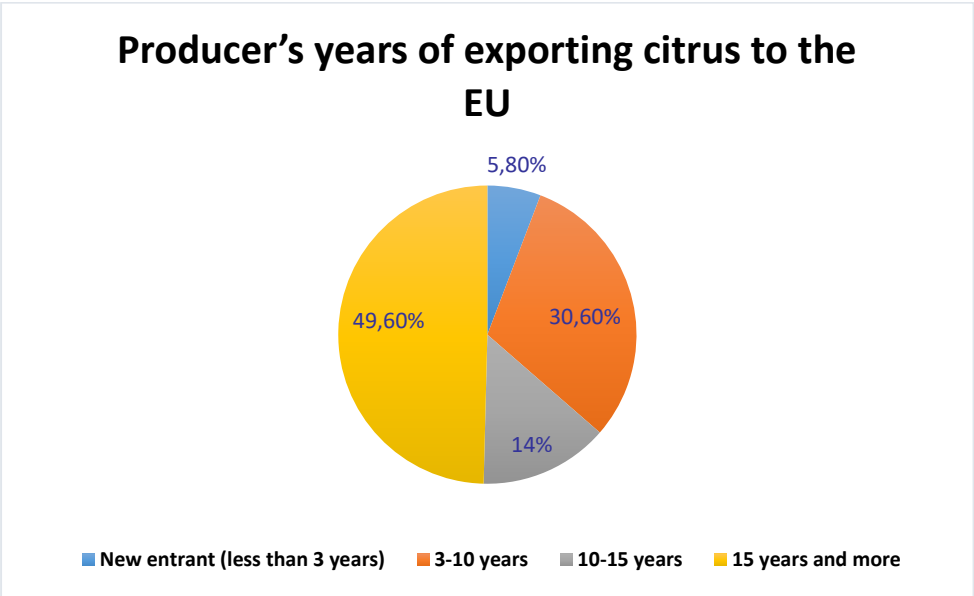

Figure 5. 4: Citrus producer's years of exporting citrus to the EU (Source: own)

5.4.4 Citrus exporting seasons

Figure 5.5 below shows the citrus exporting seasons (years) in which producers exported citrus to the EU. The majority of the respondents (56,1%) exported citrus in the 2022 season. Moreover, this figure illustrates that since 2018 the number of citrus producers registered for export of citrus has increased gradually. The figure also indicates that these participating respondents have been exporting citrus since the implementation of the FMS based on the systems approach design in 2018. Hence, they have the experience and knowledge required to complete the survey.

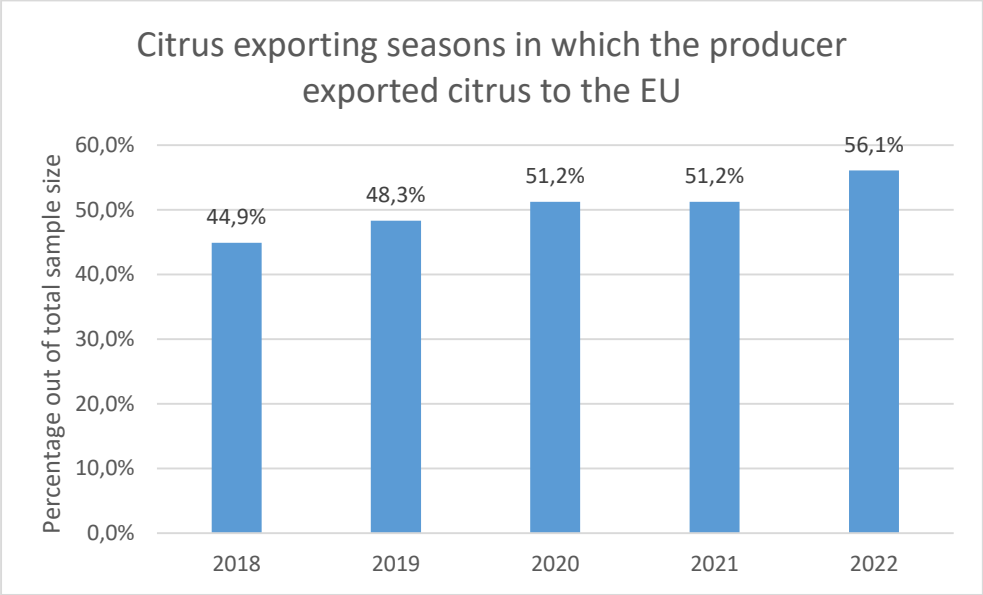

Figure 5. 5: Citrus exporting seasons (Source: own)

5.4.5 Packhouse used to pack the majority of citrus exported

Figure 5.6 below shows the type of packhouse used to pack the majority of exported citrus fruit. Many of the respondents (52,1%) transport their citrus to a packhouse privately owned by a different company and pay packing fees. While 24,3% of respondents own a packhouse and 23,1 % transport their citrus to a packhouse that is privately owned by a company of which the producer is a member or shareholder. This data aligns with the information of the DALRRD that indicates that in the Western Cape citrus producers mainly pack the bulk of their citrus in large packhouse facilities owned by private cooperatives (DALRRD, 2020).

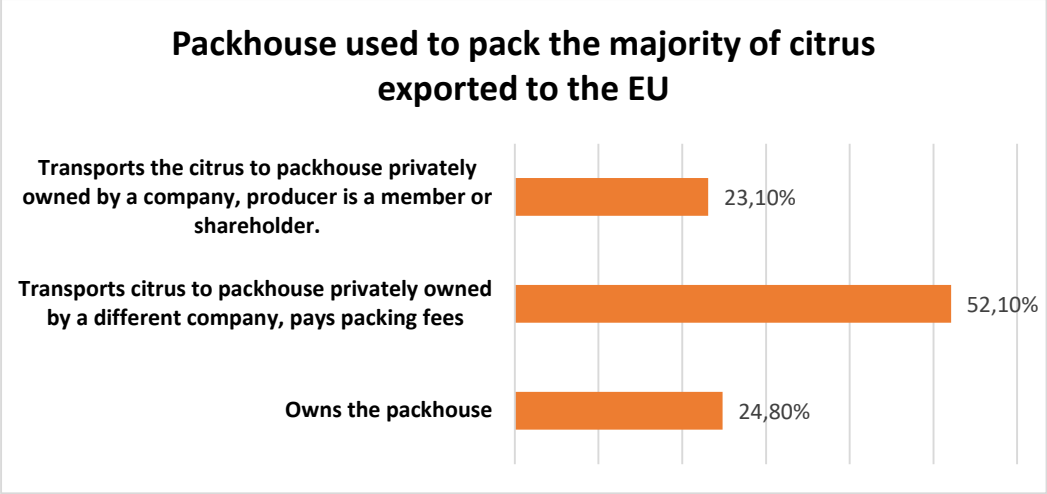

Figure 5. 6: Packhouse used for the majority of citrus fruit exported to the EU (Source: own)

5.4.6 Producer certification

Figure 5.7 below shows the various certification schemes (private standards) by which the respondents are certified that make them eligible to export citrus. Figure 5.7 indicates that most respondents are certified with GlobalG.A.P, followed by Tesco Nurture, Albert Hejin, GlobalG.A.P. Produce Handling Assurance Standard, BRC, Field to Fork, HACCP, ISO and LEAF Marque. The “other” options chosen by respondents included Costco, EU Organic certification, F.S.M.A certification (Food Safety Modernization Act, for the US market), GRASP (GLOBALG.A.P. Risk-Assessment on Social Practice), SIZA (Sustainability Initiative of South Africa), SMETA (Sedex Members Ethical Trade Audit) and WIETA (Wine and Agricultural Ethical Trade Association). This figure shows that the majority of the respondents are certified with the GlobalG.A.P. that aligns with the basic requirement needed to access the EU market, as explained in Chapter Three (3.3.3.5) of the research report. Further, it aligns with the claim made by Barrientos and Visser (2013) that most South African producers have obtained GlobalG.A.P. certification. Moreover, the data relates to statement B6, that suggests that the producers who own their own packhouse may also be certified with schemes such as HACCP, BRC, ISO and GlobalG.A.P. Produce Handling because these standards are commonly implemented for packhouse certifications (Bitzer et al., 2016).

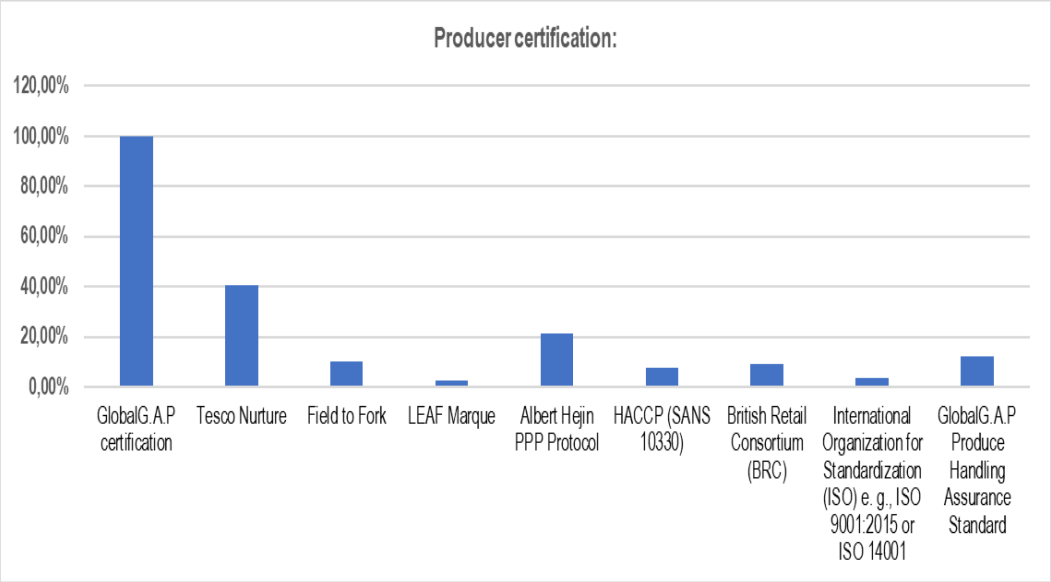

Figure 5. 7: Producer certification (Source: own)

5.4.7 General approach taken to integrate the FMS requirements

Figure 5.8 below indicates the general approach taken by respondents to integrate or implement the FMS requirements. From the 205 sample, 120 participants responded to the statement. Most of the respondents (49,2%) appointed consultants or a third party to assist with the integration of the FMS requirements, a third (33,3%) constituted farm owners who had decided to integrate the FMS requirements themselves, some respondents (16,7%) hired or designated employees specifically for this purpose, while for the “other” option only one person (0,8%) completed this option but provided no response (see Appendix B attached to this report). This data demonstrates that producers mostly used consultants and third parties to implement the FMS that is recommended by the CRI production guidelines as indicated in Chapter Two (2.4.3) above.

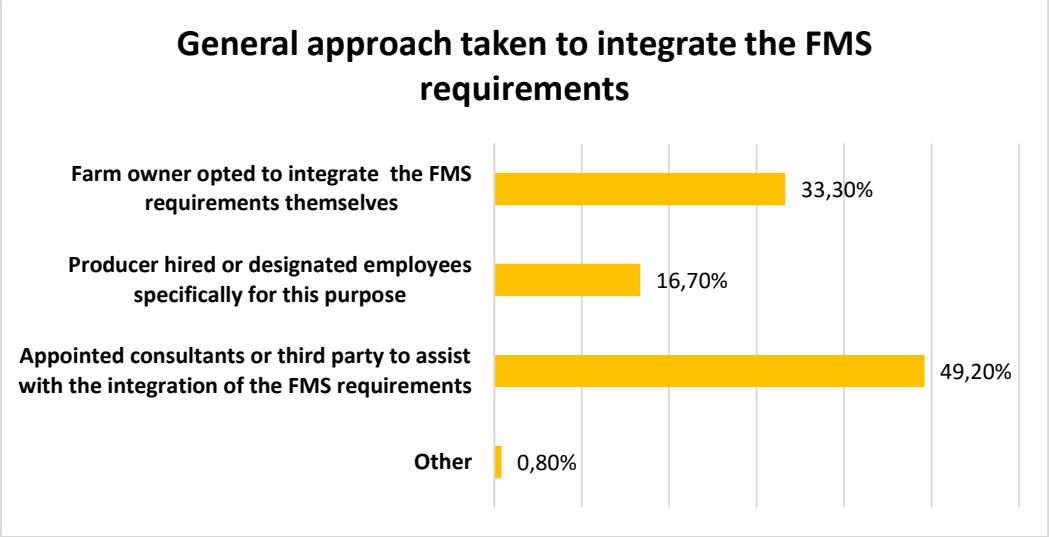

Figure 5. 8: General approach by producers to integrate the FMS requirements (Source: own)

5.4.8 Relationship between research questions, objectives and survey constructs

Section C of the questionnaire consists of 36 statements and three constructs namely non-compliances, integration measures and difficulties, all of which are presented below. Each construct consists of statements that link to a research question and corresponding objective with the aim of providing answers to the main research question. Table 5.1 below depicts the link between the construct, research question and research objective.

Table 5. 1: Research questions and objectives aligned to each construct (Source: own)

Research question	Research objective	Construct
Research question one (RQ 1): What are the difficulties experienced by citrus growers with the integration of RM practices into their existing QMS?	**Research objective one (RO 1):** To identify the difficulties experienced by citrus growers with the integration of the RM system into their existing QMS.	Difficulties
Research question two (RQ 2): What are the main non-compliances in the agri-food export chain from developing countries to the EU market?	**Research objective two (RO 2):** To determine the main non-compliances in the agri-food export chain from developing countries to the EU market.	Non-compliances
Research question three (RQ 3): What is an effective way of integrating a risk management and quality management system?	**Research objective three (RO 3):** To determine an effective way of integrating risk management and quality management system.	Integration measures

5.4.9 Descriptive statistics of Likert scale results

Descriptive statistics are presented in tabular form in Tables 5.2, 5.3 and 5.4 below per construct, and include means, sample size per statement (N), standard deviation (Std. deviation), minimum and maximum. The frequencies and descriptive statistics tables for this section can also be found in Appendix B attached to this report. The mean is a measure of central tendency that illustrates all data values in its calculation, giving an indication of the average data value for a variable (Saunders et al., 2016). If the mean is more than 3 it illustrates on average for the specific statement that the majority of respondents agree, and if less than 3 on average for the specific statement that the majority of respondents disagree. Further, the standard deviation indicates the range in which the data points of a variable are distributed away from the mean, hence a small standard deviation reflects the data points are near to the mean and a big standard deviation reflects the data points are far away (Saunders et al., 2016).

Table 5. 2: Descriptive statistics for the construct non-compliances (N=97) (Source: own)

Item	Min.	Max.	Mean	SD.
The detection of regulated pests (false codling moth).	1	5	3.49	1.226
Exceeding the pesticide residue limits (maximum residue limits)	1	5	3.05	1.236
Non-compliance with labelling requirements.	1	5	2.76	1.153
Inadequate additional declaration on the phytosanitary certificate.	1	5	2.74	1.210
Exceeding the maximum levels of regulated contaminants such as aflatoxin (produced by Aspergillus flavus).	1	5	2.74	1.111
Non-compliance with the International Standards for Phytosanitary Measures (ISPM) 15 for wood packaging material.	1	5	2.70	1.174
Absent, incomplete, unreadable or forged phytosanitary certificate.	1	5	2.63	1.302

Min.: Minimum; Max.: Maximum; SD: Standard Deviation

Table 5. 3: Descriptive statistics for the construct integration measures (N=93) (Source: own)

	Min.	Max.	Mean	SD.
Implementation takes place at an operational level (e.g., most records, work instructions and checklists are integrated).	1	5	4.16	.680
Implementation takes place at a strategic level (e.g., policies are integrated).	1	5	4.05	.826
Internal audits are conducted on the citrus farm(s).	1	5	3.96	.820
Internal audits review all stakeholder requirements during a single audit (e.g., GlobalG.A.P, FMS & other requirements).	1	5	3.94	.895
Internal audits review how effectively the FMS requirements have been implemented.	1	5	3.83	.829

Table 5. 4: Descriptive statistics for the construct difficulties (N=85) (Source: own)

	Min.	Max.	Mean	SD.
Lack of management involvement and commitment.	1	5	2.18	1.018
The high cost of implementing the FMS requirements.	1	5	3.59	1.244
The excessive human resources required for implementation.	1	5	3.54	1.209
The time required for training causes a loss of production time.	1	5	3.21	1.132
Lack of skilled workers to effectively implement integration.	1	5	3.20	1.055
The cost of training is too expensive.	1	5	3.15	1.105
The unavailability of specific false codling moth identification training.	1	5	2.99	1.143
Training of workers at all levels on the implementation of FMS requirements is inadequate.	1	5	2.89	1.061
Insufficient time to implement changes made to the FMS requirements.	1	5	2.86	1.048
There are no standardised forms to help implement the FMS requirements.	1	5	2.81	1.075
Difficult to manage the required FMS documentation effectively.	1	5	2.80	1.111
Daily operational records/documentation of all farm processes are not fully integrated.	1	5	2.73	1.062
Lack of motivation and understanding among workers about the implementation of the FMS requirements.	1	5	2.72	1.048
There is no integrated internal audit to ensure effective implementation.	1	5	2.72	.983
Lack of workers' involvement in the implementation process of the FMS requirements	1	5	2.71	1.021
Lack of skills to manage comprehensive records of all integrated farm processes.	1	5	2.68	1.049
Workers resist changes regarding the implementation of FMS requirements.	1	5	2.63	1.030
Workers' attitude towards the implementation of FMS requirements is negative.	1	5	2.51	.991
Lack of access to consultants with appropriate experience in integrating different management systems.	1	5	2.48	.971
Lack of government support and cooperation to effectively implement the FMS requirements.	1	5	3.53	1.315
Insufficient information was provided to workers about changes regarding the implementation and new duties.	1	5	2.41	.917
Poor coordination between the producer and appointed consultant or third party on the integration of FMS requirements (e.g. orchard sanitation).	1	4	2.31	.845
Insufficient information was provided to citrus growers on EU import requirements.	1	5	2.16	.974
The current chosen implementation (integration) approach is not effective.	1	5	2.71	1.010

5.4.10 Likert scale survey results

The empirical data was subjected to frequency counts that entails adding the responses for each statement (variable) to obtain the highest frequency of occurrence for each Likert scale measurement. Stack bar graphs or cluster bar charts are used for each construct to indicate the full scale of responses to each variable and are presented in percentages. The Likert scales range from 1 to 5 where 1 represents strongly disagree, 2 disagree, 3 neutral, 4 agree and 5 strongly agree. Each statement is analysed and discussed at a later stage of this report. Table 5.5 below indicates the codes assigned to each variable of analysis.

