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Contribution of Traceability to Horticultural Export Growth: Insights from Small-scale Farmers in South Rift, Kenya

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Abstract

The inclusion of rural smallholder farmers in horticultural exports offers two key benefits: increased household income through global market access and enhanced productivity that contributes to GDP growth and foreign exchange. In South Rift, Kenya, around 2,500 smallholder farmers are engaged in horticultural exports. This study aimed to investigate the relationship between traceability by smallholder farmers and the growth of the horticultural export market. Data were collected from 334 randomly selected small-scale farmers using a structured questionnaire. Validity and reliability were tested, and analysis was done using descriptive statistics and simple linear regression. Traceability was assessed based on system effectiveness, labeling and information sharing, and contract farming. Findings showed that horticultural production is dominated by older male farmers in cooperatives, working on small plots (mostly under one acre), with basic education, mainly growing fruits, and having limited export experience. A significant relationship was found between traceability and export market growth. However, gaps were noted in post-harvest management among farmers. The study recommends adopting modern technologies throughout the supply chain, implementing contract farming within a legal framework, and fostering stakeholder collaborations to reduce costs and improve compliance with market standards and competitiveness in the export of fruits and vegetables.

Keywords: Traceability, information, Contract farming, Export, Markets

1.0 Introduction

The integration of small-scale farmers into Kenya's horticultural export market has significant implications for both household income and national economic growth. By participating in the export market, these farmers can tap into global demand, which serves as a catalyst for increased productivity and contributes to the overall growth of Gross Domestic Product (GDP) and foreign exchange earnings. The on-boarding of these farmers typically involves a contractual agreement that links horticultural production directly to export markets. As detailed by Gramzow and Sefa (2018), these contracts specify the required quantities and post-harvest quality standards that

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must be met for products to qualify for export, obligating farmers to comply with these standards.

Kenya has made strides in integrating smallholder farmers into the export market, with an estimated 2,500 small-scale farmers, predominantly from the Lower Eastern and South Rift regions, now engaged in this program. However, the success of these farmers in global markets is heavily dependent on their ability to adhere to stringent traceability requirements, which are increasingly becoming a non-negotiable aspect of international trade in horticultural products.
Traceability systems play a critical role in ensuring that horticultural products meet the rigorous safety and quality standards demanded by global markets. They allow for the tracking of produce from the farm to the final consumer, thus ensuring that any issues related to safety, quality, or authenticity can be quickly identified and addressed. As the horticultural market in Africa continues to grow, the importance of traceability cannot be overstated. The continent's horticultural exports have seen substantial growth, expanding from USD 3.75 billion in 1995 to USD 16 billion in 2014, with an annual growth rate of 7.54% (Science Direct, 2022). This growth has been driven by advancements in agricultural practices, government interventions, and increasing global demand for perishable goods.

Countries like South Africa, Morocco, and Kenya have become key players in the export of horticultural products, thanks to their favorable climates, agricultural expertise, and collaborative efforts within the horticultural sector. However, these countries face challenges in meeting the strict quality requirements imposed by international markets, which include the need for robust traceability systems. According to Growth Market Reports (2023), enhancing traceability and other aspects of the value chain is essential for maintaining market access and expanding into new markets.

The horticulture sector in Kenya, particularly in the South Rift region, has experienced significant expansion, driven by a combination of favorable weather conditions, supportive government policies, and collaborative efforts to meet stringent international standards. The Kenya National Bureau of Statistics (2020) reports that horticulture contributes more than 33% of the agricultural GDP, with fruits and vegetables being major commodities for both local consumption and export. Commonly cultivated fruits in Kenya include mangoes, avocados, pineapples, and passion fruits, while key vegetables include tomatoes, onions, and French beans. The South Rift region, encompassing counties like Kericho, Narok, and Bomet, is particularly notable for its horticultural production, which has grown substantially due to rising international demand and favorable climatic conditions (Ministry of Agriculture, 2019).

