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Towards Effective Integrated Risk Management: Enhancing Compliance and Competitiveness for Sustainable Access to the EU Citrus Market

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Abstract: The tightening of sanitary and phytosanitary (SPS) regulations, along with stringent private standards in international fresh produce trade, requires citrus producers, especially in developing regions, to adopt robust compliance mechanisms. This study examines the integration of a Risk Management System (RMS) into the existing Quality Management System (QMS) of citrus producers in the Western Cape (WC), South Africa, aimed at improving adherence to European Union (EU) market requirements. Through a comprehensive survey of citrus producers, the research identifies the primary barriers to effective risk management integration, such as financial constraints, limited human resources, and the prevalent non-compliance in the export chain, including pest infestations and exceeding Maximum Residue Limits (MRLs). The results highlight the fact that producers of varying scales face substantial challenges in resource allocation for RMS implementation. The study advocates for a strategic, top-down integration approach, which includes targeted financial support, the establishment of dedicated teams, and well-structured implementation plans. Additionally, the role of both governmental and private sector support is emphasised, particularly in providing training, technical assistance, and infrastructure investments to strengthen compliance efforts. These actions are crucial for ensuring sustained market access, enhancing the competitiveness of citrus producers, and promoting sustainable agricultural practices in the global market.

Keywords: risk management; quality management; integration; compliance; sanitary and phytosanitary risk-mitigating regulations; citrus

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1. Introduction

Over the years, there has been a substantial increase in the stringency of sanitary and phytosanitary (SPS) risk-mitigating regulations and private standards governing the international trade of agricultural products. These developments have been driven by growing consumer concerns regarding the safety and quality of food products [1]. Developing nations, including South Africa (SA), often face challenges in fully complying with these stringent regulations due to resource constraints, which can act as significant barriers to trade [2]. The European Union's (EU) SPS regulations, widely regarded as some of the most stringent globally, pose a particular challenge for agricultural exporters. To access the EU market, producers must meet both the SPS regulations and adhere to private standards [3].

South Africa's citrus industry, as the world's second-largest exporter of citrus, plays a crucial role in the national economy, serving as a key foreign exchange earner [4]. For example, in the 2018/2019 production season, the industry contributed ZAR16.1 billion to the total gross value of agricultural production and employed more than 100,000 workers [5].

As the EU is the primary export destination for South African citrus, recent changes to the EU's SPS regulations—particularly regarding the pest false codling moth (FCM)—have posed new challenges for South African citrus producers [6]. In response, the country has revised its false codling moth risk management system (FMS), utilising a systems approach that integrates multiple risk-mitigating measures to collectively manage pest risks and ensure compliance with the EU's phytosanitary protection standards [7,8]. To maintain access to the high-value EU market, South African citrus producers have had to incorporate the FMS requirements into their existing Quality Management Systems (QMSs) as part of their daily operational activities. However, this integration is not without challenges.

Non-compliance with EU import regulations, whether due to ineffective risk management or poor integration of risk measures into existing quality management systems, can have severe economic repercussions for producers. This includes the rejection of shipments at EU ports or, in more serious cases, the suspension of entire export programs [9,10]. Such non-compliance could also result in even stricter, more costly SPS requirements being imposed, further exacerbating the burden on the South African citrus industry and the broader economy [10,11].

The primary objective of this study is to explore effective strategies for integrating RMS into the existing QMS of citrus producers. This integration is crucial for enhancing compliance with SPS regulations and ensuring sustained access to the EU citrus market, which is of high economic value. The study focuses on identifying the challenges that citrus producers face during the integration of RMS and QMS, determining the main areas of non-compliance within the agri-food export chain from developing countries to the EU, and establishing an effective approach to merging these systems to improve compliance with EU import regulations. This is particularly important for managing risks such as pests and chemical residues, which can create significant barriers to trade.

The findings of this research highlight the complexity and critical challenges that citrus producers encounter when integrating RMS. A key issue is the financial and human resource constraints that hamper the process, underlining the necessity for targeted support. Additionally, the study emphasises the importance of addressing non-compliance issues related to pest management, notably the FCM, and the maximum residue limits (MRLs) for pesticides, which are common difficulties for citrus exporters. A major takeaway is the essential role of incorporating the false codling moth risk management system (FMS) into the daily operations and audit procedures of citrus producers to ensure ongoing compliance with EU standards. The study advocates for greater involvement from both government institutions and the private sector to assist citrus producers in overcoming these challenges. Furthermore, it recommends several integration methodologies that could streamline this process, including process mapping to align all steps of the RMS with the QMS, applying the Plan–Do–Check–Act (PDCA) cycle for continuous improvement, conducting brainstorming sessions to identify potential risks and solutions, and performing a thorough analysis of common elements between RMS and QMS to optimize their integration.

2. Literature Review

Access to international markets demands that fresh produce producers adopt, implement, and maintain a variety of standards and management systems (MSs), which include compliance with SPS regulations imposed by the importing country [12]. In response, producers have increasingly adopted strategies to integrate different MSs, allowing them to meet the requirements of multiple stakeholders more efficiently than if these systems were operated separately [13]. The integration of MSs offers numerous benefits, as demonstrated by several studies that highlight operational cost reduction, improved performance, enhanced organisational reputation, a better working environment, and stronger relationships with stakeholders [14]. Given these advantages, the integration of quality requirements from private standards with regulatory RMS requirements becomes a logical and necessary step. This approach ensures the effective implementation and maintenance of these sys-

tems, thereby maximising the benefits for producers while maintaining compliance with stringent regulations.

2.1. Risk Management and Quality Management in the Agri-Food Export Sector

Quality management (QM) represents an organisation's dedication to delivering high-quality products and services while consistently meeting customer expectations. In contrast, risk management (RM) emphasises identifying, mitigating and addressing uncertainties that could prevent an organisation from achieving these quality standards [15]. In the realm of international trade, particularly involving plant and plant products, risks are inherent due to the unintended consequences of global commerce. These risks include the introduction of non-native pests and pathogens, which can have severe economic and environmental consequences for the importing country [16]. As a result, effective risk management in this context is not just the responsibility of individual producers or countries, but a collective effort of the international community. Phytosanitary measures, in particular, have been recognised as the most effective framework for managing these risks and ensuring sate trade practices [17].

In the agri-food sector, QM is primarily achieved through the adoption of private standards, many of which are based on frameworks such as Hazard Analysis and Critical Control Points (HACCPs) and Good Agricultural Practices (GAPs) [18]. These standards aim to safeguard the entire production process, with quality assurance playing a critical role in ensuring that operations function both effectively and efficiently [19]. Initially designed to regulate on-farm activities, GAP principles have now been extended to cover both upstream and downstream processes within the entire supply chain. This expansion is largely driven by the establishment of voluntary private standards, which seek to ensure that all stages of production and distribution adhere to the highest quality and safety requirements [20].

2.2. Private Standards in the South African Context

In response to the growing demand for private standards and the need to maintain access to high-value markets, there was a significant increase in GlobalG.A.P. certification among South African producers from 2003 to 2004. Since then, the majority of export-oriented citrus producers have achieved certification [21]. The primary private standards employed by the citrus industry include GlobalG.A.P., Tesco Nurture, Field to Fork, Leaf Marque, Albert Heijn PPP Protocol, HACCP, the British Retail Consortium, and GlobalG.A.P. Produce Handling [22]. To encourage and facilitate compliance with international market requirements, the Department of Agriculture, Land Reform and Rural Development (DALRRD) actively promotes GlobalG.A.P. certification among farmers. The proactive strategy supports the implementation of pest management programs and ensures compliance with the MRLs mandated by export markets [23]. Furthermore, GlobalG.A.P. certification guarantees critical processes, such as record-keeping, hygiene practices, crop management, employee working conditions, and essential environmental requirements [23].