Table 5. 5: Statements posed in the questionnaire (Source: own)

No.	Statement	Code
	Construct: Non-compliances: "The main non-compliances when exporting citrus fruit to the EU market include the following."	
1	The detection of regulated pests (false codling moth).	C1
2	Exceeding the pesticide residue limits (maximum residue limits).	C2
3	Non-compliance with labelling requirements.	C3
4	Exceeding the maximum levels of regulated contaminants such as aflatoxin (produced by Aspergillus flavus).	C4
5	Absent, incomplete, unreadable or forged phytosanitary certificate.	C5
6	Inadequate additional declaration on the phytosanitary certificate.	C6
7	Non-compliance with the International Standards for Phytosanitary Measures (ISPM) 15 for wood packaging material.	C7
	Construct: Integration measures: "The false codling moth risk management (FMS) was incorporated into our daily operations/planning/recordkeeping through the following the measures."	
8	Implementation takes place at a strategic level (e.g., policies are integrated).	C8
9	Implementation takes place at an operational level (e.g., most records, work instructions and checklists are integrated).	C9
10	Internal audits are conducted on the citrus farm(s).	C10
11	Internal audits review all stakeholder requirements during a single audit (e.g. GlobalG.A. P, FMS & other requirements).	C11
12	Internal audits review how effectively the FMS requirements have been implemented.	C12
	Construct: Difficulties: "Difficulties experienced with integrating (implementing) the FMS into our daily operations include the following."	
13	Lack of management involvement and commitment.	C13
14	The high cost of implementing the FMS requirements.	C14
15	The excessive human resources required for implementation.	C15
16	Lack of skilled workers to effectively implement integration.	C16
17	Training of workers at all levels on the implementation of FMS requirements is inadequate.	C17
18	The cost of training is too expensive.	C18
19	The time required for training causes a loss of production time.	C19
20	The unavailability of specific false codling moth identification training.	C20

No.	Statement	Code
21	Workers' attitude towards the implementation of FMS requirements is negative.	C21
22	Lack of motivation and understanding among workers about the implementation of the FMS requirements.	C22
23	Lack of workers' involvement in the implementation process of the FMS requirements.	C23
24	Workers resist changes regarding the implementation of FMS requirements.	C24
25	Insufficient information was provided to workers about changes regarding the implementation and new duties.	C25
26	Difficult to manage the required FMS documentation effectively.	C26
27	Lack of skills to manage comprehensive records of all integrated farm processes.	C27
28	Daily operational records/documentation of all farm processes are not fully integrated.	C28
29	There are no standardised forms to help implement the FMS requirements.	C29
30	There is no integrated internal audit to ensure effective implementation.	C30
31	Lack of access to consultants with appropriate experience in integrating different management systems.	C31
32	Poor coordination between the producer and appointed consultant or third party on the integration of FMS requirements (e.g. orchard sanitation).	C32
33	Insufficient information provided to citrus growers on EU import requirements.	C33
34	Lack of government support and cooperation to effectively implement the FMS requirements.	C34
35	Insufficient time to implement changes made to the FMS requirements.	C35
36	The current chosen implementation (integration) approach is not effective.	C36

5.4.10.1 Construct: Non-compliances

The frequencies for each variable can be found in Appendix B attached to this report. Figure 5.9 below depicts the frequencies for each variable or statement in percentages. This construct relates to the citrus producers' views and experiences on what are the main non-compliances when exporting citrus fruit to the EU market.

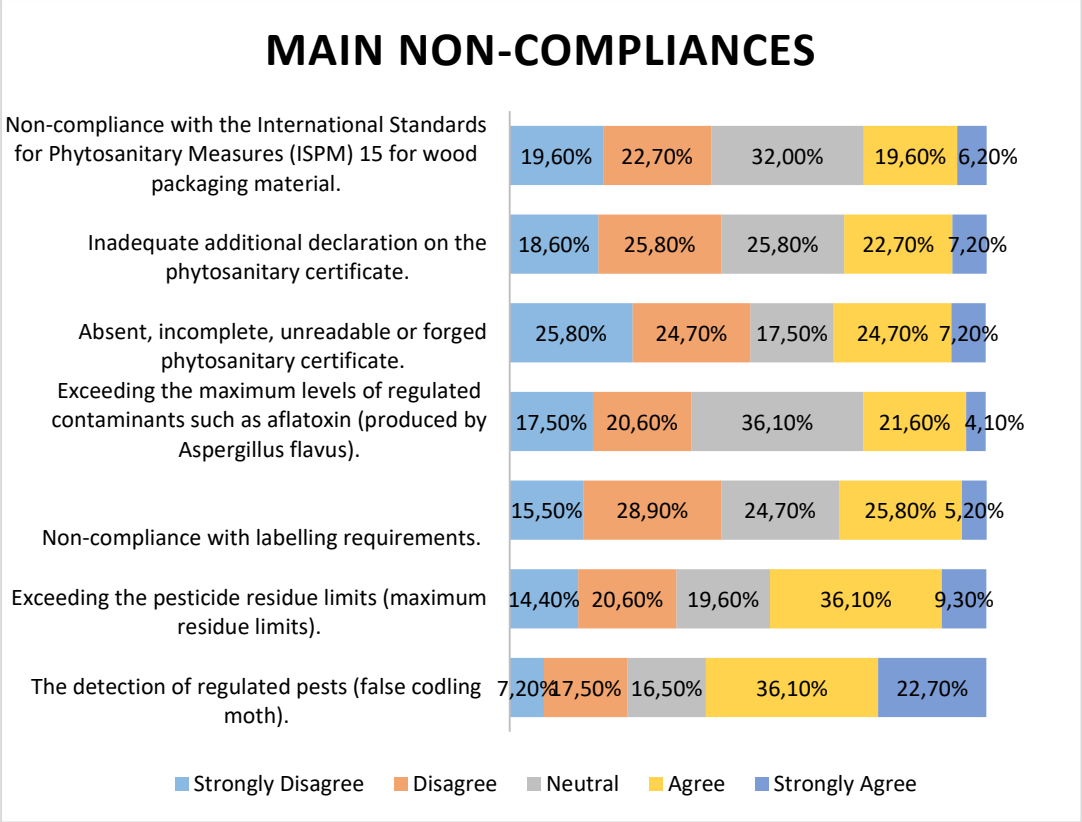

Figure 5. 9: The main non-compliances as perceived by citrus producers (Source: own)

- **Statement C1:** Most of the respondents (58,8%) agree to strongly agree that the detection of the regulated pest false codling moth is a main non-compliance. This finding illustrates that the FCM has become a major concern for most producers when exporting citrus to the EU.
- **Statement C2:** The majority of respondents (45,4%) agree to strongly agree that exceeding the maximum residue limits is a main non-compliance. This finding demonstrates that the MRL requirement for the EU is a concern to most producers.
- **Statement C3:** Most of the respondents (44,4%) disagree to strongly disagree that non-compliance with labelling requirements is not a main non-compliance. This finding suggests that non-compliance of this nature is less of a concern for most respondents. Further, it suggests there might be a lack of knowledge or experience with this type of non-compliance that may be because it is mostly attended to by other stakeholders, such as exporting companies in the cold chain. However, 31% of respondents do believe it is a main non-compliance.
- **Statement C4:** The majority of the respondents (38,6%) disagree to strongly disagree that exceeding the maximum levels of regulated contaminants is not a main non-compliance. However, 36,1% were also neutral in this regard which

illustrates that many respondents were unsure or had no knowledge or experience about this type of non-compliance.

- **Statement C5:** Most of the respondents (50,5%) disagree to strongly disagree that absent, incomplete, unreadable or forged phytosanitary certificates are not a main non-compliance. In other words, non-compliances about the phytosanitary certificate requirements are not viewed as a main non-compliance. This finding suggests that non-compliance of this nature is mainly attended to by other stakeholders (e.g. exporters) in the cold chain and amended or re-issued through the certification system of the DIS. Hence, this may contribute to the respondents' lack of knowledge and experience regarding this particular compliance issue. However, 31,9% of respondents do believe it is a main non-compliance.
- **Statement C6:** The majority of the respondents (44.4%) disagree to strongly disagree that an inadequate additional declaration on the phytosanitary certificate is not a main non-compliance. This finding suggests that non-compliance of this nature is less of a concern for most respondents, this may be because this type of non-compliance is mainly attended to by other stakeholders (e.g. exporters) in the cold chain and amended or re-issued through the certification system of the DIS, hence, contributing to the respondents' lack of knowledge and experience on this compliance issue.
- **Statement C7:** Most of the respondents (42,3%) disagree to strongly disagree that non-compliance with the ISPM 15 requirements is not a main non-compliance. This non-compliance relates to non-conformance with wood packaging material requirements. This majority disagreement may be due to a lack of experience and knowledge since 75,2% (see B6) of producers do not own packhouses but transport most of their export citrus to a packhouse that is familiar with the ISPM 15 requirement and its importance – a situation that would also explain the reason for the 32% neutral response. This finding would also explain the 25,4% agreement that it is a main non-compliance issue since 24,8% of the producers own a packhouse (see B6 above).

5.4.10.2 Summary and synthesis of results: Non-compliances

In summary, the empirical survey results indicated that most citrus producers perceived the detection of regulated pests (FCM) and exceeding the pesticide residue limits (MRLs) as main non-compliances when exporting citrus to the EU market. Furthermore, the majority of respondents felt that non-compliance with labelling

requirements, exceeding the maximum levels of regulated contaminants, non-compliance with both phytosanitary certificate requirements and ISPM 15 requirements are not main non-compliances when exporting to the EU. The percentage of respondents who responded neutrally to the statements may be due to their lack knowledge or experience with the specific non-compliance, that suggest other stakeholders within the citrus cold chain deal or engage with such non-compliances. As indicated in Chapter Two (2.4.2) of this research report each stakeholder has specific requirements with which they must comply to ensure the overall compliance of the export industry.

The literature review highlighted many non-compliances that occurred when exporting fresh produce to the EU from non-EU countries (e.g. developing countries) such as the detection of pests (harmful or quarantine pests), exceeding the MRLs, non-compliances with phytosanitary certificate requirements, non-compliance with labelling requirements, exceeding levels of contaminates and non-compliance with ISPM 15 (see section 3.4) The survey results are consistent with the literature review findings that the most concerning non-compliances for primary citrus producers in developing countries is the detection of regulated pests and MRLs. More specifically it aligns with the findings of various researchers (Fulano et al., 2021; Hatab et al., 2019; Idris et al., 2015; Lengai et al., 2022, Mutyambai et al., 2020) that the detection of pests (including specifically the FCM for some studies) and MRLs are a major concern for developing countries. Additionally, even though the majority of this study's respondents felt that the other non-compliances listed are not a main concern, the data demonstrates that some respondents feel these problems are main non-compliances – which aligns with the literature review findings that all the listed non-compliances are prevalent ones. In the South African context, this is most evident in the DALRRD's SPS notification database from March 2020 until October 2022 for citrus exported to the EU.

5.4.10.3 Construct: Integration measures

The specific frequencies for each variable for the construct integration measures can be found in Appendix B attached to this report. Figure 5.10 below depicts the frequencies for each variable or statement in percentage form. This construct relates to the integration measures taken by Western Cape citrus producers to integrate or implement the FMS into their daily operations/planning/recordkeeping.

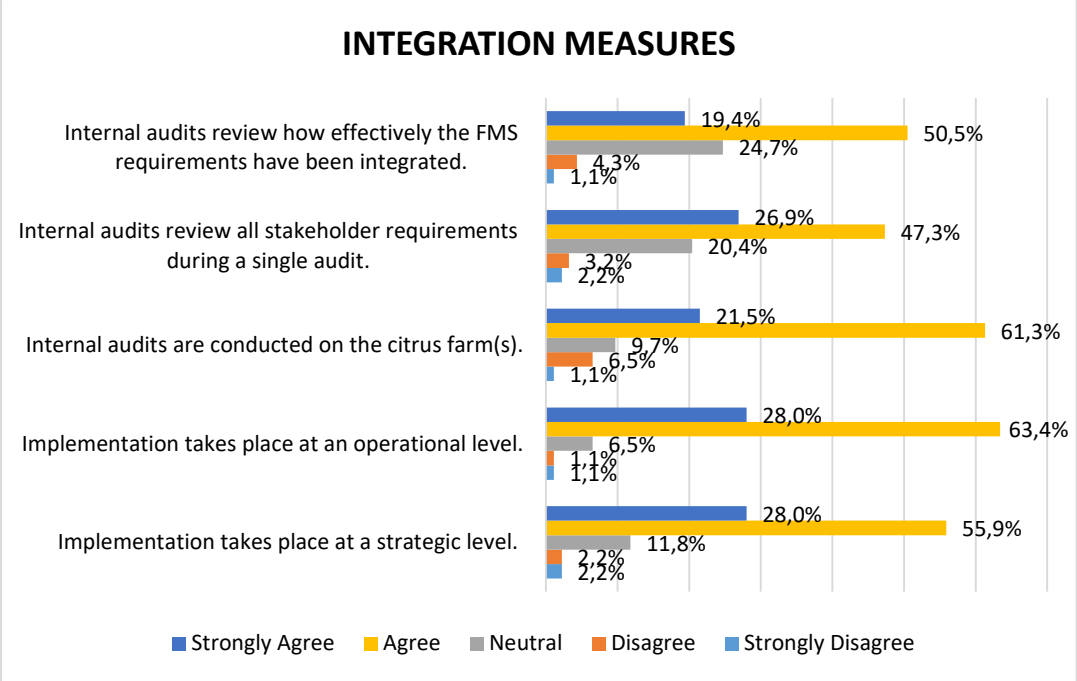

Figure 5. 10: The integration measures taken by Western Cape citrus producers (Source: own)

- **Statement C8:** The majority of respondents (83,9%) agree to strongly agree that the implementation of the FMS takes place at a strategic level, such as policies being integrated, while some respondents (4,2%) disagree with this statement.
- **Statement C9:** Most of the respondents (91,4%) agree to strongly agree that the implementation of the FMS takes place at an operational level. This finding suggests that most of the respondents have integrated most of their records, work instructions and checklists.
- **Statement C10:** The majority of respondents (82,8%) agree to strongly agree that they conduct internal audits. Only a few respondents (9,7%) were neutral suggesting they may be unsure or lack information about their internal control systems.
- **Statement C11:** The majority of respondents (74,2%) agree to strongly agree that when they conduct internal audits all stakeholder requirements are reviewed during a single audit. Some respondents (20,4%) were neutral suggesting they may be unsure or lack information on how internal audits are conducted.
- **Statement C12:** The majority of respondents (69,9%) agree to strongly agree that when they conduct internal audits they review how effectively the FMS requirements have been implemented. Some respondents (24,7%) were

neutral suggesting they may be unsure or lack information regarding the internal checks undertaken to gauge compliance with the FMS requirements.

5.4.10.4 Summary and synthesis of results: Integration measures

In summary, the survey results indicated that most citrus producers integrate the FMS into their daily operations, planning and recordkeeping on a strategic and operational level. Furthermore, the majority of the respondents reported that internal audits are conducted, all stakeholder requirements are reviewed during a single audit and internal audits review how effectively the FMS requirements have been implemented. In addition, the results indicated that for statements C10, C11 and C12 there was a decrease in the respondents' agreement with the statements and an increase in the percentage of neutral responses as the statements became more specific to stakeholder requirements and the FMS implementation. In other words, C10 that relates to internal audits had an 82,8% agreement and a 9,7% neutral response, while for C11 that relates to the specifics of internal audit processes the agreement level decreased to 74,2% and there was a 20,4% neutral response. Additionally, for C12 that relates to internal audits in relation to the FMS implementation, the agreement level decreased to 69,9% and the neutral response increase to 24,7%. These findings suggest that some respondents may lack information regarding how internal checks are conducted and their relationship to measuring compliance with the FMS requirements.

The literature review highlights four principal elements to consider when investigating the integration process, namely the implementation strategy, level of integration, integration methodology and auditing systems (Algheriani et al., 2019). This construct focused on the implementation strategy and auditing systems to investigate the integration measures taken by producers. Asif et al. (2010) explored the implementation strategy on a strategic, tactical and operational level. In addition, Nunhes et al. (2019) claim that the most commonly used effective approach to integration is a top-down approach that refers to starting with strategic decisions and then later moving on to a tactical and operational level. The survey results indicate that the general approach taken by the majority of the respondents is on a strategic and operational level.

Bernardo et al. (2017) emphasise the importance of conducting integrated audits because these enhance synergies and performance. Further, von Ahsen (2014) claims

that the benefits of integration include the optimization of audits conducted internally and externally. The survey results indicate positively that most of the respondents firstly conduct internal audits and secondly review all stakeholder requirements in a single audit – a finding that may suggest the adoption of an integrated auditing system by the majority of respondents.

5.4.10.5 Construct: Difficulties

The specific frequencies for each variable for the construct difficulties can be found in Appendix B attached to this report. Figure 5.11 below depicts the frequencies for each variable or statement in the form of a percentage. This construct relates to the experiences of Western Cape citrus producers with the integration of the FMS into their daily operations.