Despite this growth, the horticultural sector in Kenya faces significant challenges, particularly in ensuring compliance with international quality and safety standards. One of the major obstacles is the lack of adequate infrastructure, especially in rural areas where many small-scale farmers operate. The Ministry of Agriculture (2019) estimates that post-harvest losses for perishable products such as fruits and vegetables are around 30%, largely due to inadequate road infrastructure and a lack of refrigerated storage facilities. These losses not only reduce the amount of produce available for export but also undermine the profitability of farmers.

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Logistical challenges further complicate the export process. The Kenya Horticultural Exporters Association (2021) highlights that deficiencies in the supply chain, coupled with bureaucratic hurdles in customs clearance, often result in missed market opportunities and financial losses for farmers. These challenges underscore the need for improved traceability systems, which can help mitigate risks and ensure that products meet the required standards throughout the supply chain.
To fully realize the economic potential of Kenya's horticultural sub-sector, particularly in the fruits and vegetables segment, it is essential to address these challenges. This includes enhancing compliance with international standards, improving infrastructure, optimizing logistics, and ensuring that small-scale farmers can effectively participate in global markets through robust traceability systems.

1.1 Statement of the Problem

In an ideal scenario, small-scale horticultural farmers in South Rift, Kenya, would thrive in the export market by scaling up their operations and consistently meeting stringent global market standards. These standards—particularly those involving robust traceability systems and responsiveness to consumer demands—are essential for securing and maintaining access to international markets. Scholars such as Bien and Soehn (2022) and Match Maker Associates (2017) emphasize the considerable economic potential of fruit and vegetable exports in contributing to Kenya's GDP and foreign exchange earnings.

However, despite this promising outlook, there remains a notable gap in empirical research on how small-scale farmers in South Rift adopt and utilize traceability systems, and how these systems influence their market access and export growth. While previous studies have documented challenges such as pesticide residues, harmful organisms, and persistent non-compliance with technical standards (Onwude et al., 2020; Matui et al., 2016), few have examined these issues through the lens of traceability and supply chain management. As a result, the lack of comprehensive data on traceability implementation and its impact on export performance presents a critical research gap. This study, therefore, seeks to address these gaps by exploring the factors affecting market standards and the growth of horticultural exports among small-scale farmers in South Rift, Kenya, with particular emphasis on the contribution of traceability.

1.2 Research Objective

This research sought to assess the extent to which traceability mechanisms contribute to the growth of horticultural exports by small-scale farmers in the South Rift region of Kenya

1.3 Research questions

The following research questions guided data collection and analysis prior to hypothesis testing:

i. How does the reliability of traceability systems affect the export market growth of horticultural products among small-scale farmers in South Rift, Kenya?
ii. What is the effect of labeling and product information on the export market performance of horticultural products from small-scale farmers in South Rift, Kenya?

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iii. How does contract farming contribute to traceability and influence the export market growth of horticultural products among small-scale farmers in South Rift, Kenya?
iv. What is the overall relationship between traceability systems and export market growth for horticultural products among small-scale farmers in South Rift, Kenya?

1.4 Significance of the Study

This study contributes to the body of knowledge on agricultural value chains by empirically examining the role of traceability system and specifically reliability, labeling and information, and contract farming in influencing the growth of horticultural exports among small-scale farmers in Kenya's South Rift region. The findings provide critical insights for policymakers, exporters, and development practitioners seeking to enhance market access, compliance with international standards, and sustainability in smallholder horticultural exports.

2.1 Lliterature Review

The growing demand for food safety and quality assurance in global markets has made traceability systems a critical aspect of the food supply chain. Traceability refers to the ability to track the production, processing, and distribution of food products, which is essential for ensuring food safety, managing quality, and meeting regulatory requirements.A traceability system (TS) provides mechanisms for tracking the movement of agricultural products throughout the supply chain, from production to the final export market. It enables the identification of the origin, handling processes, and distribution history of horticultural products. TS enhances transparency, food safety, compliance with international standards, and accountability. For small-scale farmers, it facilitates access to high-value export markets by ensuring quality control, timely documentation, and trust among international buyers (Opara, 2003; Golan et al., 2004).
Globally, the adoption of traceability systems varies significantly. Sangkhasuk et al. (2023) conducted a study in Thailand that highlighted how consumer demand is the primary driver of traceability. The study found that consumers are increasingly concerned about the origin of their food, leading to a preference for products with clear traceability and certification. This demand has also spurred the growth of organic products, with more educated consumers particularly driving the trend. The study recommends enhancing traceability standards and ensuring timely resolution of issues within the supply chain.