2.3. The EU Import Regulations

The European Commission Regulation 2017/1279 [6] stipulates that citrus fruit (excluding certain varieties) imported from the African continent must be sourced only from countries, areas, and places of production recognized as being free from the pest FCM (*Thaumatotibia leucotreta*). Furthermore, the regulation mandates an effective cold treatment or another EU-approved treatment to ensure that the imported citrus is free from pests. The various RM measures include pest-free areas of production, single post-harvest treatments, places of production free from pests such as greenhouses and glasshouses, and systems approaches [24]. Moreover, all imported produce must comply with technical requirements such as traceability, product conformity, and the MRLs for pesticides allowed [25].

2.4. Regulatory Non-Compliances of Developing Countries with the EU Import Regulations

In 2018, the primary non-compliance issues leading to interceptions or rejections of imports from non-EU countries included the absence of a phytosanitary certificate (PC), failure to comply with wood packaging material requirements (as outlined in International Standards for Phytosanitary Measures [ISPM] 15), detection of harmful organisms (quarantine pests), issues with additional declarations on PCs, prohibited goods, and inadequacies in PCs [9]. According to Engler et al. [26], the most critical SPS and quality-related requirements that Chilean exporters must meet to export fresh fruit can be grouped into six categories: phytosanitary measures, labelling and packaging standards, MRLs, hygiene requirements, registration processes, import regulations, and private standards. Similarly, Idris et al. [27] highlight the fact that SPS regulations, including zero tolerance for pests and certification challenges, present significant barriers for Indian horticulture exporters seeking market access in the EU and US. Lengai et al. [28] also point out that pest detection, microbial contamination, and MRLs pose major phytosanitary concerns for Kenya's horticulture export sector, with compliance with MRLs being the most challenging.

Fulano et al. [25] found that Kenyan smallholder snap bean farmers often face non-compliance issues, such as the presence of regulated and quarantine pests, exceeding MRLs, and failing to meet technical standards. Additionally, Mutyambai et al. [24] report that FCM is a key cause of non-compliance in Kenya's pepper and cut flower exports. Hatab et al. [29] further note that the rejection of fresh produce from Egypt is often due to insect infestations, chemical residues, damaged packaging, and microbial contaminants. Other common reasons for rejection include exceeding regulatory limits for substances like aflatoxin [30].

2.5. EU Interception Notifications for Citrus Exported from South Africa

According to the DALRRD's SPS notification database, from March 2020 to October 2022, the primary non-compliance issues for South African citrus exports to the EU (including the UK) were related to the interception of harmful organisms such as FCM, citrus black spot, and fruit fly. Other issues included inadequate PCs, insufficient additional declarations on the PC, the presence of contaminants like Aspergillus, failure to meet wood packaging material requirements, and inaccurate information on the PC [31].

In the 2020 citrus season, there were 14 FCM interceptions for citrus imported from South Africa [7]. While this number is still considered high, it reflects a notable improvement compared to the 21 interceptions reported in the 2019 season [32]. Despite this progress, South Africa's non-compliance rate remains lower than other developing countries, such as Kenya, which had 51 interceptions, and Uganda, with 129 interceptions. These countries export far smaller volumes than South Africa, which shipped over 921,000 tonnes of citrus to the EU and UK combined [32].

Although South Africa's performance in reducing FCM interceptions has been commendable, the EU's zero-tolerance policy for live FCM remains a critical challenge. The detection of even a single FCM is considered non-compliance and can result in the rejection of the entire shipment [11,33].

2.6. Integrating Risk Management into a Quality Management System

2.6.1. Difficulties of Integrating Different Management Systems

Numerous studies have highlighted the challenges of integrating management systems, including the substantial financial and human resources required, workers' resistance to change, and a lack of commitment from top management. The integration approach and level adopted also play a critical role in determining the success of such initiatives [34–40]. Additional constraints often cited include a shortage of suitably skilled workers, insufficient training, the absence of integrated audits, and a withdrawal of management support during the process [38]. Resistance to organisational changes can arise from inadequate understanding and motivation among employees, poor dissemination of information, and limited involvement of key personnel [37].

2.6.2. Factors When Implementing a Pest RMS

Implementing a systems approach in the management of agricultural exports is crucial, particularly in addressing phytosanitary and quality standards. Key factors for success include the involvement of stakeholders in both the design and application processes, alongside ensuring that workers are provided with adequate training and experience. This is essential for the proper detection and identification of pest infestations such as FCM, a significant threat to citrus exports [24,33,41]. However, as Barrientos and Visser [21] highlight, South African farm workers often lack the requisite skills to meet the complex and stringent requirements of export markets. This gap in knowledge has been echoed in various studies that emphasize the need for both government and private sector initiatives to allocate sufficient resources for training programs, thereby creating a pool of skilled workers who can ensure compliance with international standards.

In developing countries, such as South Africa, the absence of institutional support further exacerbates the challenges faced by small-scale farmers in adhering to export standards. For example, while their counterparts in developed countries benefit from stronger state backing, workers in developing regions frequently lack knowledge of export requirements, making it difficult for them to manage comprehensive records that meet global market expectations [42]. This shortfall in record-keeping skills is particularly problematic for smallholder farmers, who are often constrained by limited access to the necessary training and resources [43]. Moreover, fulfilling export standards necessitates robust management systems that integrate various aspects of quality control and pest management. A well-integrated management system allows for efficient coordination and better compliance with phytosanitary standards, especially in sectors such as the South African citrus industry, where pest risks like FCM are prevalent. Studies have shown that integrated management systems can reduce risks, streamline processes, and enhance the quality of agricultural produce for export [34,36,37]. However, without adequate training, the benefits of these systems remain out of reach for many small-scale producers.

The literature suggests that enhancing worker training and improving institutional support are crucial for enabling smallholder farmers to meet the high standards of international markets, thereby ensuring sustainable access to export markets. This aligns with the research objective of examining the impact of training and systems integration on compliance with export market requirements, particularly for small-scale citrus farmers in South Africa.

2.6.3. Integrating MSs

The integration of MSs poses both opportunities and challenges. According to Almeida et al. [35], certain requirements can be shared across different MSs, while others remain specific to individual systems, making full integration difficult. This distinction underscores the importance of identifying which elements of MSs are integrable and which are not. De Oliveira [44] highlights the structural elements—such as policies, objectives, responsibilities, and scope—that should be integrated first, as they serve as the foundation for guiding other integration efforts. These elements provide a cohesive structure that facilitates further integration activities.

Effective integration also depends on critical success factors. Almeida et al. [35] identify key factors, such as having a motivated and capable workforce, access to experienced consultants, sufficient financial resources, top management involvement, and comprehensive employee training. Without these resources, the integration process may face significant challenges. Algheriani et al. [45] further suggest that a comprehensive study of the integration process must consider four core elements: the implementation strategy, the degree of integration, the methodology applied, and the auditing systems. Understanding these factors is essential to address both the potential benefits and difficulties associated with integrating multiple MSs.