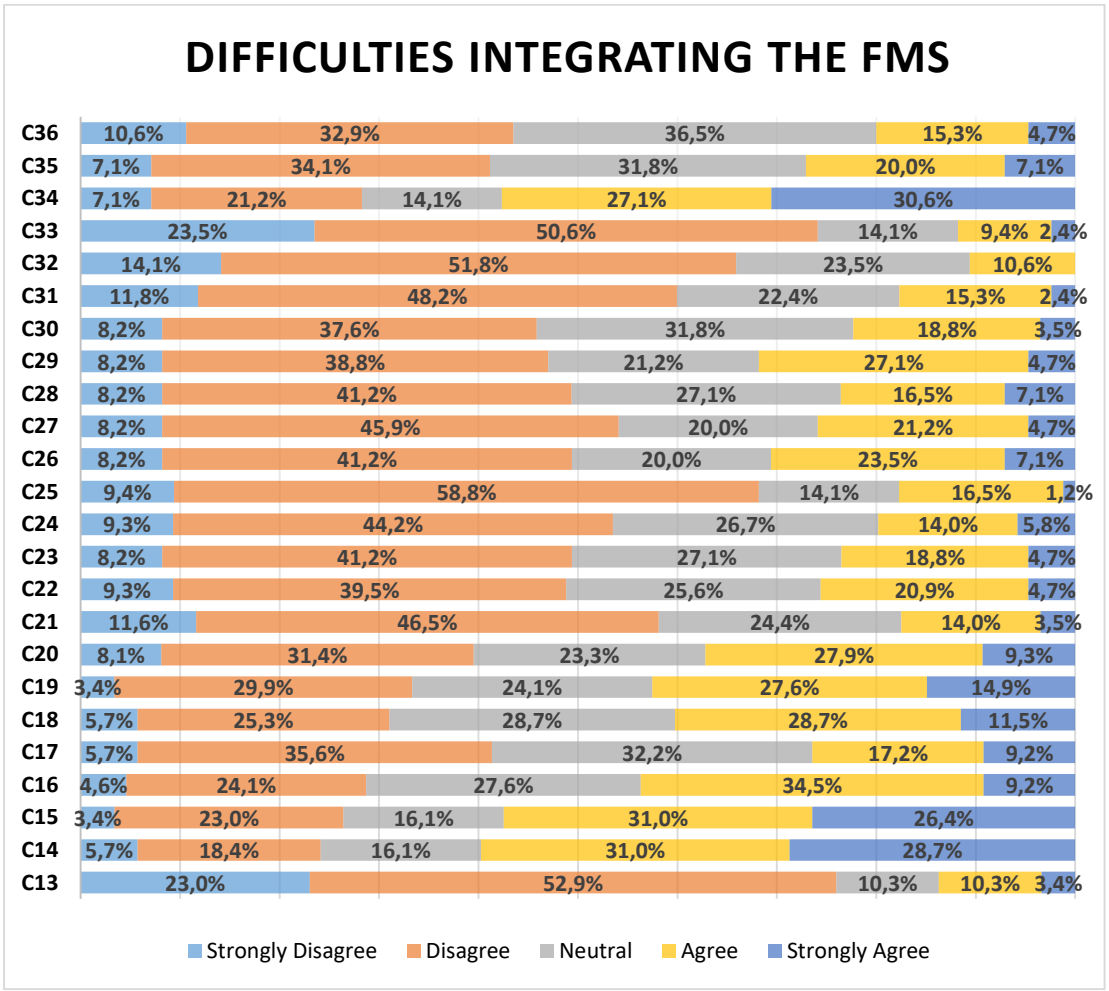

Figure 5. 11: Difficulties experienced by Western Cape citrus producers with integrating the FMS (Source: own)

- **Statement C13:** Most of the respondents (75,9%) disagree to strongly disagree that the lack of management involvement and commitment is not a difficulty they experience when integrating the FMS. However, 13% of the respondents perceived it as a difficulty.
- **Statement C14:** Most of the respondents (59,7%) agree to strongly agree that the high cost of implementing the FMS requirements is a difficulty, whereas 24,1% of the respondents did not perceive this as a difficulty.
- **Statement C15:** Most of the respondents (57,4%) agree to strongly agree that the excessive human resources required for implementation is a difficulty, while other respondents (26,4%) did not perceive it as a difficulty.
- **Statement C16:** Most of the respondents (43,7%) agree to strongly agree that the lack of skilled workers to effectively implement integration is a difficulty, whereas 28,7% of the respondents did not perceive it as a difficulty.
- **Statement C17:** Most of the respondents (41,3%) disagree to strongly disagree that training workers at all levels on the implementation of the FMS requirements is not a difficulty they experienced when integrating the FMS, whereas 26,4% of the respondents did perceive it as a difficulty.
- **Statement C18:** Most of the respondents (40,2%) agree to strongly agree that the cost of training is too expensive and, thus, is a difficulty. However, 31% of the respondents did not perceive it as a difficulty, and 28,7% were neutral, thus, suggesting they are unsure or lack information about training.
- **Statement C19:** Most of the respondents (42,5%) agree to strongly agree that the time required for training causes a loss of production time which is a difficulty they experienced when integrating the FMS. However, 33,3% of the respondents did not perceive it as a difficulty, and 24,1% were neutral, thus, suggesting they are unsure or lack information on the impact of training on production. C19 relates to the need for sufficient human resources being available to continue with operations while other workers attend a training course – a situation that can lead to a lack of training.
- **Statement C20:** Many of the respondents (39,5%) disagree to strongly disagree that the lack of specific FCM identification training is not a difficulty they experienced when integrating the FMS. However, it should be noted that almost the same number of respondents (37,2%) agree to strongly agree that the lack of such training is a difficulty they experience, thus, suggesting that appropriate training is viewed as an important factor for integration. Further, 23,3% of respondents were neutral implying that they are unsure or lack information on the availability of FCM identification training.

- **Statement C21:** Most of the respondents (58,1%) disagree to strongly disagree that workers' negative attitude towards the implementation of the FMS is not a difficulty they experienced when integrating the FMS. However, 17,5% of respondents perceived it as a difficulty they experience, and 24,4% were neutral, thus, suggesting their lack of understanding on how workers' attitude may impact integration.
- **Statement C22:** Most of the respondents (48,8%) disagree to strongly disagree that workers' lack of motivation and understanding about the implementation of the FMS requirements is not a difficulty they experienced when integrating the FMS. Whereas 25,6% of respondents perceived it as a difficulty they experience, and 25,6% were neutral that may suggest a lack of understanding and awareness on how workers' understanding and motivation may impact integration.
- **Statement C23:** Most of the respondents (49,4%) disagree to strongly disagree that a lack of worker involvement in the implementation process of the FMS requirements is not a difficulty they experienced when integrating the FMS. Whereas 23,5% of respondents perceived it as a difficulty they experience, and 27,1% were neutral that suggests their lack of understanding and awareness on how workers' involvement may impact integration.
- **Statement C24:** Most of the respondents (53,5%) disagree to strongly disagree that workers' resistance to changes regarding the implementation of the FMS requirements is not a difficulty they experienced when integrating the FMS. Whereas 19,8% of respondents perceived it as a difficulty they experience, and 26,7% were neutral that suggests they lack an understanding and awareness on how resistance to organisational change may impact integration.
- **Statement C25:** Most of the respondents (68,2%) disagree to strongly disagree that insufficient information provided to workers about changes regarding the implementation and new duties is not a difficulty they experienced when integrating the FMS. Whereas 17,7% of respondents perceived it as a difficulty they experience, and 14,1% were neutral that may suggest there is a lack of understanding on how the inadequate distribution of information to workers regarding new duties or the implementation of new systems may impact integration.
- **Statement C26:** Most of the respondents (49,4%) disagree to strongly disagree that when managing the required FMS documents, it is not a difficulty they experienced when integrating the FMS. Whereas 30,6% of respondents

perceive it as a difficulty they experience, and 20% were neutral that suggests a lack of knowledge regarding FMS documentation requirements among these respondents.

- **Statement C27:** Most of the respondents (54,1%) disagree to strongly disagree that lack of skills to comprehensively manage records of all integrated farm processes is not a difficulty they experienced when integrating the FMS. Whereas 25,9% of respondents perceived it as a difficulty they experience, and 20% of them were neutral.
- **Statement C28:** Most of the respondents (49,4%) disagree to strongly disagree that the lack of fully integrated daily operational records (documentation) of all farm processes is not a difficulty they experienced when integrating the FMS. Whereas 23,6% of respondents perceived it as a difficulty they experience, and 27,1% of them were neutral suggesting a lack of knowledge about the integration of documentation of farm processes among these respondents.
- **Statement C29:** Most of the respondents (47%) disagree to strongly disagree that the lack of standardised forms to help implement the FMS requirements is a difficulty they experienced when integrating the FMS. This response suggests that many producers have created their own forms for record keeping that they deem adequate to demonstrate compliance with the FMS requirements. However, 31,8% of respondents perceived this situation as a difficulty they experience, and 21,2% were neutral, thus, implying there is a lack of knowledge about the availability of such forms.
- **Statement C30:** Most of the respondents (45,8%) disagree to strongly disagree that the lack of an integrated internal audit is not a difficulty they experienced when integrating the FMS. Whereas 22,3% of respondents perceived it as a difficulty they experience, and 31,8% were neutral that suggests there is a lack of knowledge regarding how internal audits are conducted. Further, when considering statement C11 above in which 74,2% of respondents indicated that they review all stakeholder requirements during a single audit, this finding is consistent with C30's results which indicate that most respondents do not view this situation as a difficulty, thus, suggesting they implement an integrated internal auditing system. However, this result also implies that while some respondents indicated they do review all the requirements they are not fully aware or sure if this process is an integrated auditing system.

- **Statement C31:** Most of the respondents (60%) disagree to strongly disagree that the lack of access to consultants with appropriate experience in integrating different management systems is not a difficulty they experienced when integrating the FMS. Whereas 17,7% of respondents perceived it as a difficulty they experience, and 22,4% were neutral, suggesting there is a lack of knowledge regarding the availability of consultants or they used other approaches to implement the FMS such as indicated by the results of B8.
- **Statement C32:** Most of the respondents (65,9%) disagree to strongly disagree that poor coordination between the producer and appointed consultant or third party on the integration of the FMS is not a difficulty they experienced when integrating the FMS. Whereas 10,6% of respondents perceived it as a difficulty they experience, and 23,5% were neutral that suggests there is a lack of knowledge on how producers who use consultants or third parties operate, due to them using other approaches as indicated by the results of B8.
- **Statement C33:** Most of the respondents (74,1%) disagree to strongly disagree that insufficient information provided to producers on the EU import requirements was not a difficulty they experienced when integrating the FMS. However, 11,8% of the respondents do perceive this lack of data as a difficulty they experience.
- **Statement C34:** Most of the respondents (57,7%) agree to strongly agree that the lack of government support and cooperation to effectively implement the FMS requirements is a difficulty they experienced when integrating the FMS. Whereas 35,4% of respondents did not perceive it as a difficulty they experience, and 14,1% were neutral.
- **Statement C35:** Most of the respondents (41,2%) disagree to strongly disagree that insufficient time to implement changes made the FMS requirements is not a difficulty they experienced when integrating the FMS. Whereas 27,1% of respondents perceived it as a difficulty they experience, and 31,8% were neutral, thus, implying that some respondents are unsure of the timeframe commonly provided for the implementation of changes.
- **Statement C36:** Most of the respondents (43,5%) disagree to strongly disagree that the integration approach choosen by them is not a difficulty they experienced when integrating the FMS. Whereas 20% of respondents perceive it as a difficulty they experience, and 36,5% were neutral that suggests some respondents lack an understanding of their company's current approach to integration.

5.4.10.6 Summary and synthesis of results: Difficulties

In summary, the difficulties experienced with integrating the FMS as perceived by most of the respondents include the high cost and excessive human resources required for implementation; the lack of skilled workers to effectively implement integration; the cost of training is too expensive; the time required for training causes a loss of production time and a lack of government support and cooperation to effectively implement the FMS. Furthermore, the majority of respondents do not perceive statements C13, C17, C20-C33, C35 and C36 as difficulties when integrating the FMS into their daily operations. However, there are some of the respondents who felt these statements described a difficulty they have experienced. Additionally, the fact that some respondents who reported neutral may suggest they have no knowledge or experience with the stated difficulty.

The literature review identified critical success factors for effectively integrating various MSs, such as motivated and suitable workers, access to consultants with appropriate experience in effective integration, financial resources, top management participation and sufficient employee training (Almeida et al., 2014). Furthermore, the literature review highlighted important factors when implementing a pest RM system, such as providing sufficient information, training to identify pests of importance, skills to sufficiently manage comprehensive documentation and the importance of government and private sector support that includes providing training to create a sufficient pool of skilled workers (Barrientos & Visser, 2013; Handschuch et al., 2013; Moore, 2019; Mutyambai et al., 2020; Yoe et al., 2021). Additionally, the literature review findings illustrated the essential need for an integrated internal audit system when integrating MSs and the essential involvement of workers (Bernardo et al., 2017; Blasco-Torregrosa et al., 2021; Simon et al., 2012).

Hence, to compare the literature review findings against this study's survey results the construct was divided into groups, where each group consists of statements that relate to the same topic. The groups included management (C13), financial and human resources (C14, C15, C18, C19), workers (C16, C21-C25), training (C17, C20), documentation (C26-C29), internal audits (C30), consultants (C31, C32), government and private sector (C33-C35) and integration approach (C36). The results for management (C13) are contrary to the findings by Gianni and Gotzamani (2015) who found that the lack of top management commitment and participation had a substantial impact on the abandonment of integrating MSs. However, the survey results support

the assertion made by Abad et al. (2016) that the lack of top management commitment is not a key challenge identified by most organisations pursuing MSs integration, even though many previous research studies highlighted this fact as a difficulty. The results for financial and human resources are consistent with findings of three studies (Gianni & Gotzamani, 2015; Nunhes et al., 2017; Simon et al., 2012) that indicated these aspects as integration difficulties.

The study's results concerning workers have a mixed outcome in comparison with the literature review findings. The survey results about the lack of skilled workers support the assertion made by Barrientos and Visser (2013) that there is a lack of skilled workers in the export industry of SA, and the findings by Gianni and Gotzamani (2015) that identified it as a constraint. However, the results concerning workers' attitude, motivation, understanding, involvement, distribution of information and resistance are contrary to the findings of some researchers (Almeida et al., 2014; Domingues et al., 2015; Simon et al., 2012) that highlighted the significant impact of internal organisational difficulties on the integration process. Further, the results are in contrast with the findings of Abad et al. (2016) who found that workers' resistance to change was the most perceived difficulty.

The survey results for training compared to the literature review findings about training for workers at all levels contrasted with the findings by Gianni and Gotzamani (2015) that indicated these as constraints that contributed to the abandonment of integration. Further, the results concerning the unavailability of specific FCM identification training are noteworthy since the literature review findings emphasised the importance of such training, specifically for the identification of the pest FCM (Mutyambai et al., 2020; Moore, 2019). However, it should be noted some respondents viewed the unavailability of such training as a difficulty. The survey results for documentation compared to the literature review findings contrasted with the statement made by Handschuch et al. (2013) that small farmers in developing countries commonly lack the skills needed to manage comprehensive records for export. The survey results indicated that most of the respondents manage comprehensive integrated records of all farm processes, including the required FMS documentation. The survey results for integrated audits compared to the literature review findings of Gianni and Gotzamani (2015), who found that non-integrated audits were one of the difficulties that leads to the abandonment of the integration process. The survey results for the group consultants that relate to a lack of access and coordination with consultants differ from the findings of Gianni and Gotzamani (2015).

While the literature review findings for difficulties did not indicate government and private sector support as difficulties, their importance was highlighted when implementing a pest RM system that relates to the crucial role government and the private sector play (Kirezieva et al., 2015; Mau et al.,2007; Mengersen et al., 2012; Yoe et al., 2021). Hence, it was important to investigate if this is a difficulty for this study's respondents. The survey results for the integration approach selected contrast with the literature review findings of Gianni and Gotzamani (2015) who found that the selected approach and level may be an underlying cause for other difficulties.

5.5 Reliability test of the research instrument: Cronbach Alpha

Reliability alludes to the instrument's ability to gauge consistently or to be repeatable (Creswell, 2018). The type of reliability estimate applied for this study was the internal consistency reliability estimate using Cronbach's alpha coefficient. Tavakol and Dennick (2011) assert that Cronbach's alpha is an important concept when evaluating questionnaires and, therefore, is mandatory to estimate this quantity to provide validity and accuracy to the analysis of the data. Internal consistency defines the extent to which sets of items in an instrument measure the same underlying construct, hence, these items should have appropriate intercorrelations (Creswell, 2018). The alpha coefficient commonly ranges between 0 and 1 and the closer the "alpha coefficient is to 1.0 the greater the internal consistency of the items on the scale" (Gliem & Gliem, 2003).

Tavakol and Dennick (2011) state that the alpha is influenced by the length of the test instrument and the dimensions present. If the test is too short the alpha coefficient decreases and by increasing the length of the instrument the reliability can be enhanced. Moreover, these authors claim a high alpha can suggest redundancies and the test should be shortened. A high alpha may reflect a good internal consistency but it does not automatically signify the scale is unidimensional (Gliem & Gliem, 2003). Dimensionality can be determined by conducting a factor analysis, that determines if all the items are interrelated or if there are subsets of items that are closely related to each other (Christensen et al., 2015).

5.5.1 Reliability results for the constructs non-compliances and integration measures

For this study, the researcher employed George and Mallery's (2003) Cronbach's Alpha coefficient internal consistency guide to interpret the coefficient results: $\alpha \geq 0.9$ (Excellent), $0.7 \leq \alpha < 0.9$ (Good), $0.6 \leq \alpha < 0.7$ (Acceptable), $0.5 \leq \alpha < 0.6$ (Poor) and $\alpha < 0.5$ (Unacceptable). Furthermore, a factor analysis was conducted to determine if all items within each of the constructs (non-compliances, integration measures, difficulties) are interrelated or whether there are subsets of items that are closely connected.

Table 5.6 below presents the Cronbach's alpha coefficient results for the constructs non-compliances and integration measures. This table shows the reliability test for the construct non-compliances and integration measures respectively as 0,921 and 0,879 for all the items within the construct that, according to the guide, indicates excellent and good results. Hence, the set of items on the questionnaire is internally consistent and reliable and, therefore, measures the same underlying construct. The full analysis of these constructs can be found in Appendix C attached to this report. Furthermore, while a factor analysis was conducted for these constructs because of the number of the items, it was not considered necessary to further extract underlying factors because these sets of items are internally consistent. Hence, the items respectively measure the same construct (see Appendix C attached to this report).

Table 5. 6: Cronbach's Alpha's coefficient results for the constructs non-compliances and integration measures (Source: own)

Statements	Number of items	Construct	Cronbach's Alpha Coefficient	Strength of Association
C1-C7	7	Non-compliances	0,921	Excellent
C8-C12	5	Integration measures	0,879	Good

5.5.2 Reliability results and factor analysis for the construct difficulties

The factor analysis for the construct difficulties will be discussed and explored further due to the length of the construct (24 items). However, although Cronbach's alpha is influenced by the length of the construct and the longer the length the more the alpha increases, this growth does not necessarily signify unidimensional. Hence, the factor analysis was explored further with the assistance of the statistician to determine if there are statements or subsets of items within the construct that are closely related to each

other. In other words, within the construct difficulties are there underlying factors or constructs that are being measured by subsets of items.

Table 5.7 shows the three factors or components extracted. From this table it can be seen that many of the items (statements) were removed because they are loaded or correlated with more than one component. Therefore, they do not conform with the rule of unidimensionality, that refers to the homogeneity of the test instrument whereby an instrument is viewed as unidimensional when all the items measure a single construct (Tavakol & Dennick, 2011). Furthermore, the table shows the subsets of items that load well together. Hence, these three factors are the underlying constructs or subset of items for measuring difficulties. Moreover, the three difficulty factors have been assigned a theme respectively to indicate the new underlying constructs or factors they measure within the construct difficulties. Factor one includes statements C28, C29 and C30, factor two includes statements C13, C17 and C20 and factor three includes statements C14 and C15.