Similarly, Curto and Gaspar (2021) explored the challenges and benefits of implementing traceability systems in the food supply chain, particularly among small and medium-sized producers. The study identified the high cost of implementation and lack of awareness as significant barriers, despite widespread recognition of the value of traceability. The authors advocate for a cost-effective and adaptable traceability system that would be sustainable and acceptable to all stakeholders, particularly in tracking perishable products.
In Europe, Goddard and Nelsson (2018) reviewed 135 studies across the European Union, North America, and Asia, identifying the critical role of traceability in marketing fresh produce. The study emphasized that traceability is essential for meeting export market requirements and managing the economic risks associated with food safety incidents. The lack of common standards across regions was identified as a gap that needs addressing to streamline global trade.

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Regionally, in Africa, the adoption of traceability systems faces unique challenges. Ayim et al. (2022) examined the implementation of information technologies in Africa's agricultural sector and found that while there is increasing adoption of technology, its quality and integrity are often lacking. The study points to inadequate ICT infrastructure and insufficient training as major impediments to the effective use of traceability systems. The authors recommend government intervention in infrastructure development and training to improve compliance with traceability standards and enhance market access for small-scale farmers.

Locally, in Kenya, Heher and Steenbergen (2020) studied the traceability of horticultural products and the impact of multinational corporations on local firms. The study found that collaboration between local producers and global marketers has improved the quality and traceability of Kenyan horticultural products, making them more competitive in global markets. The study underscores the importance of contract farming and the sharing of market information as key drivers of successful traceability in Kenya's horticultural sector.

Chemeltorit, Saavedra, and Gema (2018) further explored the traceability systems in Kenya's horticultural supply chain, noting the reliance on both modern and manual systems. The study highlighted that while modern traceability systems offer greater reliability and transparency, their adoption is hindered by the high cost and technical requirements, especially for small-scale farmers. The authors recommend a shift towards contemporary information technologies across the supply chain to meet global standards and improve market access.

These studies collectively underscore the importance of traceability in ensuring food safety, enhancing market access, and meeting consumer demand for transparency in the food supply chain. While there are significant challenges, particularly in the cost and adoption of traceability technologies, the benefits in terms of market access and food safety make it a critical area for continued research and development.

2.2 Hypothesis Development

Traceability has become increasingly vital in the agricultural sector, particularly in the horticultural industry, as it ensures the quality, safety, and authenticity of products throughout the supply chain. By enabling the tracking of produce from farm to fork, traceability systems help in managing food safety risks, reducing the incidence of fraud, and meeting the stringent standards required by export markets. However, despite the acknowledged importance of traceability, there remains a gap in the literature concerning its direct impact on the growth of horticultural export markets.

Recent studies emphasize the role of traceability in enhancing the competitiveness of agricultural products in global markets. For instance, Islam et al. (2021) argue that implementing robust traceability systems can significantly increase consumer confidence, thereby driving demand and improving market access for small-scale farmers. This is particularly crucial in the horticultural

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sector, where consumers and regulators are increasingly focused on the origins and safety of the products they consume.

Additionally, research by Curto and Gaspar (2021) suggests that traceability systems can enhance the efficiency of supply chains by enabling quick responses to food safety incidents, thereby minimizing losses and maintaining market stability. They emphasize that the adoption of affordable, scalable, and user-friendly traceability systems is essential for small-scale farmers who are often constrained by limited resources and infrastructure

Furthermore, Manning et al. (2022) highlight that traceability can provide a competitive edge in export markets by meeting the high-quality standards required by international buyers. Their study shows that traceability not only improves marketability but also contributes to the sustainability of the horticultural export sector by promoting transparency and accountability throughout the supply chain.