2.6.4. The Integration Process

The implementation strategy for integrated management systems (IMSs) refers to the scope and sequence in which MSs are combined [46]. According to Asif et al. [47], two main integration strategies exist: the systems approach and the techno-centric approach. The systems approach, which begins at a strategic level and then filters down to tactical and operational levels, yields broader benefits across the organisation. In contrast, the techno-centric approach, which focuses on common elements, delivers more operational-level advantages.

A literature review by Nunhes et al. [48] highlights the fact that the top-down strategy, where integration begins with strategic decisions and cascades to tactical and operational levels, is the most widely used and effective. This approach facilitates the diffusion of integration practices and cultural changes throughout the organization. Supporting this, De Oliveira [44] found that companies adopting this top-down method achieved more structured integration compared to those using alternative approaches. Moreover, De Oliveira emphasizes that skilled workers are critical for ensuring adequate planning, execution, and control during the integration process [44]. Additionally, significant effort is required in the integration of documentation to ensure seamless implementation.

Domingues et al. [37] identified four key stages in the integration process: (1) combining non-integrated subsystems used simultaneously, (2) identifying common elements, (3) integrating these elements into a unified system, and (4) achieving a fully integrated system. The level of integration can be classified into fully integrated, partially integrated, or not integrated at all [45].

Further research by Sampaio et al. [49] defines four evolutionary levels toward full MS integration: (1) documentation integration, (2) management tools integration, (3) integration of common policies and goals, and (4) the adoption of a common organizational structure. Common integration methodologies include process mapping, analysis of shared elements, and the PDCA cycle, as outlined by Algheriani et al. [45]. Despite advancements in IMS models, many companies continue to rely on simpler tools such as process maps and brainstorming [38]. Auditing systems are another key aspect, and according to Bernardo et al., audit integration occurs at three levels: fully integrated (all MSs audited by a single team), partially integrated (some MSs audited together), and not integrated (each MS audited separately) [50].

3. Materials and Methods

A case study approach was adopted for this study, employing a quantitative data collection method. This research method was chosen to explore the phenomena identified by the research problem from the perspective of citrus producers regarding their views and experiences with the integration (implementation) of the RMS. A survey questionnaire served as the data collection strategy. The target population was citrus growers or producers situated in the WC (WC) Province exporting citrus to the EU. The citrus industry has been exporting to the EU for many years [51], giving it substantial experience and knowledge relevant to this study. Furthermore, the systems approach as a phytosanitary risk-mitigating measure represents a "first" for the entire citrus export industry since its implementation in 2018. However, this is the first RMS implemented for a quarantine pest by WC producers, compared to other producers in different provinces who had to implement an RMS for the quarantine pest Citrus Black Spot (CBS) [52]. Therefore, this target population was ideal for exploring their experiences with integration, as they had not previously been required to implement such a system.

For this study, in the context of citrus export producers, the definition provided by the DALRRD's draft National Policy on Comprehensive Producer Development Support was adopted, which classifies producers based on their support within the agricultural, forestry, and fisheries sectors. Citrus producers are classified according to their annual turnover: smallholder producers have an annual turnover ranging from ZAR 50,000 to ZAR 5 million; medium-scale producers have an annual turnover ranging from ZAR

5 million to ZAR 20 million; and large-scale producers have an annual turnover above ZAR 20 million [53].

Permission was obtained from the DALRRD to use their 2023 database of registered citrus producers exporting to the EU, which served as the sampling frame for this study. The probability sampling method was employed to select the sample, giving each citrus producer in the WC an equal chance of being selected. 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. The DALRRD database included 522 registered citrus producers in the WC, and from that list, there were 352 individuals represented as producers. Therefore, these 352 representatives constituted the target population. The closed-ended questionnaire was provided to participants in both Afrikaans and English, allowing them to answer in their preferred language. The two language options were offered because most farmers in the WC are Afrikaans-speaking. Translating the questionnaire ensured that participants understood it as intended, and that the responses and data collected were valid. The questionnaire was designed using the online platform 'LimeSurvey' and distributed via email and WhatsApp between May and June 2023. Additionally, the questionnaire employed a 5-point Likert scale, ranging from 1 to 5, where 1 represents strongly disagree, 2 represents disagree, 3 represents neutral, 4 represents agree, and 5 represents strongly agree.

A pilot study was conducted for this research. The questionnaire was sent to DALRRD employees enforcing the FMS and an expert in the citrus industry. These individuals were asked to review the questionnaire and identify any ambiguous statements that might be difficult or confusing for participants. They were selected due to their extensive knowledge and experience in the citrus export industry. Based on their feedback, the questionnaire was amended, translated into Afrikaans, and distributed (both English and Afrikaans versions) to individuals from the same target population. From the distributed questionnaires, ten individuals (consultants, citrus production managers, and an employee at the CGA) provided completed questionnaires and their feedback. Subsequently, the questionnaire was revised accordingly, making the pilot study valuable for the main study.

The Statistical Package for the Social Sciences (SPSS) software program Version 28 was used to generate descriptive and inferential statistics. Reliability tests, such as Cronbach's Alpha and Factor Analysis, were conducted, along with a one-way analysis of variance (one-way ANOVA) test.

Ethical considerations for this study included protecting participants from harm, informing them of the study's overall aim and main objectives, requesting voluntary participation, and informing them that they could exit the survey without providing reasons. Written consent was obtained from participants to proceed with the survey, including consent to collect and analyse data. Participation was voluntary, with no rewards or financial compensation offered. Participants' rights to privacy and confidentiality were respected, and the research objectives, methods, and findings were reported completely and honestly. Additionally, 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.

The research assumptions were that all participants were willing and available and responded honestly. This included having a basic understanding of a QMS and RMS, possessing the necessary knowledge about the EU import requirements, and understanding the contents of the questionnaire. Research constraints for this study included limitations and delimitations. Limitations refer to potential issues such as a lack of participant willingness to partake in the study, which could result in not achieving the desired sample size, and participants not answering honestly due to concerns that their responses might negatively impact their citrus exports for the specific season. Delimitations refer to the study's boundaries, which were limited to citrus producers in the WC and focused solely on the exportation of citrus to the EU market. Additionally, the relatively small sample size could limit the generalisability of the findings. A smaller sample size may reduce

the statistical power of the results and the extent to which they can be applied to broader populations. This could also limit the study's ability to capture the full range of experiences and perspectives on RMS implementation across the entire citrus export sector. Future research could address this limitation by employing a larger sample size or by conducting comparative studies across different provinces and citrus-producing regions. Doing so would enhance the validity and reliability of the findings, allowing for a more comprehensive understanding of RMS integration in the South African citrus industry.

4. Results and Analysis

This section describes and analyses the survey data collected to meet the research objective, "To identify the difficulties experienced by citrus growers with the integration of the RMS into their existing QMS", as well as to investigate the integration measures taken by citrus producers and their views on the main non-compliance issues when exporting to the EU.

The questionnaire consisted of three sections: Section A, which was compulsory and required respondents to provide consent to participate in the survey; Section B, which requested demographic data; and Section C, which included 36 statements based on the Likert measurement scale regarding the integration of the FMS.