Table 5. 7: Underlying factors for the construct difficulties (Source: own)

Difficulty factor	Subset of items correlating	Number of items	Theme or underlying construct
1	C28, C29, C30	3	Operational challenges
2	C13, C17, C20	3	Training challenges
3	C14, C15	2	Financial and human resources challenges

Cronbach's alpha reliability tests were conducted for the three difficulty factors or underlying constructs respectively to determine their internal consistency. Table 5.8 below shows the alpha coefficient results for the underlying constructs as 0,831 for operational challenges and 0,767 for financial and human resources challenges, according to the internally consistency guide these results are good. The alpha coefficient result for the underlying construct training challenges is 0,658 that is acceptable and, after deleting item C30, the alpha coefficient result is 0,701 which is good. The specific results of the factor analysis and reliability tests conducted can be found in Appendix C attached to this report.

Table 5. 8: Cronbach's Alpha's coefficient results for the difficulty factors (Source: own)

Theme	Difficulty factor	Number of items	Subset of items	Cronbach's Alpha Coefficient	Strength of Association
Operational challenges	1	3	C28, C29, C30	0,831	Good
Training challenges	2	3	C13,C17, C20	0,658	Acceptable
		2	C13, C17 (when deleting C20)	0,701	Good
Financial and human resources challenges	3	2	C14, C15	0,767	Good

5.5.3 Descriptive statistics for the difficulty factors

Table 5.9 below shows the descriptive statistics for the difficulty factors extracted from the factor analysis. From the descriptive statistics it can be seen that for the difficulty factors 'operational challenges and training challenges' the average mean for all categories is less than 3, hence, with reference to these categories, the majority of respondents disagree that this factor is a difficulty they experienced when integrating (implementing) the FMS. For the difficulty factor 'financial and resources challenges' the average mean for all categories is more than 3, hence in these categories the majority of respondents agree that this factor is a difficulty they experienced. These results can be found in Appendix C attached to this report.

Table 5. 9: Descriptive statistics for the difficulty factors according to citrus producer classification (Source: own)

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Operational challenges	Small-scale producer	31	2.77	.879	.158	2.45	3.10	1	5
	Medium-scale producer	37	2.77	.699	.115	2.54	3.01	1	4
	Large-scale producer	19	2.35	.933	.214	1.90	2.80	1	5
	Total	87	2.68	.829	.089	2.51	2.86	1	5
Training challenges	Small-scale producer	29	2.78	1.044	.194	2.38	3.18	1	5
	Medium-scale producer	37	2.86	.791	.130	2.60	3.13	1	4
	Large-scale producer	19	2.49	.856	.196	2.08	2.90	1	5
	Total	85	2.75	.900	.098	2.56	2.95	1	5
Financial and Human Resources challenges	Small-scale producer	31	3.39	1.078	.194	2.99	3.78	1	5
	Medium-scale producer	37	3.65	1.073	.176	3.29	4.01	1	5
	Large-scale producer	19	3.68	1.227	.282	3.09	4.28	2	5
	Total	87	3.56	1.104	.118	3.33	3.80	1	5

5.6 Inferential statistics

Leedy and Ormrod (2015) claim that when collecting data from a fairly small sample inferential statistics gives the researcher the ability to extrapolate about the larger population. In this study the one-way analysis of variance (ANOVA) test was used to determine if there are significant variances between the different citrus producer types (small, medium and large) in relation to the underlying constructs or difficulty factors extracted by the factor analysis. The ANOVA is an inferential statistical test used to compare the means of two or more groups to determine if there is a statistically significant difference. Furthermore, the test is applied when there is one quantitative dependent variable and one categorical independent variable (Christensen et al., 2015). Saunders et al. (2016) state that the ANOVA examines the distribution of data points within and between groups by comparing group means and these variances are represented by the *F* statistic or ratio. In addition, according to Saunders et al. (2016): “If the likelihood of any difference between groups occurring by chance alone is low, this will be represented by a large *F* ratio with a probability of less than 0.05. This [difference] is termed statistically significant”. Moreover, Christensen et al. (2015) claim

that when there is no difference between group means the *F* statistic value tends to be near the value of 1.00.

For this study, the quantitative dependent variable is difficulties (the three underlying constructs or difficulty factors) and the categorical independent variable is the citrus producer categories (small, medium and large).

5.6.1 ANOVA results and interpretation

Table 5.10 below indicates the one-way ANOVA results by presenting the *F* statistic and the probability for each difficulty factor in relation to the citrus producer categories. The results indicate a *F* statistic value of 1.984 with a probability (*p* value) of 0.144 for the difficulty factor operational challenges between groups. This table indicates that the *F* value is near the value of 1.00 and the *p* value is more than 0.05. For the difficulty factor training challenges, the results indicate a *F* statistic value of 1.107 with a *p* value of 0.335, and for the difficulty factor financial and human resources challenges a *F* statistic value of 0.613 with a *p* value of 0.544. Hence, it can be concluded that the independent variable did not have a statistically significant effect on the dependent variable across all citrus producer categories. In other words, there are no significant differences between how the different citrus producers in relation to their classification perceive and experience these difficulty factors. The ANOVA results can be found in Appendix C attached to this report.

Table 5. 10: ANOVA results for the difficulty factors according to citrus producer classification types (Source: own)

		Sum of Squares	df	Mean Square	F	Sig.
Operational challenges	Between Groups	2.665	2	1.333	1.984	.144
	Within Groups	56.426	84	.672		
	Total	59.091	86			
Training challenges	Between Groups	1.789	2	.894	1.107	.335
	Within Groups	66.245	82	.808		
	Total	68.034	84			
Financial and human resources challenges	Between Groups	1.510	2	.755	.613	.544
	Within Groups	103.393	84	1.231		
	Total	104.902	86			

5.7 Summary of survey results

Table 5.11 below provides a summary of the empirical survey results in relation to the research questions, objectives and constructs.

Table 5. 11: Summary of survey results as it relates to the research questions and objectives (Source: own)

Research question	Research objective	Construct	Findings
Research question one (RQ 1): What are the difficulties experienced by citrus growers with the integration of RM practices into their existing QMS?	**Research objective one (RO 1):** To identify the difficulties experienced by citrus growers with the integration of the RM system into their existing QMS.	Difficulties	According to the descriptive statistics, the difficulties experienced as perceived by majority of the respondents include the high cost and excessive human resources required for implementation, the lack of skilled workers to effectively implement the integration, the cost of training being too expensive, the time required for training causes a loss of production time and a lack of government support and cooperation to effectively implement the FMS requirements. Further analysis found there are three difficulty factors which measured the construct difficulties. These factors include operational challenges, training challenges, and financial and human resources challenges. From these factors, the majority of the respondents reported financial and human resources challenges as the main difficulties experienced and disagreed that the training and operational challenges were difficulties they encountered. Furthermore, inferential statistics indicated there is no statistically significant difference between how the different citrus producers according to their classification perceived and experienced these difficulty factors.
Research question two (RQ 2): What are the main non-compliances in the agri-food export chain from developing countries to the EU market?	**Research objective two (RO 2):** To determine the main non-compliances in the agri-food export chain from developing countries to the EU market.	Non-compliances	The majority of citrus producers perceived the detection of regulated pests (FCM) and exceeding the pesticide maximum residue limits (MRLs) as the main non-compliances when exporting citrus to the EU market.
Research question three (RQ 3): What is an effective way of integrating a risk management and quality management system?	**Research objective three (RO 3):** To determine an effective way of integrating risk management and quality management system.	Integration measures	The majority of citrus producers integrate the FMS into their daily operations, planning and recordkeeping on a strategic and operational level. Additionally, the majority of the respondents reported that internal audits are conducted, that all stakeholder requirements are reviewed during a single audit and that internal audits review how effectively the FMS requirements have been implemented.

5.8 Conclusion

This chapter described and analysed the survey results in order to answer research question one. Furthermore, the chapter demonstrates how the survey findings relate to the other research objectives (RO 2 and RO 3) and the demographic data, all of which collectively aim to answer the main research question. Moreover, the findings were described using graphs and tables to present the empirical results in a manner that is easy to understand. Additionally, ongoing analyses were provided to offer insight into the survey results and comparisons were made between these findings and those highlighted in the literature review. The significance of the survey results was also provided within the context of the research environment. In addition, reliability tests (Cronbach alpha) and factor analysis were conducted to demonstrate the internal consistency of the research instrument to illustrate the validity and reliability of the research questionnaire and, by extension, the analysis of the survey results. This process included conducting a one-way ANOVA test to determine any statistically significant differences between the citrus producer categories in relation to the factors extracted. The next chapter will conclude this study by summarizing the findings, drawing conclusions, answering the research questions and making recommendations.

CHAPTER SIX: RESEARCH CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

In this concluding chapter, the study objectives will be revisited, the findings will be summarised and conclusions drawn concerning each research objective, this process includes answering the research questions in relation to the literature review findings and empirical survey results. In addition, by addressing the research objectives the primary research objective is addressed and the investigative research questions are answered. Furthermore, recommendations and suggestions for future research will be made, including the implications of this study.

6.2 Research Problem Revisited

South Africa (SA) is the second largest citrus fruit exporter globally making this industry an important foreign exchange earner (Malan et al., 2018) The European Union (EU) is its main citrus market (DALRRD, 2021) and requires imported citrus to comply with phytosanitary risk-mitigating measures for the pest false codling moth (FCM) (DALRRD, 2021: Online; Moore, 2021). Furthermore, from 2018 onwards the EU has imposed more stringent import requirements for citrus fruit exported from SA due to exporters' frequent non-compliance with the EU import requirements for produce from African countries (EPPO, 2013; European Commission 2017/1279, 2017). In response to the new EU import regulations, the DALRRD, together with the citrus export industry, improved the false codling moth risk management system (FMS) based on the systems approach design (EFSA, 2021; ISPM 14, 2019). Subsequently, to continue exporting to the EU, the citrus producers had to integrate the FMS requirements into their existing daily operations (QMS). Moreover, non-compliance found by the EU could have economic consequences for citrus producers such as the rejection of a consignment or the temporary suspension of an export programme (Idris et al., 2015; Kapuya, 2015; South African Government Gazette, 2014). Hence, the inadequate integration of the RM system into the QMS of producers can lead to poor compliance with the import regulations of the high-value EU market, consequently, leading to stricter and expensive SPS regulations and resulting in detrimental economic consequences for SA (Iliyasu & Zainalabidin, 2018; Moore, 2021; South African Government Gazette, 2014).

6.3 Recap of the research objectives

As indicated in the Chapter One, the primary research objective of this research study is:

To determine how to effectively integrate risk management (RM) into the quality management system (QMS) of citrus growers, to enhance compliance with the EU import requirements.

The sub-research objectives of this study were formulated as follows:

- To identify the difficulties experienced by citrus growers with the integration of the RM system into their existing QMS.
- To determine the main non-compliances in the agri-food export chain from developing countries to the EU market.
- To determine an effective way of integrating risk management and a quality management system.
- To provide recommendations from this study to citrus growers to enhance compliance with EU requirements.

6.4 Key findings and summary based on research objective one

To identify the difficulties experienced by citrus growers with the integration of the RM system into their existing QMS.

The reviewed literature identified the difficulties associated with integrating various management systems (MSs) as the excessive financial and human resources required, lack of skilled workers, insufficient training, non-integrated audits, lack of top management participation, internal organisational difficulties (relating to workers' involvement, attitude, motivation and understanding) and workers' resistance to change (see Chapter 3.5.1).

From this study, the empirical survey results indicated that there are findings that are both contrary to and consistent with the literature review findings (see Chapter 5.4.10.6). According to the descriptive statistics, the difficulties experienced by most of the Western Cape citrus producers included the high cost and excessive human resources required for implementation, the lack of skilled workers to effectively implement the integration, the excessive cost of training, the time required for training results in a loss of production time and a lack of government support and cooperation

to effectively implement the FMS requirements. Further analysis found that these difficulties can be grouped into three difficulty factors, namely financial and human resources challenges, training challenges and operational challenges. The financial and human resources challenges relate to the high cost and excessive human resources required for integration. The training challenges relate to the lack of training of workers at all levels and the unavailability of specific FCM identification training. Furthermore, for this factor, the variable lack of management involvement and commitment was removed to provide higher reliability. However, it does relate to the role management plays in ensuring the training of workers by allocating the necessary funds and making arrangements for training, especially regarding FCM identification training. The operational challenges relate to non-integrated audits, the lack of fully integrated documentation of all farm processes and the lack of standardised forms to facilitate the implementation of the FMS requirements.

In addition, the analyses of the survey results illustrate there is no significant difference between how the small, medium and large-scale Western Cape citrus producers view and experience these difficulty factors. Therefore, the majority of producers reported financial and human resources challenges as the difficulties they experienced with implementing the FMS. This finding is significant because this survey's results are consistent with the literature review findings that small and medium-scale farmers in developing countries often lack the financial resources to effectively comply with safety and quality standards (Annor, 2016; Maertens & Swinnen, 2015; Rao et al., 2021). Furthermore, the results also demonstrate that even large-scale producers experience financial and human resources challenges to compliance, since there is no significant difference between the perceived difficulties experienced among small, medium and large producers. Additionally, the survey results are in agreement with the findings of the trade literature which indicate that developing countries generally lack the resources to comply with SPS measures (such as the systems approach) (Curzi et al., 2020; Jouanjean et al., 2016; Quinlan et al., 2020; Santeramo & Lamonaca, 2019). Hence, the costs of complying with the EU legislation (SPS measures) tend to be higher for farmers in developing countries compared to their counterparts in developed countries (Babatunde, 2018; Hou et al., 2015; Jacxsens et al., 2015).

In conclusion, the difficulties experienced by most of the citrus growers with the integration of RM practices into their existing QMS are the high cost and excessive human resources required for integration. These findings are consistent with those of

the literature review regarding the integration of MSs (Blasco-Torregrosa et al., 2021; Domingues et al., 2015; Nunhes et al., 2017).

6.5 Key findings and summary based on research objective two

To determine the main non-compliances in the agri-food export chain from developing countries to the EU market.

The literature review identified the most prevalent non-compliance for fresh produce exported from developing countries to the EU market as being the detection of regulated pests (harmful or quarantine pests), exceeding the maximum residue limits (MRLs), non-compliance with phytosanitary certificate requirements, labelling and packaging requirements, hygiene requirements (microbial contaminants), technical requirements (traceability and MRLs), International Standards for Phytosanitary Measures (ISPM) 15 requirements and exceeding the levels of contaminates. However, the main non-compliances identified were the detection of pests and exceeding the MRLs (see Chapter 3.4).

For this study, the empirical survey results are consistent with the findings of the literature review because the majority of the participating Western Cape citrus producers perceived the detection of regulated pests and exceeding the MRLs as the main non-compliances when exporting citrus to the EU market.

In conclusion, the main non-compliances in the agri-food export chain from developing countries, such as SA, to the EU market are the detection of regulated pests (harmful or quarantine pests) and exceeding the MRLs of pesticides.

6.6 Key findings and summary based on research objective three

To determine an effective way of integrating risk management and quality management system.

The literature review identified four principal elements of the integration process, namely the integration strategy, the integration level, integration methodology and auditing systems (Algheriani et al., 2019). Furthermore, the reviewed studies indicated that the degree of integration can occur on a strategic, tactical and operational level whereby integration is either fully, partially or not integrated (Algheriani, 2019; Asif et al., 2010; Nunhes et al., 2019). Moreover, according to Asif et al. (2010), there are two

types of integration strategies namely the “systems approach” and the “techno-centric approach”. The differences between these two methods are the integration starting point and the framework, the former starts by identifying the stakeholders and their requirements. Hence, integration begins at a strategic level and then later operates at a tactical and operational level. The latter process starts by identifying and analysing the common elements between MSs, resulting in more operational benefits. Studies have found that the top-down approach (systems approach) is the most frequently adopted and the most effective framework for integration that commences on a strategic level and moves to a tactical and operational level (Asif et al., 2010; De Oliveira, 2013; Gianni & Gotzamani, 2015; Nunhes et al., 2019; Santos, Mendes & Barbosa, 2011).

The literature review findings indicated that the main integration methods or tools used for integration are the analysis of common elements, process maps, PDCA cycle, Pareto chart, brainstorming and histograms (Algheriani, 2019; Bernardo et al., 2017; Blasco-Torregrosa et al., 2021; Gianni & Gotzamani, 2015; Nunhes et al., 2017). Moreover, the literature review indicates that, generally, most integration processes follow common steps, namely identifying the common elements within the different MSs and integrating these elements to create a single system with common elements (Domingues et al., 2015). Furthermore, the literature review findings highlighted common elements that should be implemented first (policies, responsibilities, scope and objectives) to guide other integration tasks (De Oliveira, 2013). The common elements and functions most widely integrated included work instructions, management of documents and records, top management responsibilities, structure and accountability and internal communication (Nunhes et al., 2017). Other elements and functions that were integrated included: “objectives and targets; manuals; policies; structure and responsibilities; the management representative; work instructions; document and record control; formation; internal communication; emergency plans; performance indicators; acquisition; non-compliance treatment; inspection equipment control; measuring and testing; preventive and corrective actions; internal and external audits; and critical analysis meetings” (Nunhes et al., 2017).

Moreover, the importance of continuous improvement and integrating auditing systems were highlighted as key processes to achieve higher levels of integration and attain benefits such as enhanced synergies and performance, reduced auditing costs and time and decreased redundancies in efforts and paperwork (Bernardo et al., 2017; Gianni & Gotzamani, 2015; von Ahsen, 2014). Additionally, the degree of audit

integration can be done fully, partially or not integrated (Bernardo et al., 2017). See Chapter 3.5.

While the above literature review findings provide a framework for integrating MSs it is important to understand what the critical success factors are and the difficulties generally experienced with integration. For example, several reviewed studies emphasised the essential role of top management commitment and involvement to drive the integration process and to provide the necessary strategic planning, resources (both financial and human resources), training and leadership required to successfully implement and maintain integration (Almeida et al., 2014; Gianni & Gotzamani, 2015; Nunhes et al., 2021; Sampaio et al., 2012). Furthermore, the vital role workers play in the implementation and maintenance of the integration process, and how internal organisational difficulties, such as insufficiently skilled workers and lack of worker involvement, as well as their attitudes, motivation, understanding and resistance to change, can have a detrimental impact on such the integration process (Abad et al., 2016; Blasco-Torregrosa et al., 2021; De Oliveira, 2013; Simon et al., 2012). Previous studies have also highlighted that the approach and level of integration achieved can impact the integration process and argue that resistance is more apparent when integration occurs simultaneously or partially, compared to gradual integration (Abad et al., 2016). See Chapter 3.5.

The empirical results of this case study indicated that most Western Cape citrus producers integrate the FMS into their daily operations, planning and recordkeeping on a strategic and operational level. Additionally, the majority of the respondents reported that internal audits are conducted and that all stakeholder requirements are reviewed during a single audit. Most respondents also reported that internal audits review how effectively the FMS requirements have been implemented. This result may suggest the adoption of an integrated auditing system by the majority of respondents.