Given the critical role of traceability in ensuring the quality and safety of horticultural products, it is hypothesized that traceability practices will positively influence the growth of horticultural export markets. However, the current literature lacks a direct examination of this relationship, with most studies focusing on external factors such as global trade policies and consumer preferences. To address this gap, the following hypothesis was proposed:

H01: There is no statistically significant relationship between traceability and the growth of horticultural export markets.

3.0 Materials and Methods

3.1 Subjects

The study targeted 1,891 small-scale horticultural farmers from Bomet and Narok Counties in Kenya's South Rift region. These counties were purposefully selected due to their central role in fruit and vegetable production for the export market. According to Growth Market Reports (2023), Kenya's horticultural sector recorded a 9% increase in exports in 2023. Given the sector's importance to local livelihoods, examining traceability among small-scale farmers in this region was both timely and relevant.

3.2 Sampling Procedure

A stratified random sampling approach was employed to ensure a representative sample. The population was first stratified by county, and within each stratum, simple random sampling was used to select respondents. This procedure ensured fair representation of farmers from both Bomet and Narok counties.

3.2.1 Sample Size, Power, and Precision

The sample size was determined using Yamane's (1967) formula, resulting in a final sample of 367 small-scale farmers. This number was considered statistically sufficient to ensure the

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required power and precision for generalizing the findings. To pre-test the instrument and ensure its suitability, a pilot study was conducted involving 37 farmers from Kericho County, a region with similar agricultural characteristics.

3.2.2 Measures and Covariates

Data were collected using a structured questionnaire designed to evaluate traceability practices and the growth of the horticultural export market. The constructs were measured using a 5-point Likert scale, ranging from 1 ("Strongly Disagree") to 5 ("Strongly Agree"). Validation of the research instrument involved several psychometric tests. Standardized factor loadings were examined, with a minimum threshold of 0.50 required for indicator retention. Internal consistency was assessed using Cronbach's alpha, while Average Variance Extracted (AVE) was used to test for convergent validity. Composite reliability was also calculated. Only items that met the criteria for validity and reliability were included in the final analysis.

3.2.3 Research Design

This study adopted an explanatory research design, which was appropriate for examining the causal relationships between variables. The design enabled the investigation of how traceability practices influence the growth of horticultural exports, particularly among smallholder farmers in the South Rift region.

3.2.4 Data Management

Before conducting statistical analysis, the data were thoroughly examined to ensure completeness, consistency, and accuracy. The dataset was entered into the Statistical Package for Social Sciences (SPSS) Version 22 for analysis. During data cleaning, 13 cases with missing values were identified and excluded from the dataset. Additionally, outlier analysis was performed, and extreme values were removed to enhance data integrity. As a result, 334 valid responses were retained for final analysis. The analysis involved descriptive statistics, including means and standard deviations, as well as inferential statistics. Regression analysis was conducted to test the study hypotheses and determine the relationships among the key variables.

4.0 Findings and Discussion

Demographic variables, including the type of producer, age, gender, export duration, education level, product type, and land size under cultivation, were analyzed. The findings of these demographics are presented in Table 1.

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Table 1: Demographic representation of horticultural producer in Kenya

Variable	Measures	Frequency	Percent
Nature of producer	Self-help group	40	12.0
	Cooperative society	294	88.0
	Total	**334**	**100.0**
Range of Age	30 years and below	24	7.2
	31-40 years	39	11.7
	41-50 years	109	32.6
	51 years and over	162	48.5
	Total	**334**	**100.0**
Gender	Male	236	70.7
	Female	98	29.3
	Total	**334**	**100**
Period in export business	Less than 1 year	59	17.7
	1-2 years	58	17.4
	3-5years	142	42.5
	6-10 years	71	21.2
	more than 10 years	4	1.2
	Total	**334**	**100.0**
Level of Education	Primary	88	26.3
	Secondary	116	34.7
	Tertiary	83	24.9
	University	47	14.1
	Total	**334**	**100.0**
Type of crop grown	Fruit	303	90.7
	Vegetable	31	9.3
	Total	**334**	**100.0**
Land size	Below 1 acre	238	71.3
	1-2 acres	81	24.3
	2-3 acres	13	3.9
	Over 3 acres	2	.6
	Total	**334**	**100.0**