4.1. Distribution and Response Rate of the Questionnaire

Out of a population of 352 citrus representatives in the WC, 235 were approached, and 205 participated in the survey, resulting in a sample size of 205 participants. However, many respondents did not answer all the statements posed, so the sample size varied for each statement. Of the 205 participants, 85 surveys were fully completed, and 120 were partially completed. The fully completed surveys represented a response rate of 41.46% of the sample and 24% of the population. While the response rate is relatively low, it is consistent with the rates for online surveys in agricultural research surveying farmers [54]. Furthermore, the response rate is in line with the response rate for online business surveys, which can be as low as 10% to 20% [55]. Additionally, the sample is fairly representative of the population concerning the producers' classification types. The sample distribution, as indicated by the descriptive statistics below, shows that the majority of participants are small- and medium-scale producers. This is consistent with the claim made by [56] that most commercial farms in South Africa can be classified as small- and medium-scale companies. Moreover, the questionnaire was sent during the citrus season, which was the best period for the survey to be conducted because the difficulties experienced by producers were still "fresh" in their minds, as they were experiencing these in real time. On the other hand, during this period the producers are extremely busy exporting citrus, and this could have contributed to the low response rate.

4.2. Descriptive Statistics of Demographical Findings

- Job Title: according to Figure 1, out of 121 participants, the majority (48.8%) were farm owners, followed by farm managers (25.6%) and production managers (11.6%). The remaining participants included senior managers (3.3%), senior employees (3.3%), and others (7.4%). The "other" category included roles such as technical manager, technical advisor, quality manager, operational manager, packhouse manager, exporter, and administrator. Two partially completed surveys were submitted by administrators who only filled out Section B, thus not affecting the results of Section C.
- Producers Classification: of 119 participants, the majority were medium-scale producers (40.3%), followed by small-scale producers (39.5%) and large-scale producers (20.2%).
- Experience in Farming Fresh Produce: among 121 participants, most had more than 15 years of experience (67.8%), followed by those with 10 to 15 years (20.7%), and less than 10 years of experience (11.6%).

- Years of Exporting Citrus Fruit to the EU: out of 121 participants, the majority had been exporting citrus for 15 years or more (49.6%), followed by 3 to 10 years (30.6%), 10 to 15 years (14%), and new entrants (5.8%).
- Citrus Exporting Seasons: most respondents exported citrus in the 2022 season (56.1%), followed by 2021 (51.2%), 2020 (51.2%), 2019 (48.3%), and 2018 (44.9%). This indicates that the number of registered citrus producers has been steadily increasing since 2018, coinciding with the adoption of the updated FMS.
- Packhouse Used for the Majority of Citrus Exported: of 121 participants, many transported their citrus to a packhouse privately owned by another company (52.1%) and paid packing fees. Additionally, 24.3% owned a packhouse, and 23.1% used a packhouse that was privately owned by a company of which the producer was a member or shareholder.
- Producer Certification (Private Standards): the majority were certified with GlobalG.A.P., followed by Tesco Nurture, Albert Heijn, GlobalG.A.P. Produce Handling Assurance Standard, BRC, Field to Fork, HACCP, ISO, and LEAF Marque. The "other" options included Costco, EU Organic certification, F.S.M.A certification (Food Safety Modernization Act for the US market), GLOBALG.A.P. Risk Assessment on Social Practice, Sustainability Initiative of South Africa, Sedex Members Ethical Trade Audit, and Wine and Agricultural Ethical Trade Association.
- General Approach to Integrate the FMS Requirements: of 120 participants, the majority (49.2%) appointed consultants or third parties to assist with the integration. A third (33.3%) were farm owners who decided to integrate themselves. Others (16.7%) hired or designated employees specifically for this purpose. Only one participant (0.8%) selected the "other" option but did not provide further details.

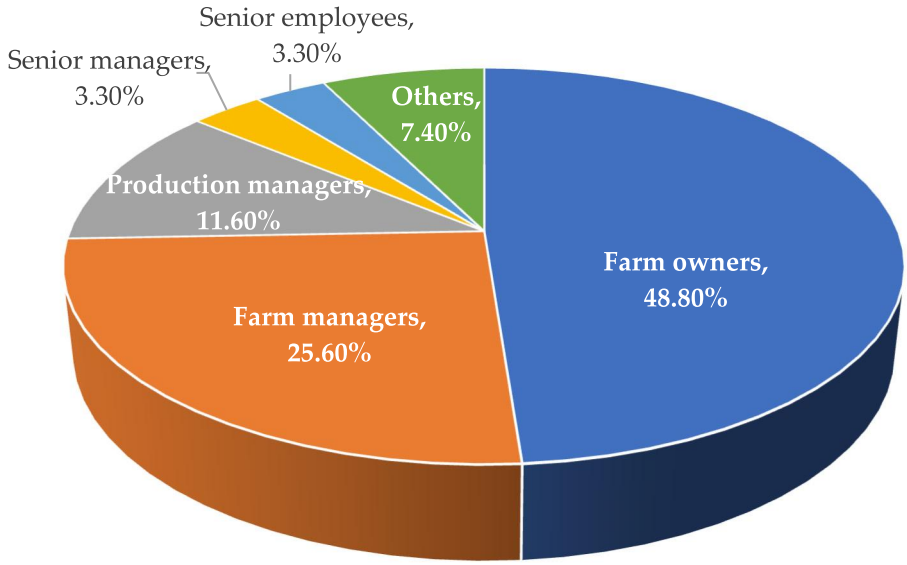

Figure 1. Job title distribution of participants.

4.3. Descriptive Statistics of Likert Scale

Table 1 demonstrates that a mean score of more than 3 indicates that the majority of respondents agree, while a mean score of less than 3 suggests that the majority disagree. The survey data were subjected to frequency counts for each statement (variable) to determine the highest frequency of occurrence for each Likert scale measurement (see Figures 2–4). Additionally, to facilitate analysis, the frequency counts for the responses were aggregated: responses of "agree" and "strongly agree" were combined, as were responses of "disagree" and "strongly disagree".

Table 1. Descriptive statistics of statements posed in the questionnaire.