In conclusion, an effective way of integrating RM and QMS based on the literature review findings would be to apply the four principal elements of the integration process as an integration framework while taking cognisance of difficulties that could be encountered and benefits that could be achieved. The most effective approach is a top-down or systems approach to the integration process that involves initially carefully planning integration (integration plan) and taking strategic decisions, then moving on to tactical and operational integration. Strategic integration would first entail integrating structural elements such as policies, objectives, scope and responsibilities that include

identifying stakeholders and their requirements. Furthermore, this process involves determining what elements can be integrated into the RM and QMS and then integrating these while ensuring specific elements not capable of integration are effectively implemented. The integration process can be completed fully or partially, gradual integration may alleviate resistance to changes by workers opposed to simultaneous or partial integration. Additionally, integration methods employed include analysis of common elements, process maps and PDCA cycle. Integrating auditing systems is essential to ensure effective integration, this practice can be achieved by ensuring the auditing team is fully integrated and focus is placed on the integrated elements of the MSs.

6.7 Key findings and summary based on research objective four

To provide recommendations that will enhance citrus growers' compliance with EU requirements.

6.7.1 Recommendations for citrus producers

It should be noted that while the recommendations below refer to the QMS and the FMS, the citrus producer may also be registered with many other certification schemes (see Chapter 5.4.6). However, the basic scheme for good agricultural practices (GAP) in the majority of cases (if not all) will be the GlobalG.A.P. certification scheme that includes a QMS.

- It is recommended that the top management of the citrus producer allocates sufficient funds to integrate (implement) the FMS requirements adequately. This includes ensuring the necessary suitable workers are appointed to implement the requirements.
- Citrus producers should establish an integration team. The team should consist of workers from different sections of the organisation. According to Nunhes et al. (2017), establishing an integration team is a way of overcoming the difficulty related to the human resources challenges.
- Citrus producers should develop a well-structured integration plan based on the four principal elements of the integration process (integration strategy, level, methodology and auditing systems). It is advised that the integration plan should describe integration activities, anticipated timeframes of such activities,

individuals responsible for these integration activities and anticipated resources required to implement integration activities (De Oliveira et al., 2013).

- Furthermore, while developing the integration plan citrus producers should be aware of difficulties they may encounter, critical success factors required for integration and the benefits to be achieved (previously mentioned in this study).
- Implementing an integration plan will assist citrus producers to plan and manage the integration process in a manner that is financially possible and sustainable for them, and may be helpful in overcoming financial difficulties. However, emphasis is placed on the importance of ensuring that adequate funds are allocated to enable the successful execution of the integration plan.
- A strategic approach (systems approach or top-down approach) should be adopted as the integration approach.
- Citrus producers should identify common elements between the existing QMS and the FMS and determine which elements of the FMS can be effectively integrated on a strategic, tactical and operational level and the level of integration to be achieved (fully or partially). Requirements of the FMS not capable of integration should be adequately implemented separately.
- Structural elements such as the scope, responsibilities and objectives of the FMS should be integrated first into the existing policies and strategic framework of the QMS, followed by tactical and operational integration. To achieve effective integrated strategic and operational procedures and documentation management it is recommended that citrus producers should develop policies and plans with specific achievable goals (Simon et al., 2012).
- Tactical and operational integration should include combining duties for various functions and integrating most farm processes and documentation, such as integrated work instructions, checklists and data collection forms (Asif et al., 2010). It is advisable to use process maps such as flowcharts to indicate common processes between the QMS and the FMS to simplify the integration documentation and make it easy for workers to understand this process (De Oliveira, 2013; Nunhes et al., 2019).
- The recommended integration methods include process maps, PDCA cycle, brainstorming and analysis of common elements.
- Internal audits should be integrated and a single audit team should be established. An internal audit programme should be developed that indicates the scope and timeframes for internal audits (Nunhes et al., 2019). Management should ensure audit findings are suitably addressed and corrective actions are implemented if and when required.

- The training processes required for both the QMS and the FMS should be integrated by establishing a training programme. This programme should include all training workshops or courses required by the various MSs implemented by the citrus producers. Moreover, it is advised that the human resource management and the top management should identify the training required by workers to ensure effective integration, and should ensure training needs are included in the organisations' strategic planning and provision should be made for training resources (Nunhes et al., 2019). Furthermore, adequate training records should be kept.
- Finally, it is recommended that citrus producers ensure all documentation is effectively integrated.

6.7.2 Recommendations for the government and private sector (citrus industry)

- The DALRRD, together with the private sector, should provide adequate support to citrus producers and ensure training courses and workshops are adequate and sufficiently resourced to create skilled farm workers.
- The citrus producers should be included in the development of the above training programmes to allow them to be part of the decision-making process and also provide input on the specific training needed by their workers. The training initiatives should be enhanced by ensuring there is a link to practical applications and follow-up work, as well as providing refresher training annually (Day et al., 2012).
- Further, training should be provided during the off-season to all workers, especially farm workers implementing the FMS requirements on the farm, to ensure effective integration into their daily operations.
- Moreover, it is recommended that the DALRRD together with the citrus associations develop standardised forms or templates to facilitate and enhance record keeping to ensure producers are able to demonstrate compliance. These templates should guide producers on the information needed to be integrated into their existing QMS documentation.
- The DALRRD and private sector should support citrus producers by providing technical support and enhanced awareness on import requirements specifically related to regulated pests and MRLs of pesticides, that are a major concern to citrus producers.

- Furthermore, it appears the South African response strategy to new or changes to the EU import requirements is “compliance” and the “voice” strategy (Vinti & Makapela, 2016). It is recommended that the government implement a “predictive” approach to improve compliance. This entails developing measures to facilitate a predictive compliance capacity to additions or changes to the EU import requirements, and proactively putting measures in place to enhance adherence (Hou et al., 2015). This type of response strategy, with the support of the government and the private sector (citrus associations), will allow producers to be better prepared for changes or new requirements to the EU import regulations. In addition, this strategy may lead to citrus producers making a greater effort to comply with stricter domestic requirements and may result in a decrease in SPS compliance costs and efforts because domestically there would be more comprehensive phytosanitary regulations already in place (Federica et al., 2021).
- It is also recommended the DALRRD develop policies and initiatives to facilitate citrus producers’ compliance. This process should include strengthening the collaborative relationship between the DALRRD and the citrus associations representing the citrus producers.
- Additionally, it is recommended that the government invest in infrastructure and technology to facilitate and enhance the compliance capacity of producers.

6.8 Future Research Directions

This study can be expanded to other categories of fruit that are exported to the EU or the world, such as the apple and pear industry. This study only focused on citrus fruit as a typical fruit in the export process, however, by applying the recommendations of this study to other fruit producers, it could add value to the fruit industry of SA. This study was sufficient to determine the difficulties encountered by producers within the context of the citrus export industry in SA, therefore, future research should focus on the difficulty factors extracted during this study to investigate if the results can be replicated in similar settings, such as the vegetable export industry of SA.

6.9 Discussion of Implications

6.9.1 Implications of the findings in the context of the international trade

Research concerning integrating different MSs has generally focused on the integration of QMS, EMS, OHSMS and the risk management system (RMS) based on

ISO 31000: 2009, that is congruent with the ISO standards (Barbosa et al., 2021; Blasco-Torregrosa et al., 2021; Nunhes & Oliveira, 2020; Olaru et al., 2014; Talapatra et al., 2019). Furthermore, studies have been conducted regarding integrating RM into QMS (Popescu & Dasclu, 2011; Samani et al., 2019). These studies conducted in countries worldwide have demonstrated the importance of integrating different MSs to sufficiently meet stakeholder requirements and the benefits of achieving and maintaining effective integration. However, to the best knowledge of the researcher, this study is the only research project that sought to investigate how the findings of previous research can be applied in the context of international trade to enhance and maintain compliance with the EU import regulations in the context of the SA citrus export industry.

6.9.2 Implications of the findings in the context of the South African citrus industry

Studies have been conducted on the impact of SPS and quality requirements on developing countries in the context of the international trade of agricultural products (Annor et al., 2016; Arita et al., 2015; Babatunde, 2018; Grundke & Moser, 2019; Henson et al., 2011; Melo et al., 2014; Murina & Nicita, 2017; Rao et al., 2021; Triwibowo & Falianty, 2018; Webb et al., 2019; Winchester et al., 2012). Moreover, there have been many studies conducted on the systems approach as an effective phytosanitary risk-mitigating measure (FAO/IAEA, 2010; Hennessey et al., 2014; Jang; 2016; Jamieson et al, 2013; Mengersen et al., 2012; Quinlan et al., 2020; van Klinken et al., 2020, 2021). These studies include research conducted in the South African citrus export context (Hattingh et al., 2020; Moore, 2021; Moore & Manrakhan, 2022; Moore et al., 2016). However, to the best knowledge of the researcher, this research study is the only one that sought to investigate how to effectively integrate a phytosanitary risk-mitigating measure into the existing QMS of SA's citrus producers to enhance and maintain access to the lucrative EU export market.

Furthermore, the contributions of this study concerning practical implications are the empirical results that highlight the difficulties experienced by Western Cape citrus producers with the integration of the RM system. By understanding the difficulties, the government and the citrus industry (private sector) can better support producers, and more effectively plan the integration of the RM requirements to enhance citrus producers' compliance. In addition, this study provides a guide to assist citrus producers, farmers, exporters and managers to realise the importance of RM in the

export process to effectively achieve and maintain compliance with import requirements.

6.10 Final Conclusion

In conclusion, the study achieved its objectives by identifying the difficulties encountered by the Western Cape citrus producers with the integration. Recommendations on how to effectively integrate the FMS into the existing QMS are also provided. Additionally, the study identified the main non-compliances when exporting to the EU as perceived by the citrus producers.

Furthermore, this study advocates for enhanced government and private sector collaboration to enable an effective compliance environment. This study also emphasises the importance of government and private sector (citrus industry) support for citrus producers. Providing technical support and training is essential to ensure the effective integration of the RM system so that producers can achieve the benefits of such an integration. Additionally, it is recommended that the government invest in infrastructure and technology to facilitate and enhance the compliance capacity of the producers. Moreover, to overcome financial and human resources challenges with integrating the FMS, citrus producers should establish an integration team and develop a well-structured integration plan. By implementing this study's recommendations, the citrus producers, the DALRRD and the private sector may enhance the implementation of the FMS requirements and heighten citrus producers' ability to demonstrate compliance, subsequently resulting in collectively improving their compliance with the EU import regulations. This study further advocates for the continuous improvement and adaptation of compliance processes in the context of international trade of agricultural products. Compliance with both SPS regulations and private standards will create opportunities for both small and medium-scale producers to access lucrative export markets. Therefore, the agriculture sector of SA, and more specifically the citrus industry, have the capacity to contribute significantly to the economy and create many jobs to achieve South Africa's economic developmental goals.

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APPENDIX A: INFORMATION LETTER AND QUESTIONNAIRE

Principal Researcher: **Ms Samantha Phologane**
Supervisors: Dr L Valentine; Prof B Yan
Department of Industrial and Systems Engineering
Faculty of Engineering and the Built Environment
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Date: 22 May 2023

Information letter and Questionnaire

Dear Respondent

Re: Integration of risk management system: towards sustained access to EU citrus market

This study aims to determine how to effectively integrate the false codling moth risk management (FMS) into the quality management system (QMS) of citrus growers to enhance compliance with the EU import requirements. Furthermore, to identify the difficulties experienced by growers when implementing the FMS as prescribed by the Department of Agriculture, Land Reform and Rural Development (DALRRD) for citrus exported to the EU.
Please complete the survey below which will take 15 minutes. Kindly note the survey must be completed by either the farm owner, manager or any senior manager or person specifically dealing with the citrus supply chain on the farm(s). The survey is anonymous. All responses will be aggregated and summarised to ensure no information can be used to identify participants or their associated citrus producer. Participation is voluntary and can be left at any moment without reason. All the information will be kept confidential and only used for academic purposes. Please complete one survey for all PUCs registered under the specific citrus producer.
The questionnaire consists of three sections. Section A is compulsory to ensure participants provide his/her consent before continuing. Section B is demographical data and information related to the research environment. Section C is a decision-making section which consists of statements related to the integration. Kindly respond to each of the statements by ticking the statement that most suitably describes your view and experiences related to the FMS.

Please contact me should you have any questions or concerns about the survey.

Thanking you in advance.

Sincerely,

Samantha Phologane

Section A: Consent

Kindly note consent must be given to proceed with the survey.

1. Name (optional): _____

2. Citrus Producer/Grower (optional): _____

3. I give consent to participate in this research survey.

Yes	
No	

4. I give consent to the researchers of this study to retain the provided data, and to use it only for academic purposes.

Yes	
No	

Section B: Demographical data and information related to the research environment (please mark the appropriate choice using a cross (X).

1. Job Title or Position (specifically dealing with the citrus supply chain on the citrus farm)

Farm Owner	
Farm Manager	
Production Manager	
Senior Manager (e.g. quality control manager)	
Senior employee (related to the citrus supply chain)	
Other (Please specify)	

2. Classification of the citrus producer according to the annual turnover.

Small-scale producer (annual turnover ranging from R50 000 - R5 million)	
Medium-scale producer (annual turnover ranging from R5 million – R20 million)	
Large-scale producer (annual turnover above R20 million)	

3. Producer's years of experience in farming fresh produce.

Less than 10 years	
10-15 years	
15 years and more	

4. Producer's years of exporting citrus to the EU.

New entrant (less than 3 years)	
3-10 years	
10-15 years	
15 years and more	

5. Citrus exporting seasons in which the producer exported citrus to the EU (more than one export season can be chosen).

2018	
2019	
2020	
2021	
2022	

6. Please select which of the statements applies to the packhouse used to pack the majority of the citrus exported to the EU.

The producer owns the packhouse.	
The producer transports the citrus to a packhouse privately owned by a different company and pays packing fees.	
The producer transports the citrus to a packhouse which is privately owned by a company, of which the producer is a member or shareholder.	
Other (Please specify)	

7. The producer is certified with the following certification scheme(s), more than one option can be selected.

GlobalG.A.P certification	
Tesco Nurture	
Field to Fork	
LEAF Marque	
Albert Hejin PPP Protocol	
HACCP (SANS 10330)	
British Retail Consortium (BRC)	
International Organization for Standardization (ISO) e. g., ISO 9001:2015 or ISO 14001	
GlobalG.A.P Produce Handling Assurance Standard	
Other (Please specify)	

8. The following general approach was taken to integrate or implement the FMS requirements.

The producer appointed consultants or a third party to assist with the integration and implementation of the FMS requirements.	
The producer hired or designated employees specifically for this purpose.	
The farm owner opted to integrate or implement the FMS requirements themselves.	
Other (Please specify)	

Section C: Statements related to the integration (implementation) of the false codling moth risk management (FMS).

Please make use of the following options (1-5) to indicate your level of agreement with the following statements.								
1	2	3	4	5				
Strongly disagree	Disagree	Neutral	Agree	Strongly agree				
The main non-compliances when exporting citrus fruit to the EU market include the following.								
1.	The detection of regulated pests (false codling moth).	1	2	3	4	5		
2.	Exceeding the pesticide residue limits (maximum residue limits).	1	2	3	4	5		
3.	Non-compliance with labelling requirements.	1	2	3	4	5		
4.	Exceeding the maximum levels of regulated contaminants such as aflatoxin (produced by *Aspergillus flavus*).	1	2	3	4	5		
5.	Absent, incomplete, unreadable or forged phytosanitary certificate.	1	2	3	4	5		
6.	Inadequate additional declaration on the phytosanitary certificate.	1	2	3	4	5		
7.	Non-compliance with the International Standards for Phytosanitary Measures (ISPM) 15 for wood packaging material.	1	2	3	4	5		
The false codling moth risk management (FMS) was incorporated into our daily operations/planning/recordkeeping through the following the measures.								
8.	Implementation takes place at a strategic level (e.g. policies are integrated).	1	2	3	4	5		
9.	Implementation takes place at an operational level (e.g. most records, work instructions and checklists are integrated).	1	2	3	4	5		
10.	Internal audits are conducted on the citrus farm(s).	1	2	3	4	5		
11.	Internal audits review all stakeholder requirements during a single audit (e.g. GlobalG.A. P, FMS & other requirements).	1	2	3	4	5		
12.	Internal audits review how effectively the FMS requirements have been implemented.	1	2	3	4	5		
Difficulties experienced with integrating (implementing) the FMS into our daily operations include the following.								
13.	Lack of management involvement and commitment.	1	2	3	4	5		
14.	The high cost of implementing the FMS requirements.	1	2	3	4	5		
15.	The excessive human resources required for implementation.	1	2	3	4	5		
16.	Lack of skilled workers to effectively implement integration.	1	2	3	4	5		
17.	Training of workers at all levels on the implementation of FMS requirements is inadequate.	1	2	3	4	5		
18.	The cost of training is too expensive.	1	2	3	4	5		
19.	The time required for training causes a loss of production time.	1	2	3	4	5		
20.	The unavailability of specific false codling moth identification training.	1	2	3	4	5		
21.	Workers' attitude towards the implementation of FMS requirements is negative.	1	2	3	4	5		
22.	Lack of motivation and understanding among workers about the implementation of the FMS requirements.	1	2	3	4	5		
23.	Lack of workers' involvement in the implementation process of the FMS requirements.	1	2	3	4	5		
24.	Workers resist changes regarding the implementation of FMS requirements.	1	2	3	4	5		
25.	Insufficient information was provided to workers about changes regarding the implementation and new duties.	1	2	3	4	5		
26.	Difficult to manage the required FMS documentation effectively.	1	2	3	4	5		
27.	Lack of skills to manage comprehensive records of all integrated farm processes.	1	2	3	4	5		
28.	Daily operational records/documentation of all farm processes are not fully integrated.	1	2	3	4	5		

29.	There are no standardised forms to help implement the FMS requirements.	1	2	3	4	5
30.	There is no integrated internal audit to ensure effective implementation.	1	2	3	4	5
31.	Lack of access to consultants with appropriate experience in integrating different management systems.	1	2	3	4	5
32.	Poor coordination between the producer and appointed consultant or third party on the integration of FMS requirements (e.g. orchard sanitation).	1	2	3	4	5
33.	Insufficient information provided to citrus growers on EU import requirements.	1	2	3	4	5
34.	Lack of government support and cooperation to effectively implement the FMS requirements.	1	2	3	4	5
35.	Insufficient time to implement changes made to the FMS requirements.	1	2	3	4	5
36.	The current chosen implementation (integration) approach is not effective.	1	2	3	4	5

Hoofnavorser: **Me Samantha Phologane**
Moderators: Dr L Valentine; Prof B Yan
Departement van Industriële en Stelsels Ingenieurswese
Fakulteit van Ingenieurswese en die Bou Omgewing

Datum: 22 Mei 2023

Inligtingsbrief en Vraelys

Beste Deelnemer

Integrasie van risiko-bestuurstelsel: Om volhoubare toegang tot die EU sitrusmark te skep

Hierdie studie beoog om te bepaal hoe om die valskodlingmot –risikobestuurstelsel (false codling moth risk management system) (FMS) effektief in die kwaliteitbestuurstelsel (QMS) van sitrusprodusente te integreer om voldoening aan die EU-invoervereistes te verbeter. Verder, om die uitdagings te identifiseer wat produsente ondervind met die implementering van die FMS soos voorgeskryf deur die Departement van Landbou, Grondhervorming en Landelike Ontwikkeling (DALRRD) vir sitrus wat na die EU uitgevoer word.
Voltooi asseblief die onderstaande vraelys wat slegs 15 minute sal neem. Neem asseblief kennis dat dit voltooi moet word deur óf die plaaseienaar, bestuurder óf enige senior bestuurder of persoon wat spesifiek met die sitrusvoorsieningsketting op die plaas(e) te doen het. Die vraelys is anoniem. Alle antwoorde sal saamgevoeg en opgesom word om te verseker dat geen inligting gebruik kan word om deelnemers of hul geassosieerde sitrusprodusent te identifiseer nie. Deelname is vrywillig en kan enige oomblik sonder rede gelaat word. Al die inligting sal vertroulik gehou word en slegs vir akademiese doeleindes gebruik word. Voltooi asseblief een vraelys vir alle PUC's geregistreer onder die spesifieke sitrusprodusent.
Die vraelys bestaan uit drie afdelings. Afdeling A is verpligtend om te verseker dat deelnemers sy/haar toestemming verskaf voordat hulle voortgaan. Afdeling B is demografiese data en inligting wat met die navorsingsomgewing verband hou. Afdeling C is 'n besluitnemingsafdeling wat bestaan uit stellings wat met die integrasie (implementering) verband hou. Reageer asseblief op elkeen van die stellings deur die stelling te merk wat die beste jou siening en ervarings met die risiko-bestuurstelsel (FMS) beskryf.