Source: Survey, Data, 2023

Findings show that 88% of the respondents were members of cooperative societies, while 12% belonged to self-help groups. On land size under horticulture, it was observed that 71.3% of farmers owned below 1 acre of land, 24.3% owned between 1 and 2 acres, and 3.9% owned between 2 and 3 acres. Only 0.6% own over 3 acres. Thus, horticultural production was on a small scale, to sustain the global demand, there was the need for the farmers to undertake aggregation of their produce through cooperative and self-help groups. On age, a majority (48.5%) of the small-scale farmers were above 51 years; they were followed (32.6%) by those

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between 41-50 years. The number of farmers decreased with age as 11.7% were between 31-40 years, while 7.2% were 30 years and below. These findings show that farming was not attractive to the younger generations, and they pursued alternative forms of employment. On gender, male farmers comprised 70.7%, while 29.3% were female.

The small-scale farmers were generally new in horticulture as a majority (42.5%) of them had engaged themselves for a period between 3-5 years, whereas 21.2% had 6-10 years, 17.7% had < 1 year, 17.4 % of them had 1-2 years while 1.2% had >10 years of experience. On education, it was established that most farmers had basic education (i.e., 34.7% had a Secondary level of education and 26.3% primary). Another sizable number had a tertiary level of education (24.9% had a college education with 14.1% University) indicating that they could comprehend the market dynamics and respond to the questions adequately. On the type of product, it was established that the majority (90.7%) of the farmers grew fruits while 9.3% grew vegetables.

4.1 Descriptive Statistics

To understand the perception of traceability in small-scale farms, the study used Means and Standard Deviation (SD) as presented in Table 2.

Table 2:Traceability

Item	N	Mean	SD
Traceability System Effectiveness			
There is traceability systems suitable for fruit and vegetable export environment supply chain	334	2.60	1.055
The fruit and vegetable traceability system which is currently in place is affordable	334	2.47	1.245
The farmers can recall the products within the existing supply chain	334	2.38	0.998
The consumers can trace the origin of fruits and vegetables	334	2.93	0.714
All the farmers are aware of the traceability requirements of their product	334	2.45	0.640
Labeling and Information Sharing			
There has been sufficient labeling information on fruits and vegetables offered in various market destinations	334	3.02	1.126
There are qualified personnel to guide on traceability requirements	334	2.99	0.760
There is adequate information sharing between producers and consumers in contract farming arrangements of fruit and vegetables for the export market	334	3.52	1.119
Contract Farming and Traceability			
There is a contract farming arrangement for fruit and vegetables for the export market	334	2.95	1.182
The use of contract farming arrangements between the farmers of fruit and vegetables enhances product traceability requirements in export marketing	334	3.67	1.010

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The registration of farmers under contract farming has helped farmers to meet product traceability in the export market	334	3.64	1.009

Source: Survey, Data, 2023

The study analyzed the effectiveness of traceability systems in the fruit and vegetable export market, revealing a mean score of 2.60 with a standard deviation of 1.055. The respondents acknowledged the suitability of these traceability systems for the export supply chain. However, there were concerns about the affordability of the current traceability system, reflected in a lower mean score of 2.47 (SD = 1.245). Additionally, respondents expressed doubt about the farmers' ability to recall products within the existing supply chain, which had a mean score of 2.38 (SD = 1.245). The awareness of traceability requirements among farmers was also low, with a mean of 2.45 (SD = 0.640).