Code	Statement	N	Min.	Max.	Mean	Std. D
	Construct Non-compliances: the main non-compliances when exporting citrus fruit to the EU market include the following:					
C1	The detection of regulated pests (false codling moth).	97	1	5	3.49	1.226
C2	Exceeding the pesticide residue limits (maximum residue limits).	97	1	5	3.05	1.236
C3	Non-compliance with labelling requirements.	97	1	5	2.76	1.153
C4	Exceeding the maximum levels of regulated contaminants such as aflatoxin (produced by *Aspergillus flavus*).	97	1	5	2.74	1.111
C5	Absent, incomplete, unreadable or forged phytosanitary certificate.	97	1	5	2.63	1.302
C6	Inadequate additional declaration on the phytosanitary certificate.	97	1	5	2.74	1.210
C7	Non-compliance with the International Standards for Phytosanitary Measures (ISPM) 15 for wood packaging material.	97	1	5	2.70	1.174
	Construct: Integration measures: the false codling moth risk management (FMS) was incorporated into our daily operations/planning/recordkeeping through the following measures:					
C8	Implementation takes place at a strategic level (e.g., policies are integrated).	93	1	5	4.16	0.680
C9	Implementation takes place at an operational level (e.g., most records, work instructions and checklists are integrated).	93	1	5	4.05	0.826
C10	Internal audits are conducted on the citrus farm(s).	93	1	5	3.96	0.820
C11	Internal audits review all stakeholder requirements during a single audit (e.g., GlobalG.A.P., FMS and other requirements).	93	1	5	3.94	0.895
C12	Internal audits review how effectively the FMS requirements have been implemented.	93	1	5	3.83	0.829
	Construct Difficulties: difficulties experienced with integrating (implementing) the FMS into our daily operations include the following:					
C13	Lack of management involvement and commitment.	87	1	5	2.18	1.018
C14	The high cost of implementing the FMS requirements.	87	1	5	3.59	1.244
C15	The excessive human resources required for implementation.	87	1	5	3.54	1.209
C16	Lack of skilled workers to effectively implement integration.	87	1	5	3.20	1.055
C17	Training of workers at all levels on the implementation of FMS requirements is inadequate.	87	1	5	2.89	1.061
C18	The cost of training is too expensive.	87	1	5	3.15	1.105
C19	The time required for training causes a loss of production time.	87	1	5	3.21	1.132
C20	The unavailability of specific false codling moth identification training.	86	1	5	2.99	1.143
C21	Workers' attitude towards the implementation of FMS requirements is negative.	86	1	5	2.51	0.991
C22	Lack of motivation and understanding among workers about the implementation of the FMS requirements.	86	1	5	2.72	1.048
C23	Lack of workers' involvement in the implementation process of the FMS requirements.	85	1	5	2.71	1.021
C24	Workers resist changes regarding the implementation of FMS requirements.	86	1	5	2.63	1.030
C25	Insufficient information was provided to workers about changes regarding the implementation and new duties.	85	1	5	2.41	0.917
C26	Difficult to manage the required FMS documentation effectively.	85	1	5	2.80	1.111
C27	Lack of skills to manage comprehensive records of all integrated farm processes.	85	1	5	2.68	1.049
C28	Daily operational records/documentation of all farm processes are not fully integrated.	85	1	5	2.73	1.062
C29	There are no standardised forms to help implement the FMS requirements.	85	1	5	2.81	1.075
C30	There is no integrated internal audit to ensure effective implementation.	85	1	5	2.72	0.983
C31	Lack of access to consultants with appropriate experience in integrating different management systems.	85	1	5	2.48	0.971

Table 1. *Cont.*

Code	Statement	N	Min.	Max.	Mean	Std. D
C32	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	0.845
C33	Insufficient information provided to citrus growers on EU import requirements.	85	1	5	2.16	0.974
C34	Lack of government support and cooperation to effectively implement the FMS requirements.	85	1	5	3.53	1.315
C35	Insufficient time to implement changes made to the FMS requirements.	85	1	5	2.86	1.048
C36	The current chosen implementation (integration) approach is not effective.	85	1	5	2.71	1.010

N = sample size (per statement), Min.: minimum; Max.: maximum; Std. D: standard deviation.

4.4. Construct: Non-Compliances

Main non-compliances as perceived by citrus producers exporting citrus fruit to the EU market.

Figure 2 illustrates the fact that the majority of producers perceive the detection of regulated pests (58.8%) and exceeding pesticide residue limits (45.4%) as the main non-compliances when exporting citrus to the EU market. Additionally, many respondents identified non-compliance with labelling requirements (44.4%), exceeding maximum levels of regulated contaminants (38.6%), and issues with PC requirements (50.5% and 44.4%) as significant concerns. However, a substantial proportion felt that non-compliance with ISPM 15 requirements (42.3%) was not a major issue.

The high percentage of neutral responses might indicate a lack of specific knowledge or experience regarding these non-compliances, suggesting that other stakeholders within the citrus cold chain might be more engaged with these issues.

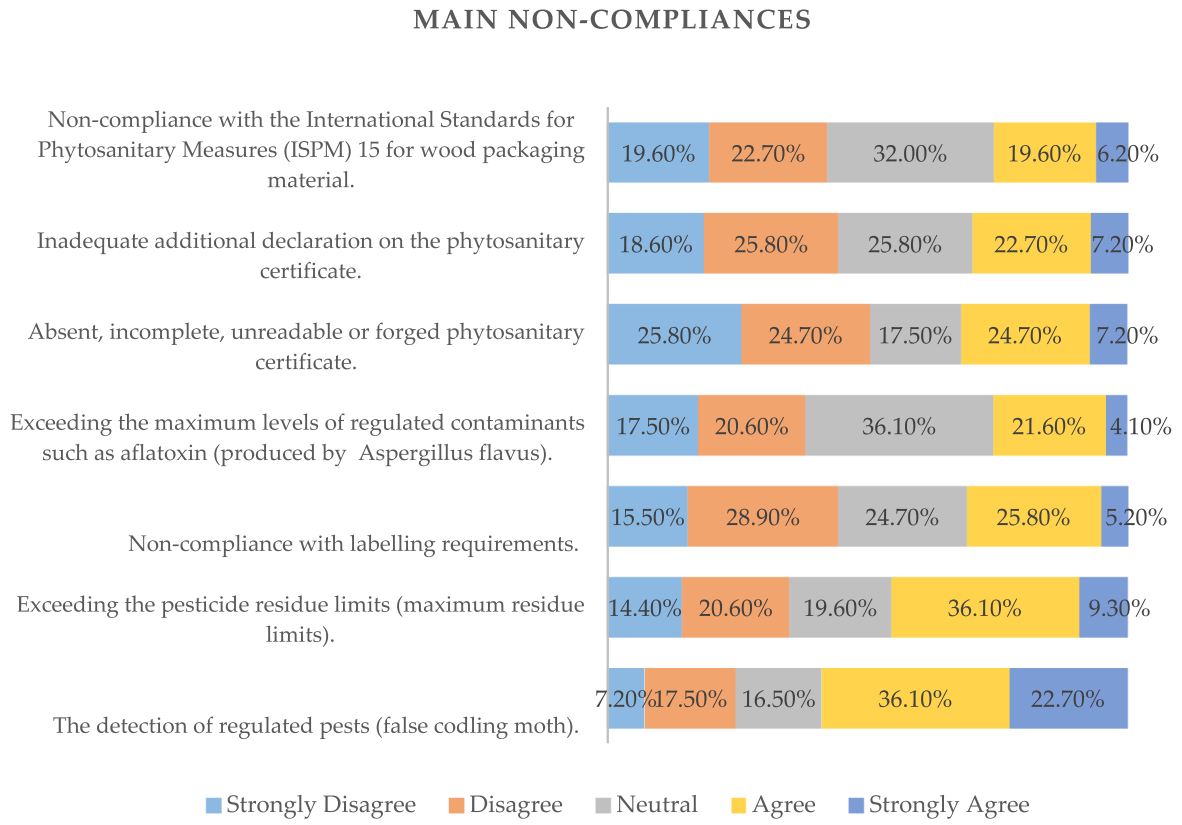

Figure 2. The main non-compliances as perceived by citrus producers (Source: own).

4.5. Construct: Integration Measures

Figure 3 shows that most citrus producers in the WC have integrated the FMS into their daily operations, planning, and recordkeeping at both strategic (83.9%) and operational (91.4%) levels. Additionally, the majority of respondents reported that internal audits are conducted (82.8%), all stakeholder requirements are reviewed during a single audit (74.2%), and internal audits assess the effectiveness of FMS implementation (69.9%).

However, there was a notable decrease in agreement and an increase in neutral responses for more specific statements related to internal audit processes and FMS implementation. For instance, Statement C10, related to general internal audits, had an 82.8% agreement and a 9.7% neutral response. In contrast, Statement C11, which focused on specifics of the internal audit processes, saw a decrease in agreement, to 74.2%, and an increase in neutral responses, to 20.4%. Similarly, Statement C12, concerning internal audits related to FMS implementation, showed a further decline in agreement, to 69.9%, and an increase in neutral responses, to 24.7%.