Kontak my asseblief indien u enige vrae of bekommernisse oor die vraelys het.

By voorbaat dank.

Die uwe,
Samantha Phologane

Afdeling A: Toestemming

Neem asseblief kennis dat toestemming gegee moet word om met die vraelys voort te gaan.

1. Naam (opsioneel): _____

2.Sitrusprodusent/-kweker (opsioneel): _____

3. Ek gee toestemming om aan hierdie navorsingsopname deel te neem.	Ja	
	Nee	

4. Ek gee toestemming aan die navorsers van hierdie studie om die verskafde data te behou, en om dit slegs vir akademiese doeleindes te gebruik.	Ja	
	Nee	

Afdeling B: Demografiese data en inligting wat verband hou met die navorsingsomgewing (merk asseblief die toepaslike keuse met 'n kruisie (X).

1.Postitel of pos (wat spesifiek werk met die sitrusvoorsieningsketting op die sitrusplaas)

Plaaseienaar	
Plaasbestuurder	
Produksiebestuurder	
Senior Bestuurder (bv. Kwaliteitbeheerbestuurder)	
Senior werknemer (verwant aan die sitrusvoorsieningsketting)	
Ander (spesifiseer asseblief)	

2. Klassifikasie van sitrusprodusent volgens die jaarlikse omset.

Kleinskaalse produsent (jaarlikse omset wissel van R50 000 - R5 miljoen)	
Mediumskaalse produsent (jaarlikse omset wissel van R5 miljoen – R20 miljoen)	
Grootskaalse produsent (jaarlikse omset bo R20 miljoen)	

3. Produsent se ondervinding in boerdery met vars produkte.

Minder as 10 jaar	
10-15 jaar	
15 jaar en meer	

4. Produsent se ondervinding in die uitvoer van sitrus na die EU.

Nuweling (minder as 3 jaar)	
3-10 jaar	
10-15 jaar	
15 jaar en meer	

5. Sitrusuitvoerseisoene waarin die produsent sitrus na die EU uitgevoer het (meer as een uitvoerseisoen kan gekies word).

2018	
2019	
2020	
2021	
2022	

6. Kies asseblief watter van die stellings van toepassing is op die pakhuis waar die meeste sitrus verpak is vir uitvoer doeleindes na die EU.

Die produsent besit die pakhuis.	
Die produsent vervoer die sitrus na 'n pakhuis wat privaat besit word deur 'n ander maatskappy en betaal verpakkingsfooie.	

Die produsent vervoer die sitrus na 'n pakhuis wat privaat besit word deur 'n maatskappy, waarvan die produsent 'n lid of aandeelhouer is.	
Ander (spesifiseer asseblief).	

7. Die produsent is gesertifiseer met die volgende sertifiseringskema(s), meer as een opsie kan gekies word.

GlobalG.A.P certification	
Tesco Nurture	
Field to Fork	
LEAF Marque	
Albert Hejin PPP Protocol	
HACCP (SANS 10330)	
British Retail Consortium (BRC)	
International Organization for Standardization (ISO) e. g., ISO 9001:2015 or ISO 14001	
GlobalG.A.P Produce Handling Assurance Standard	
Ander (spesifiseer asseblief)	

8. Die volgende algemene benadering is gevolg om die risiko-beheerstelselvereistes (FMS) te integreer of te implementeer.

Die produsent het konsultante of 'n derde party aangestel om te help met die integrasie en implementering van die FMS-vereistes.	
Die produsent het werknemers spesifiek vir hierdie doel gehuur of aangewys.	
Die plaaseienaar het gekies om self die FMS-vereistes te integreer of implementeer.	
Ander (spesifiseer asseblief)	

Afdeling C: Stellings wat verband hou met die integrasie (implementering) van die valskodlingmot-risikobestuurstelsels (FMS).

Maak asseblief gebruik van die volgende opsies (1-5) om aan te dui tot watter mate u met die volgende stellings saamstem.								
1	2	3	4	5				
Stem sterk nie saam	Stem nie saam	Neutraal	Stem saam	Stem sterk saam				
Die hoof nie-nakomings (non-compliances) wanneer sitrusvrugte na die EU-mark uitgevoer word, is die volgende.								
1.	Die opsporing van gereguleerde plae (valskodlingmot).	1	2	3	4	5		
2.	Oorskryding van die plaagdoder residu limiete (maksimum residu limiete).	1	2	3	4	5		
3.	Nie-nakoming van etikettering vereistes.	1	2	3	4	5		
4.	Oorskry die maksimum vlakke van gereguleerde kontaminante soos aflatoksien (geproduseer deur *Aspergillus flavus*).	1	2	3	4	5		
5.	Afwesig, onvolledige, onleesbare of vervalste fitosanitêre sertifikaat.	1	2	3	4	5		
6.	Onvoldoende bykomende verklaring op die fitosanitêre sertifikaat.	1	2	3	4	5		
7.	Nie-nakoming van die Internasionale Standaarde vir Fitosanitêre Maatreëls (ISPM 15) vir houtverpakkingsmateriaal.	1	2	3	4	5		
Die valskodlingmot-risikobestuurstelsels (FMS) is deel gemaak van ons daaglikse bedrywighede/beplanning/rekordhouding deur die volgende maatreëls.								
8.	Implementering vind plaas op 'n strategiese vlak (bv. beleide word geïntegreer).	1	2	3	4	5		
9.	Implementering vind plaas op 'n operasionele vlak (bv. die meeste rekords, werkinstruksies en kontrolelyste is geïntegreer).	1	2	3	4	5		
10.	Interne oudits word op die sitrusplaas(e) uitgevoer.	1	2	3	4	5		
11.	Interne oudits hersien alle belanghebbendevereistes tydens 'n enkele oudit (bv. GlobalG.A. P, FMS & ander vereistes).	1	2	3	4	5		
12.	Interne oudits hersien hoe effektief die FMS-vereistes geïmplementeer is.	1	2	3	4	5		
Uitdagings ondervind met die implementering (integrasie) van die FMS in ons daaglikse bedrywighede, sluit in die volgende.								
13.	Gebrek aan bestuursbetrokkenheid en toewyding.	1	2	3	4	5		
14.	Die hoë koste van die implementering van die FMS-vereistes.	1	2	3	4	5		
15.	Die buitensporige menslike hulpbronne benodig vir implementering.	1	2	3	4	5		
16.	Gebrek aan geskoolde werkers om integrasie effektief te implementeer.	1	2	3	4	5		
17.	Onvoldoende opleiding van werkers op alle vlakke oor die implementering van die FMS-vereistes.	1	2	3	4	5		
18.	Die koste van opleiding is te duur.	1	2	3	4	5		
19.	Die tyd wat benodig word vir opleiding veroorsaak 'n verlies aan produksietyd.	1	2	3	4	5		
20.	Die onbeskikbaarheid van spesifieke opleiding vir identifikasie van valskodlingmot.	1	2	3	4	5		
21.	Werkers se houding teenoor die implementering van die FMS-vereistes is negatief.	1	2	3	4	5		
22.	Gebrek aan motivering en begrip onder werkers oor die implementering van die FMS-vereistes.	1	2	3	4	5		
23.	Gebrek aan werkers se betrokkenheid by die implementering proses van die FMS-vereistes.	1	2	3	4	5		
24.	Werkers' weerstaan veranderinge rakende die implementering van die FMS-vereistes.	1	2	3	4	5		
25.	Onvoldoende inligting is aan werkers verskaf oor veranderinge rakende die implementasie en nuwe pligte.	1	2	3	4	5		
26.	Dis moeilik om die vereiste FMS-dokumentasie effektief te bestuur.	1	2	3	4	5		

27.	Gebrek aan vaardighede om omvattende rekords van alle geïntegreerde plaasprosesse te bestuur.	1	2	3	4	5
28.	Daaglikse operasionele rekords/dokumentasie van alle plaasprosesse is nie ten volle geïntegreer nie.	1	2	3	4	5
29.	Daar is geen gestandaardiseerde vorms om die FMS-vereistes te help implementeer nie.	1	2	3	4	5
30.	Daar is geen geïntegreerde interne oudit om effektiewe implementasie te verseker nie.	1	2	3	4	5
31.	Gebrek aan toegang tot konsultante met toepaslike ondervinding in die integrasie van verskillende bestuurstelsels .	1	2	3	4	5
32.	Swak koördinasie tussen die produsent en aangestelde konsultant of derde party oor die integrasie van FMS-vereistes (bv. boordsanitasie).	1	2	3	4	5
33.	Onvoldoende inligting verskaf aan sitrusprodusente oor EU-invoervereistes.	1	2	3	4	5
34.	Gebrek aan regeringsondersteuning en samewerking om die FMS-vereistes effektief te implementer.	1	2	3	4	5
35.	Onvoldoende tyd om veranderinge aan die FMS-vereistes te implementeer.	1	2	3	4	5
36.	Die huidige implementasiebenadering is nie effektief nie.	1	2	3	4	5

APPENDIX B: DESCRIPTIVE STATISTICS

Frequency Tables

Job Title or Position (specifically dealing with the citrus supply chain on the citrus farm)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Farm Owner	**59**	**28.8**	**48.8**	**48.8**
	Farm Manager	**31**	**15.1**	**25.6**	**74.4**
	Production Manager	**14**	**6.8**	**11.6**	**86.0**
	Senior Manager (e.g. quality control manager)	**4**	**2.0**	**3.3**	**89.3**
	Senior employee (related to the citrus supply chain)	**4**	**2.0**	**3.3**	**92.6**
	other	**9**	**4.4**	**7.4**	**100.0**
	Total	**121**	**59.0**	**100.0**	
Missing	System	**84**	**41.0**		
Total		**205**	**100.0**		

[Other] Job Title or Position (specifically dealing with the citrus supply chain on the citrus farm)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		**197**	**96.1**	**96.1**	**96.1**
	admin	**1**	**.5**	**.5**	**96.6**
	Admin	**1**	**.5**	**.5**	**97.1**
	Operasionele Best	**1**	**.5**	**.5**	**97.6**
	Packhouse manager	**1**	**.5**	**.5**	**98.0**
	Quality Manager	**1**	**.5**	**.5**	**98.5**
	Tegniese Adviseur	**1**	**.5**	**.5**	**99.0**
	Tegniese Bestuurd	**1**	**.5**	**.5**	**99.5**
	Uitvoerder	**1**	**.5**	**.5**	**100.0**
	Total	**205**	**100.0**	**100.0**	

Classification of the citrus producer according to the annual turnover

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Small-scale producer (annual turnover ranging from R50 000 - R5 million)	**47**	**22.9**	**39.5**	**39.5**
	Medium-scale producer (annual turnover ranging from R5 million – R20 million)	**48**	**23.4**	**40.3**	**79.8**
	Large-scale producer (annual turnover above R20 million)	**24**	**11.7**	**20.2**	**100.0**
	Total	**119**	**58.0**	**100.0**	
Missing	System	**86**	**42.0**		
Total		**205**	**100.0**		

Producer's years of experience in farming fresh produce

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 10 years	**14**	**6.8**	**11.6**	**11.6**
	10-15 years	**25**	**12.2**	**20.7**	**32.2**
	15 years and more	**82**	**40.0**	**67.8**	**100.0**
	Total	**121**	**59.0**	**100.0**	
Missing	System	**84**	**41.0**		

Total		**205**	**100.0**		

Producer's years of exporting citrus to the EU

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	New entrant (less than 3 years)	**7**	**3.4**	**5.8**	**5.8**
	3-10 years	**37**	**18.0**	**30.6**	**36.4**
	10-15 years	**17**	**8.3**	**14.0**	**50.4**
	15 years and more	**60**	**29.3**	**49.6**	**100.0**
	Total	**121**	**59.0**	**100.0**	
Missing	System	**84**	**41.0**		
Total		**205**	**100.0**		

[2018] Citrus exporting seasons in which the producer exported citrus to the EU

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	**92**	**44.9**	**100.0**	**100.0**
Missing	System	**113**	**55.1**		
Total		**205**	**100.0**		

[2019] Citrus exporting seasons in which the producer exported citrus to the EU

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	**99**	**48.3**	**100.0**	**100.0**
Missing	System	**106**	**51.7**		
Total		**205**	**100.0**		

[2020] Citrus exporting seasons in which the producer exported citrus to the EU

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	**105**	**51.2**	**100.0**	**100.0**
Missing	System	**100**	**48.8**		
Total		**205**	**100.0**		

[2021] Citrus exporting seasons in which the producer exported citrus to the EU

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	**105**	**51.2**	**100.0**	**100.0**
Missing	System	**100**	**48.8**		
Total		**205**	**100.0**		

[2022] Citrus exporting seasons in which the producer exported citrus to the EU

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	**115**	**56.1**	**100.0**	**100.0**
Missing	System	**90**	**43.9**		
Total		**205**	**100.0**		

Please select which of the statements applies to the packhouse used to pack the majority of the citrus exported to the EU

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	The producer owns the packhouse.	**30**	**14.6**	**24.8**	**24.8**
	The producer transports the citrus to a packhouse	**63**	**30.7**	**52.1**	**76.9**

	privately owned by a different company and pays packing fees.				
	The producer transports the citrus to a packhouse which is privately owned by a company, of which the producer is a memb	**28**	**13.7**	**23.1**	**100.0**
	Total	**121**	**59.0**	**100.0**	
Missing	System	**84**	**41.0**		
Total		**205**	**100.0**		

[Other] Please select which of the statements applies to the packhouse used to pack the majority of the citrus exported to the EU

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		**205**	**100.0**	**100.0**	**100.0**

[GlobalG.A.P certification] Producer certification:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	**121**	**59.0**	**100.0**	**100.0**
Missing	System	**84**	**41.0**		
Total		**205**	**100.0**		

[Tesco Nurture] Producer certification:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	**49**	**23.9**	**100.0**	**100.0**
Missing	System	**156**	**76.1**		
Total		**205**	**100.0**		

[Field to Fork] Producer certification:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	**12**	**5.9**	**100.0**	**100.0**
Missing	System	**193**	**94.1**		
Total		**205**	**100.0**		

[LEAF Marque] Producer certification:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	**3**	**1.5**	**100.0**	**100.0**
Missing	System	**202**	**98.5**		
Total		**205**	**100.0**		

[Albert Hejin PPP Protocol] Producer certification:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	**26**	**12.7**	**100.0**	**100.0**
Missing	System	**179**	**87.3**		
Total		**205**	**100.0**		

[HACCP (SANS 10330)] Producer certification:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	**9**	**4.4**	**100.0**	**100.0**
Missing	System	**196**	**95.6**		
Total		**205**	**100.0**		

[British Retail Consortium (BRC)] Producer certification:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	**11**	**5.4**	**100.0**	**100.0**
Missing	System	**194**	**94.6**		
Total		**205**	**100.0**		

[International Organization for Standardization (ISO) e. g., ISO 9001:2015 or ISO 14001] Producer certification:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	**4**	**2.0**	**100.0**	**100.0**
Missing	System	**201**	**98.0**		
Total		**205**	**100.0**		

[GlobalG.A.P Produce Handling Assurance Standard] Producer certification:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	**15**	**7.3**	**100.0**	**100.0**
Missing	System	**190**	**92.7**		
Total		**205**	**100.0**		

[Other] The producer is certified with the following certification scheme(s), more than one option can be selected

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		**175**	**85.4**	**85.4**	**85.4**
	Costco	**1**	**.5**	**.5**	**85.9**
	F.S.M.A	**1**	**.5**	**.5**	**86.3**
	Fairtrade, Siza	**1**	**.5**	**.5**	**86.8**
	FSMA	**2**	**1.0**	**1.0**	**87.8**
	FSMA en ook SIZA	**1**	**.5**	**.5**	**88.3**
	FSMA Siza	**1**	**.5**	**.5**	**88.8**
	FSMA, SIZA	**2**	**1.0**	**1.0**	**89.8**
	Siza	**3**	**1.5**	**1.5**	**91.2**
	SIZA	**13**	**6.3**	**6.3**	**97.6**
	SIZA & WIETA	**1**	**.5**	**.5**	**98.0**
	SIZA Social , GRASP	**1**	**.5**	**.5**	**98.5**
	SIZA, Fsma	**1**	**.5**	**.5**	**99.0**
	SIZA; EU ORganic certificate	**1**	**.5**	**.5**	**99.5**
	SMETA	**1**	**.5**	**.5**	**100.0**
	Total	**205**	**100.0**	**100.0**	

The following general approach was taken to integrate or implement the FMS requirements

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	The producer appointed consultants or a third party to assist with the integration and implementation of the FMS require	**59**	**28.8**	**49.2**	**49.2**
	The producer hired or designated employees specifically for this purpose.	**20**	**9.8**	**16.7**	**65.8**
	The farm owner opted to integrate or implement the	**40**	**19.5**	**33.3**	**99.2**

	FMS requirements themselves.				
	other	**1**	**.5**	**.8**	**100.0**
	Total	**120**	**58.5**	**100.0**	
Missing	System	**85**	**41.5**		
Total		**205**	**100.0**		

[Other] The following general approach was taken to integrate or implement the FMS requirements

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		**204**	**99.5**	**99.5**	**99.5**
	X	**1**	**.5**	**.5**	**100.0**
	Total	**205**	**100.0**	**100.0**	

Non-compliances

The detection of regulated pests (false codling moth).