Despite these challenges, the study found that consumers were generally able to trace the origin of fruits and vegetables, with a mean score of 2.93 and a standard deviation of 0.714. It is emphasized that for an ideal traceability system to be effective, it should be affordable, scalable, and acceptable to all stakeholders. As noted by Curto and Gaspar (2021), such a system must also be economically viable, sustainable, and manageable for both backward and forward tracing. Before developing policies and regulations, it is crucial to assess the proficiency of producers and the needs of consumers to enhance the acceptance and implementation of an affordable traceability system. This approach would help establish trust between producers and consumers during trade transactions, as highlighted by Anastasiadis, Apostolidou, and Michailidis (2021).

The study further noted that fruits and vegetables in various market destinations had adequate labeling information, with a mean score of 3.02 (SD = 1.126). Qualified personnel were available to guide traceability requirements, with respondents giving this aspect a mean score of 2.99 (SD = 0.760). There was also sufficient information sharing between producers and consumers in contract farming arrangements for the export market, indicated by a mean score of 3.52 (SD = 1.119).

Contract farming arrangements for fruit and vegetable exports were recognized, with a mean score of 2.95 (SD = 1.182). Respondents agreed that these arrangements enhanced product traceability in export marketing, as shown by a mean score of 3.67 (SD = 1.010). Moreover, the registration of farmers under contract farming facilitated their ability to meet product traceability requirements in the export market, with a mean score of 3.64 (SD = 1.009). Frascarelli (2021) argued that contract farming is particularly effective when regulatory agencies are either ineffective or distant from farmers, and suggested improving contract farming as a means to bolster quality and traceability across various regions.

The overall mean score of 3.01 for traceability (SD = 1.14) suggests that traceability significantly impacts the market expansion of horticultural products among small-scale farmers, though perceptions varied among respondents. Anastasiadis, Apostolidou, and Michailidis (2021)

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corroborated these findings, noting that an effective traceability system in the supply chain of fruits and vegetables must prioritize consumer trust, protection, food safety, awareness, enhanced food quality, and improved market access.

4.2 Hypothesis Testing Results

Simple linear regression was used to test the relationship between traceability and growth of horticultural export markets. The results of the regression analysis are presented in Tables 3-5.

Table 3: Model Summary for Traceability

					Change Statistics				
Model	R	R Square	Adjusted Square	RStd. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.367a	.135	.132	.38056	.135	51.706	1	332.000	

a. Predictors: (Constant), Traceability

Source; Survey Data, 2023

The model summary in Table 3 indicates that there is a moderate positive correlation between traceability and market growth, with an R value of 0.367. This suggests that as traceability improves, market growth tends to increase as well. The R Square value of 0.135 means that 13.5% of the variation in market growth can be explained by traceability, implying that while traceability has a noticeable impact, other factors also contribute to market growth.

The adjusted R Square value, which is slightly lower at 0.132, adjusts for the number of predictors in the model, confirming the modest but meaningful contribution of traceability. The standard error of the estimate, at 0.38056, indicates the average distance between the observed values and the predicted values from the model, reflecting a moderate level of accuracy in predicting market growth.

The R Square Change is the same as the R Square value (13.5%) since traceability is the only predictor in this model. The F Change value of 51.706 shows that the model is statistically significant, meaning that traceability significantly influences market growth. The degrees of freedom (df1 = 1, df2 = 332) further support the statistical significance of the model. The results demonstrate that traceability plays a significant role in predicting market growth, although its impact is moderate when compared to other possible predictors

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Table 4: ANOVAa for Traceability

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	7.488	1	7.488	51.706	.000
	Residual	48.081	332	.145		
	Total	55.569	333			

a. Dependent Variable: Market Growth
b. Predictors: (Constant), Traceability
Source; Survey Data, 2023

Table 4, shows that traceability has a statistically significant model. This was supported by the p value of 0.000 which was lower than the standard probability of 0.05. Hence, the model was fit to predict market growth using traceability. Table 5 presents the indices (t coefficients and significance levels) used to test the hypothesis. The study accepted or rejected the hypothesis based on a p-value threshold of $p<0.05$.