These findings suggest that some respondents may lack detailed information about how internal checks are conducted and their relation to measuring compliance with FMS requirements.

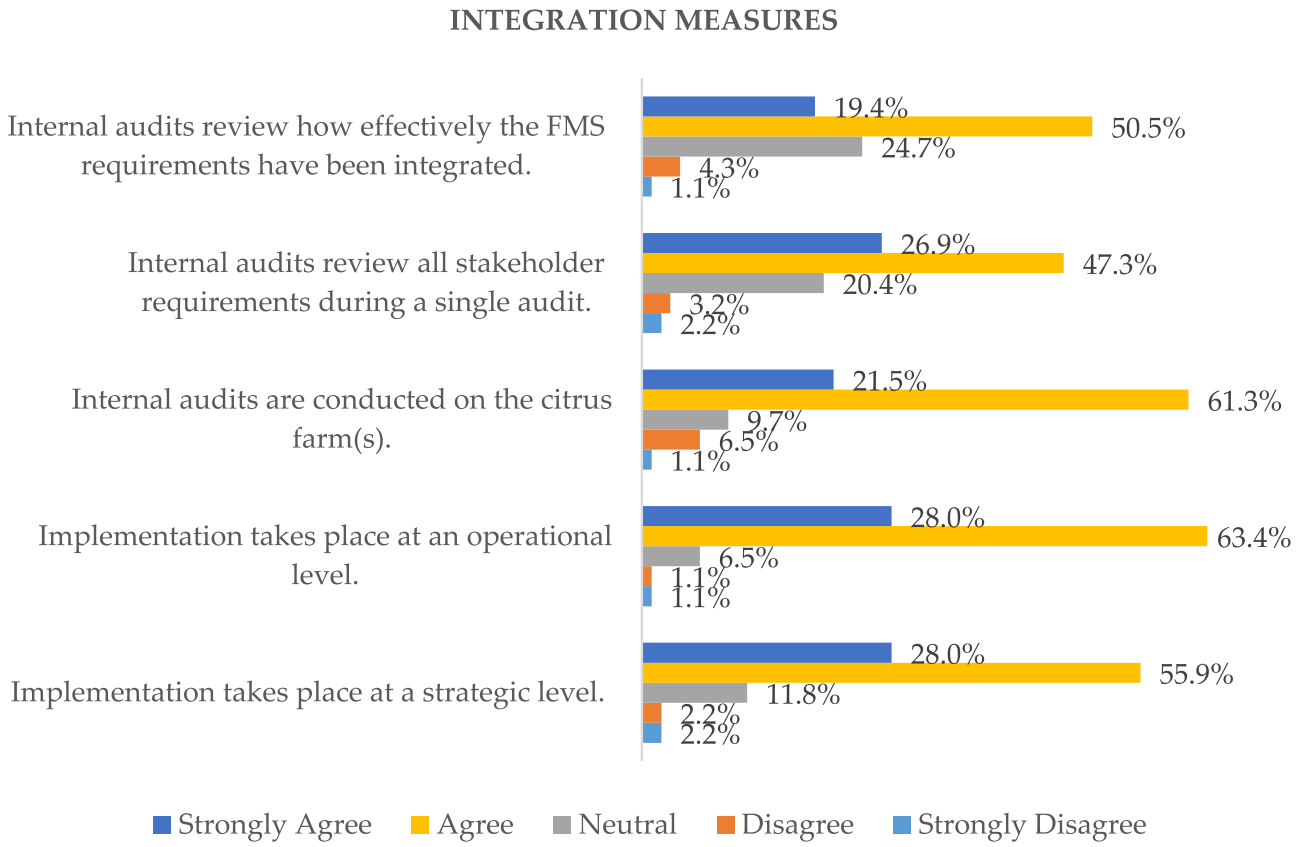

Figure 3. The integration measures taken by WC citrus producers (source: own).

4.6. Construct: Difficulties

Difficulties experienced by WC citrus producers with integrating the FMS into their daily operations (QMS).

Figure 4 illustrates the fact that the primary difficulties experienced by respondents in integrating the FMS include high costs (59.7%), excessive human resources (57.4%) required for implementation, a lack of skilled workers (43.7%), expensive training costs (40.2%), and the loss of production time due to training (42.5%). Additionally, many respondents

cited a lack of government support and cooperation as a significant barrier to effective FMS implementation (57.7%).

However, the majority of respondents did not perceive the following statements as difficulties: C13 (75.9%), C17 (41.3%), C20 (39.5%), C21 (58.1%), C22 (48.8%), C23 (49.4%), C24 (53.5%), C25 (68.2%), C26 (49.4%), C27 (54.1%), C28 (49.4%), C29 (47%), C30 (45.8%), C31 (60%), C32 (65.9%), C33 (74.1%), C35 (41.2%), and C36 (43.5%). Nevertheless, some respondents did indicate that these statements did reflect difficulties they had encountered during the integration process.