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	**7**	**3.4**	**7.2**	**7.2**
	Disagree	**17**	**8.3**	**17.5**	**24.7**
	Neutral	**16**	**7.8**	**16.5**	**41.2**
	Agree	**35**	**17.1**	**36.1**	**77.3**
	Strongly Agree	**22**	**10.7**	**22.7**	**100.0**
	Total	**97**	**47.3**	**100.0**	
Missing	System	**108**	**52.7**		
Total		**205**	**100.0**		

Exceeding the pesticide residue limits (maximum residue limits).

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	**14**	**6.8**	**14.4**	**14.4**
	Disagree	**20**	**9.8**	**20.6**	**35.1**
	Neutral	**19**	**9.3**	**19.6**	**54.6**
	Agree	**35**	**17.1**	**36.1**	**90.7**
	Strongly Agree	**9**	**4.4**	**9.3**	**100.0**
	Total	**97**	**47.3**	**100.0**	
Missing	System	**108**	**52.7**		
Total		**205**	**100.0**		

Non-compliance with labelling requirements.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	**15**	**7.3**	**15.5**	**15.5**
	Disagree	**28**	**13.7**	**28.9**	**44.3**
	Neutral	**24**	**11.7**	**24.7**	**69.1**
	Agree	**25**	**12.2**	**25.8**	**94.8**
	Strongly Agree	**5**	**2.4**	**5.2**	**100.0**
	Total	**97**	**47.3**	**100.0**	
Missing	System	**108**	**52.7**		
Total		**205**	**100.0**		

Exceeding the maximum levels of regulated contaminants such as aflatoxin (produced by Aspergillus flavus).

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	**17**	**8.3**	**17.5**	**17.5**
	Disagree	**20**	**9.8**	**20.6**	**38.1**
	Neutral	**35**	**17.1**	**36.1**	**74.2**
	Agree	**21**	**10.2**	**21.6**	**95.9**

	Strongly Agree	**4**	**2.0**	**4.1**	**100.0**
	Total	**97**	**47.3**	**100.0**	
Missing	System	**108**	**52.7**		
Total		**205**	**100.0**		

Absent, incomplete, unreadable or forged phytosanitary certificate.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	**25**	**12.2**	**25.8**	**25.8**
	Disagree	**24**	**11.7**	**24.7**	**50.5**
	Neutral	**17**	**8.3**	**17.5**	**68.0**
	Agree	**24**	**11.7**	**24.7**	**92.8**
	Strongly Agree	**7**	**3.4**	**7.2**	**100.0**
	Total	**97**	**47.3**	**100.0**	
Missing	System	**108**	**52.7**		
Total		**205**	**100.0**		

Inadequate additional declaration on the phytosanitary certificate.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	**18**	**8.8**	**18.6**	**18.6**
	Disagree	**25**	**12.2**	**25.8**	**44.3**
	Neutral	**25**	**12.2**	**25.8**	**70.1**
	Agree	**22**	**10.7**	**22.7**	**92.8**
	Strongly Agree	**7**	**3.4**	**7.2**	**100.0**
	Total	**97**	**47.3**	**100.0**	
Missing	System	**108**	**52.7**		
Total		**205**	**100.0**		

Non-compliance with the International Standards for Phytosanitary Measures (ISPM) 15 for wood packaging material.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	**19**	**9.3**	**19.6**	**19.6**
	Disagree	**22**	**10.7**	**22.7**	**42.3**
	Neutral	**31**	**15.1**	**32.0**	**74.2**
	Agree	**19**	**9.3**	**19.6**	**93.8**
	Strongly Agree	**6**	**2.9**	**6.2**	**100.0**
	Total	**97**	**47.3**	**100.0**	
Missing	System	**108**	**52.7**		
Total		**205**	**100.0**		

Integration measures

Implementation takes place at a strategic level (e.g. policies are integrated).

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	**2**	**1.0**	**2.2**	**2.2**
	Disagree	**2**	**1.0**	**2.2**	**4.3**
	Neutral	**11**	**5.4**	**11.8**	**16.1**
	Agree	**52**	**25.4**	**55.9**	**72.0**
	Strongly Agree	**26**	**12.7**	**28.0**	**100.0**
	Total	**93**	**45.4**	**100.0**	
Missing	System	**112**	**54.6**		
Total		**205**	**100.0**		

Implementation takes place at an operational level (e.g. most records, work instructions and checklists are integrated).

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	**1**	**.5**	**1.1**	**1.1**

	Disagree	1	.5	1.1	2.2
	Neutral	6	2.9	6.5	8.6
	Agree	59	28.8	63.4	72.0
	Strongly Agree	26	12.7	28.0	100.0
	Total	93	45.4	100.0	
Missing	System	112	54.6		
Total		205	100.0		

Internal audits are conducted on the citrus farm(s).

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	1	.5	1.1	1.1
	Disagree	6	2.9	6.5	7.5
	Neutral	9	4.4	9.7	17.2
	Agree	57	27.8	61.3	78.5
	Strongly Agree	20	9.8	21.5	100.0
	Total	93	45.4	100.0	
Missing	System	112	54.6		
Total		205	100.0		

Internal audits review all stakeholder requirements during a single audit (e.g. GlobalG.A. P, FMS & other requirements).

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	2	1.0	2.2	2.2
	Disagree	3	1.5	3.2	5.4
	Neutral	19	9.3	20.4	25.8
	Agree	44	21.5	47.3	73.1
	Strongly Agree	25	12.2	26.9	100.0
	Total	93	45.4	100.0	
Missing	System	112	54.6		
Total		205	100.0		

Internal audits review how effectively the FMS requirements have been implemented.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	1	.5	1.1	1.1
	Disagree	4	2.0	4.3	5.4
	Neutral	23	11.2	24.7	30.1
	Agree	47	22.9	50.5	80.6
	Strongly Agree	18	8.8	19.4	100.0
	Total	93	45.4	100.0	
Missing	System	112	54.6		
Total		205	100.0		

Difficulties

Lack of management involvement and commitment.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	20	9.8	23.0	23.0
	Disagree	46	22.4	52.9	75.9
	Neutral	9	4.4	10.3	86.2
	Agree	9	4.4	10.3	96.6
	Strongly Agree	3	1.5	3.4	100.0
	Total	87	42.4	100.0	
Missing	System	118	57.6		
Total		205	100.0		

The high cost of implementing the FMS requirements.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	**5**	**2.4**	**5.7**	**5.7**
	Disagree	**16**	**7.8**	**18.4**	**24.1**
	Neutral	**14**	**6.8**	**16.1**	**40.2**
	Agree	**27**	**13.2**	**31.0**	**71.3**
	Strongly Agree	**25**	**12.2**	**28.7**	**100.0**
	Total	**87**	**42.4**	**100.0**	
Missing	System	**118**	**57.6**		
Total		**205**	**100.0**		

The excessive human resources required for implementation.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	**3**	**1.5**	**3.4**	**3.4**
	Disagree	**20**	**9.8**	**23.0**	**26.4**
	Neutral	**14**	**6.8**	**16.1**	**42.5**
	Agree	**27**	**13.2**	**31.0**	**73.6**
	Strongly Agree	**23**	**11.2**	**26.4**	**100.0**
	Total	**87**	**42.4**	**100.0**	
Missing	System	**118**	**57.6**		
Total		**205**	**100.0**		

Lack of skilled workers to effectively implement integration.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	**4**	**2.0**	**4.6**	**4.6**
	Disagree	**21**	**10.2**	**24.1**	**28.7**
	Neutral	**24**	**11.7**	**27.6**	**56.3**
	Agree	**30**	**14.6**	**34.5**	**90.8**
	Strongly Agree	**8**	**3.9**	**9.2**	**100.0**
	Total	**87**	**42.4**	**100.0**	
Missing	System	**118**	**57.6**		
Total		**205**	**100.0**		

Training of workers at all levels on the implementation of FMS requirements is inadequate.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	**5**	**2.4**	**5.7**	**5.7**
	Disagree	**31**	**15.1**	**35.6**	**41.4**
	Neutral	**28**	**13.7**	**32.2**	**73.6**
	Agree	**15**	**7.3**	**17.2**	**90.8**
	Strongly Agree	**8**	**3.9**	**9.2**	**100.0**
	Total	**87**	**42.4**	**100.0**	
Missing	System	**118**	**57.6**		
Total		**205**	**100.0**		

The cost of training is too expensive.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	**5**	**2.4**	**5.7**	**5.7**
	Disagree	**22**	**10.7**	**25.3**	**31.0**
	Neutral	**25**	**12.2**	**28.7**	**59.8**
	Agree	**25**	**12.2**	**28.7**	**88.5**
	Strongly Agree	**10**	**4.9**	**11.5**	**100.0**
	Total	**87**	**42.4**	**100.0**	
Missing	System	**118**	**57.6**		
Total		**205**	**100.0**		

The time required for training causes a loss of production time.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	**3**	**1.5**	**3.4**	**3.4**
	Disagree	**26**	**12.7**	**29.9**	**33.3**
	Neutral	**21**	**10.2**	**24.1**	**57.5**
	Agree	**24**	**11.7**	**27.6**	**85.1**
	Strongly Agree	**13**	**6.3**	**14.9**	**100.0**
	Total	**87**	**42.4**	**100.0**	
Missing	System	**118**	**57.6**		
Total		**205**	**100.0**		

The unavailability of specific false codling moth identification training.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	**7**	**3.4**	**8.1**	**8.1**
	Disagree	**27**	**13.2**	**31.4**	**39.5**
	Neutral	**20**	**9.8**	**23.3**	**62.8**
	Agree	**24**	**11.7**	**27.9**	**90.7**
	Strongly Agree	**8**	**3.9**	**9.3**	**100.0**
	Total	**86**	**42.0**	**100.0**	
Missing	System	**119**	**58.0**		
Total		**205**	**100.0**		

Workers' attitude towards the implementation of FMS requirements is negative.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	**10**	**4.9**	**11.6**	**11.6**
	Disagree	**40**	**19.5**	**46.5**	**58.1**
	Neutral	**21**	**10.2**	**24.4**	**82.6**
	Agree	**12**	**5.9**	**14.0**	**96.5**
	Strongly Agree	**3**	**1.5**	**3.5**	**100.0**
	Total	**86**	**42.0**	**100.0**	
Missing	System	**119**	**58.0**		
Total		**205**	**100.0**		

Lack of motivation and understanding among workers about the implementation of the FMS requirements.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	**8**	**3.9**	**9.3**	**9.3**
	Disagree	**34**	**16.6**	**39.5**	**48.8**
	Neutral	**22**	**10.7**	**25.6**	**74.4**
	Agree	**18**	**8.8**	**20.9**	**95.3**
	Strongly Agree	**4**	**2.0**	**4.7**	**100.0**
	Total	**86**	**42.0**	**100.0**	
Missing	System	**119**	**58.0**		
Total		**205**	**100.0**		

Lack of workers' involvement in the implementation process of the FMS requirements.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	**7**	**3.4**	**8.2**	**8.2**
	Disagree	**35**	**17.1**	**41.2**	**49.4**
	Neutral	**23**	**11.2**	**27.1**	**76.5**
	Agree	**16**	**7.8**	**18.8**	**95.3**
	Strongly Agree	**4**	**2.0**	**4.7**	**100.0**
	Total	**85**	**41.5**	**100.0**	

Missing	System	**120**	**58.5**		
Total		**205**	**100.0**		

Workers resist changes regarding the implementation of FMS requirements.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	**8**	**3.9**	**9.3**	**9.3**
	Disagree	**38**	**18.5**	**44.2**	**53.5**
	Neutral	**23**	**11.2**	**26.7**	**80.2**
	Agree	**12**	**5.9**	**14.0**	**94.2**
	Strongly Agree	**5**	**2.4**	**5.8**	**100.0**
	Total	**86**	**42.0**	**100.0**	
Missing	System	**119**	**58.0**		
Total		**205**	**100.0**		

Insufficient information was provided to workers about changes regarding the implementation and new duties.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	**8**	**3.9**	**9.4**	**9.4**
	Disagree	**50**	**24.4**	**58.8**	**68.2**
	Neutral	**12**	**5.9**	**14.1**	**82.4**
	Agree	**14**	**6.8**	**16.5**	**98.8**
	Strongly Agree	**1**	**.5**	**1.2**	**100.0**
	Total	**85**	**41.5**	**100.0**	
Missing	System	**120**	**58.5**		
Total		**205**	**100.0**		

Difficult to manage the required FMS documentation effectively.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	**7**	**3.4**	**8.2**	**8.2**
	Disagree	**35**	**17.1**	**41.2**	**49.4**
	Neutral	**17**	**8.3**	**20.0**	**69.4**
	Agree	**20**	**9.8**	**23.5**	**92.9**
	Strongly Agree	**6**	**2.9**	**7.1**	**100.0**
	Total	**85**	**41.5**	**100.0**	
Missing	System	**120**	**58.5**		
Total		**205**	**100.0**		

Lack of skills to manage comprehensive records of all integrated farm processes.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	**7**	**3.4**	**8.2**	**8.2**
	Disagree	**39**	**19.0**	**45.9**	**54.1**
	Neutral	**17**	**8.3**	**20.0**	**74.1**
	Agree	**18**	**8.8**	**21.2**	**95.3**
	Strongly Agree	**4**	**2.0**	**4.7**	**100.0**
	Total	**85**	**41.5**	**100.0**	
Missing	System	**120**	**58.5**		
Total		**205**	**100.0**		

Daily operational records/documentation of all farm processes are not fully integrated.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	**7**	**3.4**	**8.2**	**8.2**
	Disagree	**35**	**17.1**	**41.2**	**49.4**
	Neutral	**23**	**11.2**	**27.1**	**76.5**
	Agree	**14**	**6.8**	**16.5**	**92.9**

	Strongly Agree	**6**	**2.9**	**7.1**	**100.0**
	Total	**85**	**41.5**	**100.0**	
Missing	System	**120**	**58.5**		
Total		**205**	**100.0**		

There are no standardised forms to help implement the FMS requirements.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	**7**	**3.4**	**8.2**	**8.2**
	Disagree	**33**	**16.1**	**38.8**	**47.1**
	Neutral	**18**	**8.8**	**21.2**	**68.2**
	Agree	**23**	**11.2**	**27.1**	**95.3**
	Strongly Agree	**4**	**2.0**	**4.7**	**100.0**
	Total	**85**	**41.5**	**100.0**	
Missing	System	**120**	**58.5**		
Total		**205**	**100.0**		

There is no integrated internal audit to ensure effective implementation.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	**7**	**3.4**	**8.2**	**8.2**
	Disagree	**32**	**15.6**	**37.6**	**45.9**
	Neutral	**27**	**13.2**	**31.8**	**77.6**
	Agree	**16**	**7.8**	**18.8**	**96.5**
	Strongly Agree	**3**	**1.5**	**3.5**	**100.0**
	Total	**85**	**41.5**	**100.0**	
Missing	System	**120**	**58.5**		
Total		**205**	**100.0**		

Lack of access to consultants with appropriate experience in integrating different management systems.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	**10**	**4.9**	**11.8**	**11.8**
	Disagree	**41**	**20.0**	**48.2**	**60.0**
	Neutral	**19**	**9.3**	**22.4**	**82.4**
	Agree	**13**	**6.3**	**15.3**	**97.6**
	Strongly Agree	**2**	**1.0**	**2.4**	**100.0**
	Total	**85**	**41.5**	**100.0**	
Missing	System	**120**	**58.5**		
Total		**205**	**100.0**		

Poor coordination between the producer and appointed consultant or third party on the integration of FMS requirements (e.g. orchard sanitation).