Table 5: Coefficients a for Traceability

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	T	Sig.
1	(Constant)	2.735	.090		30.522	.000
	Traceability	.205	.029	.367	7.191	.000

a. Dependent Variable: Market Growth
Source; Survey Data, 2023

The coefficients in Table 5 indicate that traceability is a significant predictor of market growth ($\beta = 0.205$, $t = 7.191$, $p < 0.05$). This suggests that for every unit increase in traceability, there is a corresponding 0.205 increase in market growth. The t-value of 7.191 indicates that the estimated coefficient is 7.191 times larger than its standard error, reinforcing the significance of this relationship. The results clearly show that traceability has a positive and statistically significant effect on market growth. These findings align with Curto & Gaspar (2021), who advocated for an affordable, scalable, and widely acceptable traceability system, making it economical, sustainable, and effective for managing both backward and forward tracing. Furthermore, Islam, Manning, and Cullen (2021) supported these conclusions, emphasizing the need for policies and regulations that enhance food traceability while addressing the challenges farmers face in market access.

5.0 Conclusion

This study assessed the role of traceability in influencing the growth of horticultural export markets among small-scale farmers in Kenya's South Rift region. The results demonstrate that traceability system: comprising system effectiveness, labeling and information sharing, and contract farming, significantly contribute to the expansion of export opportunities. Although the

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explanatory power was moderate, with traceability accounting for 13.5% of the variation in market growth, the statistical significance of this relationship affirms its strategic importance within agricultural value chains.

The demographic profile of the respondents underscores structural challenges in the sector, such as aging farmer populations, limited land sizes, and low levels of traceability awareness. Nonetheless, mechanisms like contract farming were shown to enhance traceability compliance and facilitate market access. These findings suggest that improving traceability systems, particularly by addressing affordability, farmer education, and institutional support can increase the competitiveness and sustainability of smallholder horticultural exports.

The study contributes to the ongoing discourse on agricultural trade by offering empirical insights into how traceability frameworks can be leveraged to meet international standards and enhance market integration. Policymakers and stakeholders are therefore encouraged to invest in inclusive, scale-able, and cost-effective traceability solutions that empower smallholder farmers and reinforce Kenya's position in global horticultural markets.

6.0 Recommendation

To enhance their prospects for market expansion, small-scale farmers in the South Rift region should focus on aligning with market standards through strategic investments in effective traceability mechanisms. Adopting contract farming is crucial as it not only supports product traceability but also provides a structured marketing approach. Given the prohibitive costs of traceability systems, a collaborative effort is needed to acquire and implement appropriate information technologies tailored to the production and export of fruits and vegetables. Access to up-to-date and reliable consumer information within the horticultural export industry is vital, necessitating government collaboration with stakeholders to improve network connectivity for these farmers. Additionally, enhancing the contract farming model to meet regulatory traceability requirements will be essential. Marketing policies should emphasize transparency and facilitate the exchange of market knowledge through cost-effective information technology solutions. By adopting these measures, small-scale farmers will be better equipped to make informed, market-oriented, and consumer-focused decisions. This strategic approach will not only boost their competitiveness in the dynamic horticultural sector but also secure their success in the export market. Building consumer trust through robust product traceability is key to improving market access and ensuring long-term sustainability in the fruit and vegetable export market.

Limitations and Suggestions for Further Research

The tools for data collection were designed in English, although the respondents were primarily fluent in their native language. Furthermore, the poor road network in many parts of the study area posed significant challenges in reaching the respondents, potentially affecting the data collection process. The study identified three key constructs related to traceability: the traceability systems effectiveness, labeling and information sharing and contract farming and traceability. However, it is important to acknowledge that several other factors influencing traceability were not addressed. Given these limitations, we recommend that future research

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explore additional factors that may pose challenges to traceability. Moreover, this study was confined to registered small-scale farmers within organized producer groups, thereby excluding small-scale farmers who operate independently but also engage in the production and export of fruits and vegetables. We suggest conducting a comparative study on these independent farmers to provide a broader perspective on traceability.

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