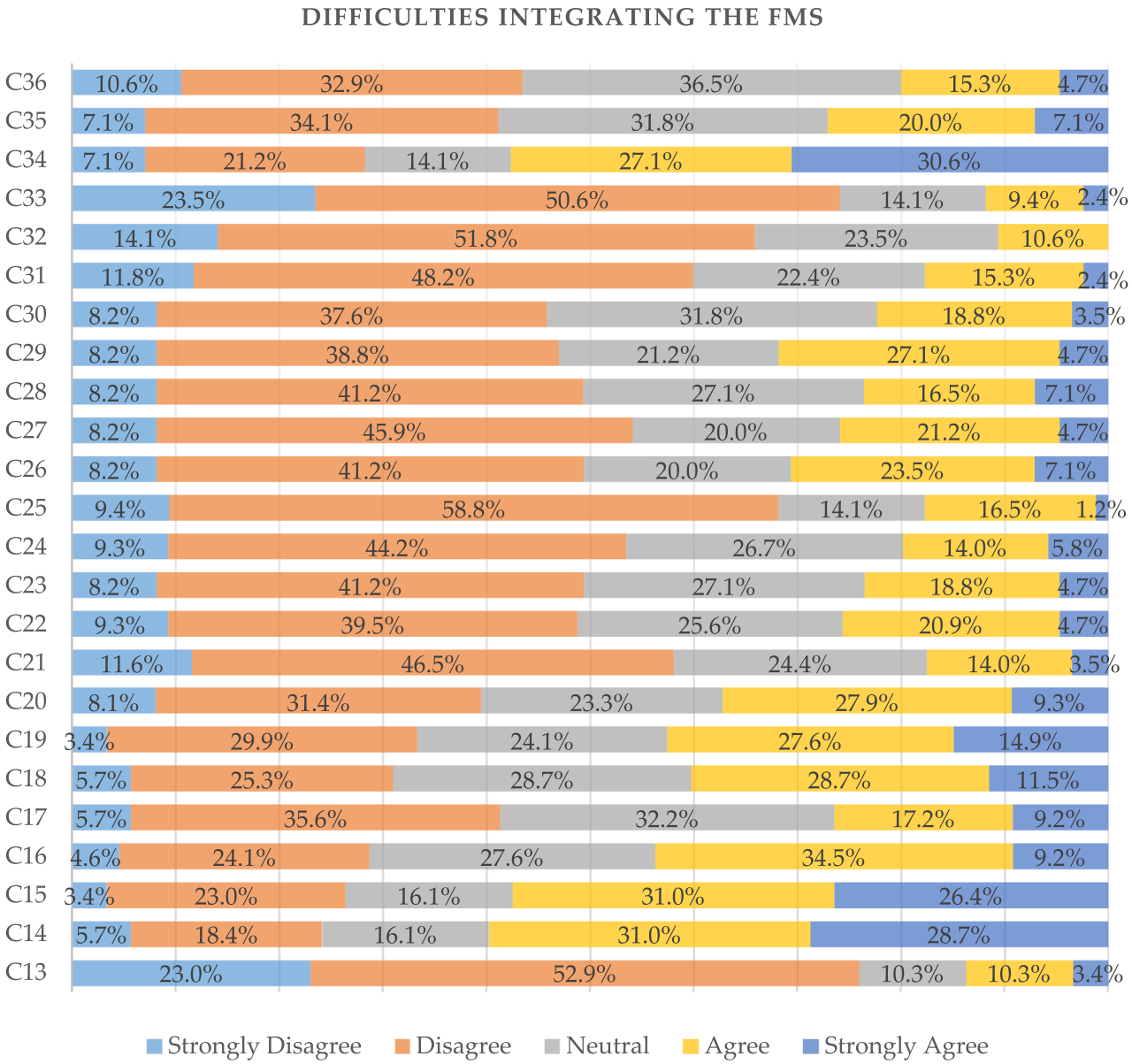

Figure 4. Difficulties experienced by WC citrus producers with integrating the FMS (source: own).

4.7. Reliability Results for the Constructs' Non-Compliances and Integration Measures

The coefficient results for the constructs' non-compliances and integration measures as presented in Table 2 are 0.921 and 0.879, which can be interpreted, respectively, as excellent and good, indicating sufficient internal consistency [57].

Table 2. 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

4.8. Reliability Results and Factor Analysis for the Construct Difficulties

The alpha coefficient is influenced by the length of the test instrument and the dimensions of the constructs it measures [58]. Given that the construct in this study comprises 24 items, a factor analysis was conducted to ensure the reliability of the results. Table 3 presents the three factors extracted from the analysis. These factors, which correlate well, represent subsets of items that measure underlying constructs within the category of difficulties. Each factor has been assigned a theme to indicate the new difficulty factors. Table 3 also shows the coefficient results for the extracted difficulty factors: Difficulty Factor 1 has a coefficient of 0.831, Difficulty Factor 2 has a coefficient of 0.701 (after item C20 is deleted), and Difficulty Factor 3 has a coefficient of 0.767. These results indicate that the overall set of items for the difficulty factors is internally consistent and reliable [57].

Table 3. Underlying factors for the construct difficulties and their respective Cronbach's alpha coefficient results (source: own).

Difficulty Factor	Subset of Items Correlating	Number of Items	Theme or Underlying Construct	Cronbach's Alpha Coefficient	Strength of Association
1	C28, C29, C30	3	Operational challenges	0.831	Good
2	C13, C17, C20	3	Training challenges	0.658	Acceptable
	C13, C17 (when deleting C20)	2		0.701	Good
3	C14, C15	2	Financial and HR challenges	0.767	Good

4.9. Inferential Statistics

In this study, an ANOVA was conducted to assess whether there are significant differences in the difficulties experienced by different types of citrus producers (small, medium, and large). The dependent variable is the difficulties (extracted difficulty factors), and the independent variable is the citrus producer category (small, medium, and large). Table 4 presents the ANOVA results, including the F statistic and the corresponding *p*-values for each difficulty factor.

Table 4. ANOVA results for the difficulty factors according to citrus producer classification types (source: own).

Challenges		Sum of Squares	df	Mean Square	*F*	Sig.
Operational challenges	Between Groups	2.665	2	1.333	1.984	0.144
	Within Groups	56.426	84	0.672		
	Total	59.091	86			
Training challenges	Between Groups	1.789	2	0.894	1.107	0.335
	Within Groups	66.245	82	0.808		
	Total	68.034	84			

Table 4. *Cont.*

Challenges		Sum of Squares	df	Mean Square	*F*	Sig.
Financial and human resources challenges	Between Groups	1.510	2	0.755	0.613	0.544
	Within Groups	103.393	84	1.231		
	Total	104.902	86			

For the difficulty factor "operational challenges", the ANOVA results show an F statistic value of 1.984 with a *p*-value of 0.144. For "training challenges", the F statistic is 1.107 with a *p*-value of 0.335. For "financial and human resources challenges", the F statistic is 0.613 with a *p*-value of 0.544. According to [55] (p. 544), a statistically significant difference is indicated by a large F ratio with a *p*-value of less than 0.05.

Therefore, it can be concluded that there are no statistically significant differences in how different categories of citrus producers perceive and experience the difficulty factors. In other words, the type of citrus producer (small, medium, or large) does not significantly influence the perception of difficulties encountered.

5. Discussion

5.1. Key Findings and Discussion Based on the Research Objective

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

The empirical results align with the assertion by [34] that lack of top management commitment is not a primary challenge for organisations pursuing integration. This suggests that, contrary to some concerns, management support is generally not seen as a significant barrier by most respondents in this study.

The findings regarding financial and human resources challenges are consistent with previous studies [38–40], which identified these aspects as major integration difficulties. This reinforces the notion that financial constraints and the availability of human resources are significant issues faced during integration.

The study's results related to workforce issues present a mixed picture compared to the literature. On one hand, the findings support those of [21], which show that a shortage of skilled workers is a constraint in South Africa's export industry. On the other hand, factors such as workers' attitudes, motivation, and resistance—which were highlighted by [34,35,37,40] as significant—did not show a similar impact in this study. This discrepancy suggests that while some workforce-related issues are evident, others may not be as impactful as previously thought.

Regarding training, the survey results contrast with research in [38], which identified training as a constraint. Notably, some respondents indicated that the unavailability of specific FCM (false codling moth) identification training was a difficulty, despite its importance being emphasised in the literature [24,33].

The results also show that most respondents manage comprehensive integrated records, including required FMS documentation, which contrasts with [43], who suggested inadequacies in record-keeping. Additionally, integrated audits were not seen as a constraint in this study, contrary to [38], which had identified them as problematic.

The difficulties identified in the survey can be categorized into three primary factors:

- Financial and Human Resources Challenges;
- Training Challenges;
- Operational Challenges.

There were no significant differences between how small-, medium-, and large-scale citrus producers perceived these difficulty factors. This finding highlights the fact that financial and human resource challenges are pervasive across all producer categories, which is consistent with the trade literature noting that small- and medium-scale farmers in developing countries often struggle with financial constraints in meeting safety and quality

standards [59,60]. Moreover, large-scale producers also face similar challenges, reflecting broader resource constraints in developing countries [2,61].

5.2. Key Findings and Discussion Based on Research Objective

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

The research objective was to determine the main non-compliances in the agri-food export chain from developing countries to the EU market. The literature review identified several prevalent non-compliances for fresh produce exports, include the following:

- Detection of regulated pests (harmful or quarantine pests);
- Exceeding Maximum Residue Levels (MRLs);
- Non-compliance with phytosanitary certificate requirements;
- Labelling and packaging requirements;
- Hygiene requirements (microbial contaminants);
- Technical requirements (traceability and MRLs);
- ISPM 15 requirements;
- Exceeding levels of contaminants.

The empirical survey results confirm these findings. The majority of WC citrus producers identified the detection of regulated pests (FCM) and exceeding MRLs as the primary non-compliances when exporting citrus to the EU market. This consistency with the literature underscores the ongoing challenges faced by producers in adhering to EU import regulations.