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	**12**	**5.9**	**14.1**	**14.1**
	Disagree	**44**	**21.5**	**51.8**	**65.9**
	Neutral	**20**	**9.8**	**23.5**	**89.4**
	Agree	**9**	**4.4**	**10.6**	**100.0**
	Total	**85**	**41.5**	**100.0**	
Missing	System	**120**	**58.5**		
Total		**205**	**100.0**		

Insufficient information was provided to citrus growers on EU import requirements.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	**20**	**9.8**	**23.5**	**23.5**
	Disagree	**43**	**21.0**	**50.6**	**74.1**
	Neutral	**12**	**5.9**	**14.1**	**88.2**

	Agree	**8**	**3.9**	**9.4**	**97.6**
	Strongly Agree	**2**	**1.0**	**2.4**	**100.0**
	Total	**85**	**41.5**	**100.0**	
Missing	System	**120**	**58.5**		
Total		**205**	**100.0**		

Lack of government support and cooperation to effectively implement the FMS requirements.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	**6**	**2.9**	**7.1**	**7.1**
	Disagree	**18**	**8.8**	**21.2**	**28.2**
	Neutral	**12**	**5.9**	**14.1**	**42.4**
	Agree	**23**	**11.2**	**27.1**	**69.4**
	Strongly Agree	**26**	**12.7**	**30.6**	**100.0**
	Total	**85**	**41.5**	**100.0**	
Missing	System	**120**	**58.5**		
Total		**205**	**100.0**		

Insufficient time to implement changes made to the FMS requirements.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	**6**	**2.9**	**7.1**	**7.1**
	Disagree	**29**	**14.1**	**34.1**	**41.2**
	Neutral	**27**	**13.2**	**31.8**	**72.9**
	Agree	**17**	**8.3**	**20.0**	**92.9**
	Strongly Agree	**6**	**2.9**	**7.1**	**100.0**
	Total	**85**	**41.5**	**100.0**	
Missing	System	**120**	**58.5**		
Total		**205**	**100.0**		

The current chosen implementation (integration) approach is not effective

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	**9**	**4.4**	**10.6**	**10.6**
	Disagree	**28**	**13.7**	**32.9**	**43.5**
	Neutral	**31**	**15.1**	**36.5**	**80.0**
	Agree	**13**	**6.3**	**15.3**	**95.3**
	Strongly Agree	**4**	**2.0**	**4.7**	**100.0**
	Total	**85**	**41.5**	**100.0**	
Missing	System	**120**	**58.5**		
Total		**205**	**100.0**		

Descriptive statistics for Non-compliances

	N	Minimum	Maximum	Mean	Std. Deviation
Implementation takes place at a strategic level (e.g. policies are integrated).	**93**	**1**	**5**	**4.05**	**.826**
The detection of regulated pests (false codling moth).	**97**	**1**	**5**	**3.49**	**1.226**
Exceeding the pesticide residue limits (maximum residue limits).	**97**	**1**	**5**	**3.05**	**1.236**
Non-compliance with labelling requirements.	**97**	**1**	**5**	**2.76**	**1.153**
Inadequate additional declaration on the phytosanitary certificate.	**97**	**1**	**5**	**2.74**	**1.210**

Exceeding the maximum levels of regulated contaminants such as aflatoxin (produced by Aspergillus flavus).	**97**	**1**	**5**	**2.74**	**1.111**
Non-compliance with the International Standards for Phytosanitary Measures (ISPM) 15 for wood packaging material.	**97**	**1**	**5**	**2.70**	**1.174**
Absent, incomplete, unreadable or forged phytosanitary certificate.	**97**	**1**	**5**	**2.63**	**1.302**
Valid N (listwise)	**93**				

Descriptive statistics for Integration measures

	N	Minimum	Maximum	Mean	Std. Deviation
Implementation takes place at an operational level (e.g. most records, work instructions and checklists are integrated).	**93**	**1**	**5**	**4.16**	**.680**
Implementation takes place at a strategic level (e.g. policies are integrated).	**93**	**1**	**5**	**4.05**	**.826**
Internal audits are conducted on the citrus farm(s).	**93**	**1**	**5**	**3.96**	**.820**
Internal audits review all stakeholder requirements during a single audit (e.g. GlobalG.A. P, FMS & other requirements).	**93**	**1**	**5**	**3.94**	**.895**
Internal audits review how effectively the FMS requirements have been implemented.	**93**	**1**	**5**	**3.83**	**.829**
Valid N (listwise)	**93**				

Descriptive statistics for difficulties

	N	Minimum	Maximum	Mean	Std. Deviation
Lack of management involvement and commitment.	**87**	**1**	**5**	**2.18**	**1.018**
The high cost of implementing the FMS requirements.	**87**	**1**	**5**	**3.59**	**1.244**
The excessive human resources required for implementation.	**87**	**1**	**5**	**3.54**	**1.209**
The time required for training causes a loss of production time.	**87**	**1**	**5**	**3.21**	**1.132**
Lack of skilled workers to effectively implement integration.	**87**	**1**	**5**	**3.20**	**1.055**
The cost of training is too expensive.	**87**	**1**	**5**	**3.15**	**1.105**
The unavailability of specific false codling moth identification training.	**86**	**1**	**5**	**2.99**	**1.143**
Training of workers at all levels on the implementation of FMS requirements is inadequate.	**87**	**1**	**5**	**2.89**	**1.061**
Insufficient time to implement changes made to the FMS requirements.	**85**	**1**	**5**	**2.86**	**1.048**
There are no standardised forms to help implement the FMS requirements.	**85**	**1**	**5**	**2.81**	**1.075**
Difficult to manage the required FMS documentation effectively.	**85**	**1**	**5**	**2.80**	**1.111**
Daily operational records/documentation of all farm processes are not fully integrated.	**85**	**1**	**5**	**2.73**	**1.062**

Lack of motivation and understanding among workers about the implementation of the FMS requirements.	**86**	**1**	**5**	**2.72**	**1.048**
There is no integrated internal audit to ensure effective implementation.	**85**	**1**	**5**	**2.72**	**.983**
Lack of workers' involvement in the implementation process of the FMS requirements	**85**	**1**	**5**	**2.71**	**1.021**
Lack of skills to manage comprehensive records of all integrated farm processes.	**85**	**1**	**5**	**2.68**	**1.049**
Workers resist changes regarding the implementation of FMS requirements.	**86**	**1**	**5**	**2.63**	**1.030**
Workers' attitude towards the implementation of FMS requirements is negative.	**86**	**1**	**5**	**2.51**	**.991**
Lack of access to consultants with appropriate experience in integrating different management systems.	**85**	**1**	**5**	**2.48**	**.971**
Lack of government support and cooperation to effectively implement the FMS requirements.	**85**	**1**	**5**	**3.53**	**1.315**
Insufficient information was provided to workers about changes regarding the implementation and new duties.	**85**	**1**	**5**	**2.41**	**.917**
Poor coordination between the producer and appointed consultant or third party on the integration of FMS requirements (e.g. orchard sanitation).	**85**	**1**	**4**	**2.31**	**.845**
Insufficient information was provided to citrus growers on EU import requirements.	**85**	**1**	**5**	**2.16**	**.974**
The current chosen implementation (integration) approach is not effective.	**85**	**1**	**5**	**2.71**	**1.010**
Valid N (list wise)	**85**				

APPENDIX C: RELIABILITY TEST RESULTS, FACTOR ANALYSIS AND ANOVA RESULTS

Factor Analysis: Non-compliances

Correlation Matrix[a]

a. Determinant = .002

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		**.821**
Bartlett's Test of Sphericity	Approx. Chi-Square	**590.980**
	df	**21**
	Sig.	**<.001**

Communalities

	Initial	Extraction
The detection of regulated pests (false codling moth).	**1.000**	**.391**
Exceeding the pesticide residue limits (maximum residue limits).] Main Non-compliances	**1.000**	**.590**
Non-compliance with labelling requirements.	**1.000**	**.684**
Exceeding the maximum levels of regulated contaminants such as aflatoxin (produced by Aspergillus flavus).] Main Non-compliances	**1.000**	**.716**
Absent, incomplete, unreadable or forged phytosanitary certificate.] Main Non-compliances	**1.000**	**.830**
Inadequate additional declaration on the phytosanitary certificate.] Main Non-compliances	**1.000**	**.822**
Non-compliance with the International Standards for Phytosanitary Measures (ISPM) 15 for wood packaging material.] Main Non-compliances	**1.000**	**.774**

Extraction Method: Principal Component Analysis.

Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	**4.808**	**68.681**	**68.681**	**4.808**	**68.681**	**68.681**
2	**.840**	**12.001**	**80.682**			
3	**.490**	**7.005**	**87.687**			
4	**.343**	**4.899**	**92.586**			
5	**.285**	**4.077**	**96.663**			
6	**.186**	**2.656**	**99.318**			
7	**.048**	**.682**	**100.000**			

Extraction Method: Principal Component Analysis.

Component Matrix[a]

	Component 1
Absent, incomplete, unreadable or forged phytosanitary certificate.] Main Non-compliances	**.911**
Inadequate additional declaration on the phytosanitary certificate.] Main Non-compliances	**.907**
Non-compliance with the International Standards for Phytosanitary Measures (ISPM) 15 for wood packaging material.] Main Non-compliances	**.880**
Exceeding the maximum levels of regulated contaminants such as aflatoxin (produced by Aspergillus flavus).] Main Non-compliances	**.846**
Non-compliance with labelling requirements.	**.827**
Exceeding the pesticide residue limits (maximum residue limits).] Main Non-compliances	**.768**
The detection of regulated pests (false codling moth).	**.625**

Extraction Method: Principal Component Analysis.

a. 1 components extracted.

Rotated Component Matrix[a]

a. Only one component was extracted. The solution cannot be rotated.

Reliability: Non-compliances

Scale: C1

Case Processing Summary

		N	%
Cases	Valid	**97**	**47.3**
	Excluded[a]	**108**	**52.7**
	Total	**205**	**100.0**

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.921	**7**

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
The detection of regulated pests (false codling moth).	**16.63**	**38.361**	**.542**	**.930**
Exceeding the pesticide residue limits (maximum residue limits).] Main Non-compliances	**17.07**	**36.172**	**.699**	**.915**
Non-compliance with labelling requirements.	**17.36**	**36.212**	**.760**	**.908**
Exceeding the maximum levels of regulated contaminants such as aflatoxin (produced by Aspergillus flavus).] Main Non-compliances	**17.38**	**36.447**	**.776**	**.907**
Absent, incomplete, unreadable or forged phytosanitary certificate.] Main Non-compliances	**17.49**	**33.482**	**.857**	**.898**
Inadequate additional declaration on the phytosanitary certificate.] Main Non-compliances	**17.38**	**34.551**	**.849**	**.899**
Non-compliance with the International Standards for Phytosanitary Measures (ISPM) 15 for wood packaging material.] Main Non-compliances	**17.42**	**35.351**	**.814**	**.903**

Factor Analysis: Integration measures

Correlation Matrix[a]

a. Determinant = .072

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		**.853**
	Approx. Chi-Square	**235.236**

Bartlett's Test of Sphericity	df	**10**
	Sig.	**<.001**

Communalities

	Initial	Extraction
Implementation takes place at a strategic level (e.g. policies are integrated).	**1.000**	**.628**
Implementation takes place at an operational level (e.g. most records, work instructions and checklists are integrated).	**1.000**	**.755**
Internal audits are conducted on the citrus farm(s).	**1.000**	**.723**
Internal audits review all stakeholder requirements during a single audit (e.g. GlobalG.A. P, FMS & other requirements).	**1.000**	**.656**
Internal audits review how effectively the FMS requirements have been implemented.	**1.000**	**.646**

Extraction Method: Principal Component Analysis.

Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	**3.408**	**68.163**	**68.163**	**3.408**	**68.163**	**68.163**
2	**.586**	**11.717**	**79.879**			
3	**.407**	**8.143**	**88.022**			
4	**.329**	**6.573**	**94.595**			
5	**.270**	**5.405**	**100.000**			

Extraction Method: Principal Component Analysis.

Component Matrix[a]

	Component 1
Implementation takes place at an operational level (e.g. most records, work instructions and checklists are integrated).	**.869**
Internal audits are conducted on the citrus farm(s).	**.850**
Internal audits review all stakeholder requirements during a single audit (e.g. GlobalG.A. P, FMS & other requirements).	**.810**
Internal audits review how effectively the FMS requirements have been implemented.	**.804**
Implementation takes place at a strategic level (e.g. policies are integrated).	**.793**

Extraction Method: Principal Component Analysis.
a. 1 components extracted.

Rotated Component Matrix[a]

a. Only one component was extracted. The solution cannot be rotated.

Reliability: Integration measures

Scale: C2

Case Processing Summary

		N	%
Cases	Valid	**93**	**45.4**
	Excluded[a]	**112**	**54.6**
	Total	**205**	**100.0**

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.879	**5**

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Implementation takes place at a strategic level (e.g. policies are integrated).	**15.88**	**7.453**	**.663**	**.864**
Implementation takes place at an operational level (e.g. most records, work instructions and checklists are integrated).	**15.77**	**7.720**	**.779**	**.843**
Internal audits are conducted on the citrus farm(s).	**15.98**	**7.152**	**.753**	**.843**
Internal audits review all stakeholder requirements during a single audit (e.g. GlobalG.A. P, FMS & other requirements).	**16.00**	**7.022**	**.697**	**.858**
Internal audits review how effectively the FMS requirements have been implemented.	**16.11**	**7.336**	**.691**	**.858**

Factor Analysis: Difficulties

Correlation Matrix[a]
a. Determinant = .067

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.715
Bartlett's Test of Sphericity	Approx. Chi-Square	217.738
	df	28
	Sig.	<.001

Component Matrix[a]			
	Component		
	1	2	3
C28 Daily operational records/documentation of all farm processes are not fully integrated.	.761		-.307
C30 There is no integrated internal audit to ensure effective implementation.	.754	-.350	-.307
C17 Training of workers at all levels on the implementation of FMS requirements is inadequate.	.745		.409
C29 There are no standardised forms to help implement the FMS requirements.	.703	-.447	
C20 The unavailability of specific false codling moth identification training.	.595		.562
C13 Lack of management involvement and commitment.	.475		.451
C14 The high cost of implementing the FMS requirements.	.406	.759	
C15 The excessive human resources required for implementation.	.489	.695	
Extraction Method: Principal Component Analysis.			
a. 3 components extracted.			

Communalities	
	Extraction
C13 Lack of management involvement and commitment.	.495
C14 The high cost of implementing the FMS requirements.	.827
C15 The excessive human resources required for implementation.	.759
C17 Training of workers at all levels on the implementation of FMS requirements is inadequate.	.727
C20 The unavailability of specific false codling moth identification training.	.686
C28 Daily operational records/documentation of all farm processes are not fully integrated.	.720
C29 There are no standardised forms to help implement the FMS requirements.	.757
C30 There is no integrated internal audit to ensure effective implementation.	.786
Extraction Method: Principal Component Analysis.	

Total Variance Explained				
	Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
Component	Total	% of Variance	Cumulative %	Total
1	3.183	39.789	39.789	2.692
2	1.513	18.916	58.705	2.345
3	1.060	13.253	71.958	1.872
Extraction Method: Principal Component Analysis.				
a. When components are correlated, sums of squared loadings cannot be added to obtain a total variance.				

Pattern Matrix[a]			
	Component		
	1	2	3
C30 There is no integrated internal audit to ensure effective implementation.	.894		
C29 There are no standardised forms to help implement the FMS requirements.	.880		
C28 Daily operational records/documentation of all farm processes are not fully integrated.	.818		
C20 The unavailability of specific false codling moth identification training.		.836	
C17 Training of workers at all levels on the implementation of FMS requirements is inadequate.		.759	
C13 Lack of management involvement and commitment.		.703	
C14 The high cost of implementing the FMS requirements.			.923
C15 The excessive human resources required for implementation.			.843
Extraction Method: Principal Component Analysis. Rotation Method: Promax with Kaiser Normalization. [a]			
a. Rotation converged in 4 iterations.			

Structure Matrix			
	Component		
	1	2	3
C30 There is no integrated internal audit to ensure effective implementation.	.886	.371	
C29 There are no standardised forms to help implement the FMS requirements.	.863	.360	
C28 Daily operational records/documentation of all farm processes are not fully integrated.	.837	.385	

C17 Training of workers at all levels on the implementation of FMS requirements is inadequate.	.482	.840	
C20 The unavailability of specific false codling moth identification training.	.380	.806	
C13 Lack of management involvement and commitment.		.669	.319
C14 The high cost of implementing the FMS requirements.			.908
C15 The excessive human resources required for implementation.		.308	.867

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.

Component Correlation Matrix

Component	1	2	3
1	1.000	.438	.170
2	.438	1.000	.261
3	.170	.261	1.000

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.

Reliability: Difficulty factors

Scale: Difficulty factor 1

Case Processing Summary

		N	%
Cases	Valid	86	42.0
	Excluded[a]	119	58.0
	Total	205	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.658	3

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Lack of management involvement and commitment.	5.88	3.751	.355	.701
Training of workers at all levels on the implementation of FMS requirements is inadequate.	5.17	2.946	.584	.402
The unavailability of specific false codling moth identification training.	5.08	2.993	.483	.545

Reliability

Scale: Difficulty factor 2

Case Processing Summary			
		N	%
Cases	Valid	85	41.5
	Excluded[a]	120	58.5
	Total	205	100.0
a. Listwise deletion based on all variables in the procedure.			

Reliability Statistics	
Cronbach's Alpha	N of Items
.831	3

Item-Total Statistics				
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Daily operational records/documentation of all farm processes are not fully integrated.	5.53	3.514	.665	.793
There are no standardised forms to help implement the FMS requirements.	5.45	3.393	.693	.765
There is no integrated internal audit to ensure effective implementation.	5.54	3.632	.718	.743

Reliability

Scale: Difficulty factor 3

Case Processing Summary			
		N	%
Cases	Valid	87	42.4
	Excluded[a]	118	57.6
	Total	205	100.0
a. Listwise deletion based on all variables in the procedure.			

Reliability Statistics	
Cronbach's Alpha	N of Items
.767	2

Item-Total Statistics				
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted

The high cost of implementing the FMS requirements.	3.54	1.461	.622	.
The excessive human resources required for implementation.	3.59	1.548	.622	.

Descriptive statistics: Difficulty factors

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Operational challenges	87	1	5	2.68	.829
Training challenges	85	1	5	2.75	.900
Financial and Human Resources challenges	87	1	5	3.56	1.104
Valid N (listwise)	85				

Descriptive Statistics									
						95% Confidence Interval for Mean			
		N	Mean	Std. Deviation	Std. Error	Lower Bound	Upper Bound	Minimum	Maximum
Operational challenges	Small-scale producer (annual turnover ranging from R50 000 - R5 million)	31	2.77	.879	.158	2.45	3.10	1	5
	Medium-scale producer (annual turnover ranging from R5 million – R20 million)	37	2.77	.699	.115	2.54	3.01	1	4
	Large-scale producer (annual turnover above R20 million)	19	2.35	.933	.214	1.90	2.80	1	5
	Total	87	2.68	.829	.089	2.51	2.86	1	5
Training challenges	Small-scale producer (annual turnover ranging from R50 000 - R5 million)	29	2.78	1.044	.194	2.38	3.18	1	5
	Medium-scale producer (annual turnover ranging from R5 million – R20 million)	37	2.86	.791	.130	2.60	3.13	1	4
	Large-scale producer (annual turnover above R20 million)	19	2.49	.856	.196	2.08	2.90	1	5
	Total	85	2.75	.900	.098	2.56	2.95	1	5

Financial and Human resources challenges	Small-scale producer (annual turnover ranging from R50 000 - R5 million)	31	3.39	1.078	.194	2.99	3.78	1	5
	Medium-scale producer (annual turnover ranging from R5 million – R20 million)	37	3.65	1.073	.176	3.29	4.01	1	5
	Large-scale producer (annual turnover above R20 million)	19	3.68	1.227	.282	3.09	4.28	2	5
	Total	87	3.56	1.104	.118	3.33	3.80	1	5

One-way ANOVA

Tests of Homogeneity of Variances

		Levene Statistic	df1	df2	Sig.
Operational challenges	Based on Mean	.389	2	84	.679
	Based on Median	.235	2	84	.791
	Based on Median and with adjusted df	.235	2	68.937	.791
	Based on trimmed mean	.342	2	84	.711
Training challenges	Based on Mean	1.431	2	82	.245
	Based on Median	1.483	2	82	.233
	Based on Median and with adjusted df	1.483	2	76.114	.233
	Based on trimmed mean	1.495	2	82	.230
Financial and Human Resources challenges	Based on Mean	.830	2	84	.440
	Based on Median	.762	2	84	.470
	Based on Median and with adjusted df	.762	2	79.974	.470
	Based on trimmed mean	.857	2	84	.428

ANOVA Results

		Sum of Squares	df	Mean Square	F	Sig.
Operational challenges	Between Groups	2.665	2	1.333	1.984	.144
	Within Groups	56.426	84	.672		
	Total	59.091	86			
Training challenges	Between Groups	1.789	2	.894	1.107	.335
	Within Groups	66.245	82	.808		
	Total	68.034	84			
Financial and Human Resources challenges	Between Groups	1.510	2	.755	.613	.544
	Within Groups	103.393	84	1.231		
	Total	104.902	86			