To determine an effective way of integrating RM and QMS.

The literature review identified four principal elements crucial for the integration process: integration strategy, integration level, integration methodology, and auditing systems [45]. The construct of integration measures focused on implementation strategy and auditing systems to investigate how producers integrate these systems.

The reviewed literature highlights several integration strategies, including the following:

1. Integration Strategy: two main approaches are identified:
   - Systems Approach: starts by identifying stakeholders and their requirements.
   - Techno-Centric Approach: begins with identifying and analysing common elements between management systems (MSs) [47].

The top-down approach (systems approach) is frequently adopted and considered most effective [38,44,47,48].

2. Integration Level: integration can occur on strategic, tactical, and operational levels, with degrees ranging from full to partial or non-integration [45,47,48].
3. Integration Methodology: common methods include the following:
   - Analysis of common elements;
   - Process maps;
   - PDCA (Plan–Do–Check–Act) cycle;
   - Pareto charts;
   - Brainstorming;
   - Histograms [36,38,39,45,50].

Effective integration often involves integrating structural elements such as policies, objectives, scope, responsibilities, and management of documents and records [39].

4. Auditing Systems: the integration of auditing systems is crucial for achieving higher levels of integration. The importance of continuous improvement and integrated audits is emphasised to ensure effective implementation and monitoring [38,50].

Critical Success Factors and Challenges.

The literature underscores the importance of the following:

- Top Management Commitment: essential for strategic planning, resource allocation, training, and leadership [13,35,38,49].
- Worker Involvement: vital for successful implementation and maintenance. Insufficiently skilled workers and internal organisational difficulties can impact the process negatively [34,36,40,44].
- Approach and Level of Integration: gradual integration is often preferred for reducing resistance, compared to simultaneous or partial integration [34].

Empirical Results and Integration Framework:

The empirical survey results revealed that most WC citrus producers integrate the FMS into their daily operations, planning, and record-keeping on both strategic and operational levels. Internal audits are commonly conducted, and stakeholder requirements are reviewed during a single audit, suggesting the adoption of an integrated auditing system by most respondents.

Recommendations for Effective Integration:

- Adopt a Top-Down or Systems Approach: begin with strategic planning and decision-making, followed by tactical and operational integration.
- Strategic Integration: integrate structural elements such as policies, objectives, scope, and responsibilities. Identify stakeholders and their requirements and determine which elements of the RMS and QMS can be integrated.

Tactical and Operational Integration: implement integration gradually, to minimize resistance from workers. Utilise methods such as process maps, analysis of common elements, and the PDCA cycle.

Ensure Effective Auditing: integrate auditing systems to monitor and assess the effectiveness of the integration. Ensure the auditing team is fully integrated and focused on the combined elements of the RMS and QMS.

In summary, applying the four principal elements of the integration process—strategy, level, methodology, and auditing—while addressing potential difficulties, provides a robust framework for effectively integrating the RMS and QMS. The top-down approach, gradual integration, and careful planning are crucial for overcoming challenges and achieving successful integration.

6. Conclusions and Recommendations

The increasing stringency of SPS regulations in international trade, coupled with the demanding requirements of private standards, underscores the need to explore factors that impact citrus producers' ability to comply and to develop strategies for enhancing compliance. This study investigated the integration of the RMS into the QMS of citrus producers in the Western Cape (WC) to sustain access to the EU citrus market. It also identified the challenges that producers face during this integration process.

Key findings revealed that financial constraints and human resource challenges were the primary obstacles to successful integration. Additionally, producers identified the detection of regulated pests and exceeding MRLs as the most common non-compliance issues when exporting to the EU. Despite these challenges, most producers reported implementing the RMS at both strategic and operational levels. This included conducting internal audits, reviewing stakeholder requirements within a single audit, and assessing the effectiveness of RMS implementation.

While this study provides important insights, certain limitations must be acknowledged. The small sample size and low response rate, likely due to the timing of data collection during the busy citrus season, could have affected the generalisability of the findings. Future research should consider conducting surveys during the off-season and expanding the study to include producers from all citrus-growing provinces in South Africa to increase the sample size and response rate. Additionally, employing qualitative methods such as focus groups could provide deeper insights into the experiences and challenges of different producer groups.

Future research should also explore how producers in other provinces, who have more experience in implementing RMS for quarantine pests like CBS, perceive the integration of RMS compared to those in the WC, who are less experienced in this area. Such comparative studies could provide valuable lessons for improving RMS integration across diverse regions. Furthermore, the long-term impact of RMS integration on producers' financial performance and market access warrants further investigation.

From an industry perspective, the findings of this study highlight the need for policymakers and industry stakeholders to provide targeted financial and technical support to producers, especially smallholders, to overcome the barriers to compliance. Additionally, training programs that enhance producers' human resource capacity to manage complex phytosanitary requirements could be critical in improving compliance rates. Policymakers should also consider streamlining SPS regulations to reduce the administrative burden on producers, while still ensuring that stringent EU requirements are met.

In conclusion, while the integration of RMS into QMS holds great potential for sustaining market access and ensuring compliance, continued research and collaborative efforts between regulators, industry bodies, and producers are essential to address the remaining challenges. By fostering a more supportive regulatory and operational environment, the South African citrus industry can not only meet current market demands, but also maintain its competitive edge in the global market.

7. Implications of the Study Findings

Previous studies on integrating MSs have mainly focused on QMS, Environmental Management Systems (EMSs), and Occupational Health and Safety Management Systems (OHSMSs), as well as risk management, that is congruent with the ISO standards [13,14,36] While these global studies emphasise the importance of integrating MSs to meet stakeholder demands and enhance compliance—particularly in international trade—this research addresses a significant gap by examining how risk management can be integrated specifically for South African citrus exports to the EU. Notably, no prior studies have explored the implications of this integration for compliance with EU regulations in the South African citrus industry, nor its relevance to other developing regions.

The empirical findings reveal challenges faced by citrus producers in integrating phytosanitary risk management. By identifying these challenges, the study provides valuable insights for producers, stakeholders, and regulators regarding compliance barriers and opportunities.

For producers, the study underscores the need to streamline risk management within existing QMS frameworks to reduce operational complexity and costs. Emphasising capacity building, particularly through digital tools and advanced monitoring systems, can simplify compliance tracking. Moreover, collaboration among producers via industry associations can enhance knowledge sharing, especially for small and medium-sized enterprises (SMEs) lacking resources.

For policymakers and regulators, actionable recommendations include providing targeted support for smallholders through tailored training and subsidies for technology adoption. A centralised digital platform for compliance tracking could significantly ease the administrative burden on producers, improving transparency and efficiency.

From a policy perspective, the South African government and industry stakeholders should advocate for the harmonisation of international phytosanitary regulations. Engaging with EU regulatory bodies to ensure predictable import requirements aligned with local production cycles will allow producers more time to adapt. Establishing bilateral or multilateral agreements to simplify compliance for small-scale producers would promote broader participation in international trade and support rural economic development.

Finally, the findings have broader implications for other agricultural sectors in the Global South, where compliance with stringent international standards is critical for market access. The lessons learned from this study can inform similar regulatory challenges across

various industries, fostering sustainable and compliant agricultural practices throughout the region.

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Informed Consent Statement: The study was conducted according to the criteria set by the Declaration of Helsinki, and informed consent was obtained from participants involved in this research.

Data Availability Statement: Data will be made available on request.

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