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Growth of Horticultural Export Market: The implication of Post-harvest Handling Practices among Small Scale Farmers in South Rift, Kenya

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Abstract

The inclusion of rural smallholder farmers in the export of horticultural products has two major implications: increased household income through access to a promising global market and enhanced productivity, cumulatively contributing to the growth of Gross Domestic Product (GDP) and foreign exchange. Currently, there are an estimated 2,500 smallholder farmers participating in horticultural exports South Rift of Kenya. Consequently, this study aimed to investigate the relationship between post-harvest handling practices by smallholder farmers and the growth of the horticultural export market. Quantitative data were collected using a structured questionnaire from a sample of 334 small-scale horticultural farmers, randomly selected for the study. Validity and reliability tests were conducted prior to the main study. Descriptive statistics and simple linear regression were employed to analyze the data. Post-harvest handling practices were assessed through the utilization of packaging materials, storage facilities, energy supply, hygiene, and transportation facilities. The findings indicated a statistically significant

relationship between post-harvest handling practices and the growth of horticultural export markets. However, deficiencies were observed among small-scale farmers in South Rift, Kenya, in managing horticultural products after harvest. The study recommended for strategic interventions for the adoption of modern technologies in every stage of the supply chain and establishes collaborations with key stakeholders in order to minimize cost of investment per farmer and ultimately enhancing market standards compliance and competitiveness in the fruit and vegetable export market.

Keywords: *Post harvest, storage, packaging, Hygiene, Export, Markets*

1.0 Introduction

The inclusion of rural smallholder farmers in the export of horticultural products has two major implications: increased household income through a promising global market, which is a catalyst for productivity, cumulatively growing Gross Domestic Product and foreign exchange. The on boarding of the farmers is done through a contractual process that ties the production of horticulture to exports(Gramzow & Sefa, 2018). The contract spells out the quantities and post harvest quality of products that meet the threshold for exports, and farmers are under obligation to comply. So far, Kenya has estimated 2500 smallholder farmers under this program who are mainly from the lower Eastern and South Rift parts of Kenya.

The horticulture market in Africa has witnessed substantial growth, making a considerable contribution to the continent's agricultural exports. The industry has had significant expansion, increasing from USD 3.75 billion in 1995 to USD 16 billion in 2014, with a steady annual growth rate of 7.54% (Science Direct, 2022). Advancements in agricultural methodologies, governmental interventions, and the rising worldwide demand for perishable agricultural products are primarily responsible for the significant expansion. South Africa, Morocco, and Kenya have become significant contributors to the export of horticultural products due to their advantageous climates, skills in cultivation, and collaborative partnerships in the field of horticulture. African countries face obstacles, such as strict quality requirements and impediments to entering markets. However, there are substantial prospects for improving adherence to global standards and growing into untapped markets. The continent's emphasis on improving agricultural infrastructure, including cold storage and transportation facilities, has also contributed to the expansion of the horticultural sector. Access to export markets necessitates adherence to the value chain (Science Direct, 2022; Growth Market Reports, 2023).

The horticulture sector has experienced significant expansion at a local level, especially in terms of exports. The nation has emerged as a prominent exporter of diverse fruits and vegetables. Kenya experienced a significant increase of around 93% in its earnings from exporting horticultural products. Favorable weather conditions, effective government policies regarding production practices, and cooperative efforts to meet strict quality standards primarily influenced this growth. Global Market Estimates in 2021 and the Kenya Ministry of Agriculture in 2020 support these findings. This sub-sector involves the manufacturing of several horticulture commodities, such as fruits, vegetables, flowers, and ornamental plants. Horticulture constituted more than 33% of the agricultural Gross Domestic Product (GDP), as reported by the Kenya National Bureau of Statistics in 2020. Fruits and vegetables hold significant importance in this range of products, serving as essential items for local consumption and major commodities for export.

Commonly cultivated fruits in Kenya include mangoes, guavas, avocados, pineapples, papayas, grapes, strawberries, and passion fruits. The vegetable group comprises crops such as tomatoes, onions, cabbages, carrots, turnips, and French beans. Farmers grow these items in various places, with the South Rift, which includes Kericho, Narok, and Bomet counties, being notable areas for horticultural farming. The exportation of fruits and vegetables from Kenya has experienced significant expansion, propelled by rising international demand and the country's advantageous climatic conditions that enable continuous production (Ministry of Agriculture, 2019).
Nevertheless, the sector faces certain obstacles that impede its full potential. An important obstacle is ensuring compliance with the rigorous quality and safety criteria mandated by global markets.

Insufficient infrastructure, especially in rural regions where numerous small-scale farmers operate, is a significant obstacle. Significant post-harvest losses, estimated to be approximately 30% for perishable agricultural products like fruits and vegetables, are a result of inadequate road infrastructure and the absence of refrigerated storage facilities (Ministry of Agriculture, 2019). These losses reduce the exportable produce and jeopardize farmers' profitability.
Logistical challenges may present a substantial obstacle. The exportation of horticulture products entails a series of stages, encompassing harvesting, transportation, handling, and shipment. Any disruptions or mismanagement at any stage can jeopardize the quality of the produce. According to the Kenya Horticultural Exporters Association (2021), deficiencies in the supply chain, along with bureaucratic obstacles in customs clearance, sometimes lead to missed chances in the market and financial setbacks.

The horticultural sub-sector in Kenya, specifically the fruits and vegetables segment, has substantial potential for economic growth and poverty reduction. However, to fully exploit this potential, we must solve several difficulties. To overcome these obstacles and improve the performance of the sector, it is crucial to prioritize enhancing compliance with international quality standards, upgrading infrastructure, optimizing logistical procedures, and addressing market dynamics for small-scale farmers.

1.1 Statement of the Problem

In an ideal scenario, small-scale horticultural farmers in South Rift, Kenya, would flourish in the export market by expanding their operations and adhering to stringent global market standards. These standards include pre-harvest and post-harvest quality controls and responsiveness to consumer demands. Authors such as Bien & Soehn (2022) and Match Maker Associates (2017) emphasize the potential for significant contributions to the Kenyan economy through the export of fruits and vegetables. However, challenges remain, as highlighted by Onwude et al. (2020), Fulano, Lengai, and Muthoni (2021), and Matui et al. (2016). These challenges include pesticide residues, harmful organisms, and non-compliance with technical standards, which result in limited market access and high levels of loss within the supply chain. Therefore, this research aimed to investigate the factors influencing market standards and growth in horticultural products among small-scale farmers in South Rift, Kenya, with a particular focus on quality controls.

2.1 Literature Review

The relationship between post-harvest handling practices and market access has been an area of growing interest, particularly in the context of small-scale farmers who are pivotal in horticultural production. Several studies have examined the barriers and opportunities in post-

harvest handling, emphasizing the need for improved infrastructure, technology, and policy support to enhance market quality compliance and export potential. Adhikari & Aarati (2021) explored post-harvest practices in Nepal and found that small-scale farmers, responsible for 90% of horticultural production, struggle with market access due to limited modern storage facilities. Punjari et al. (2015) examined India's vegetable supply chain, identifying inadequate cold chain facilities, high wastage, and insufficient transport as significant barriers. Similarly, Etefa, Forsido, and Kebede (2022) studied post-harvest losses in Ethiopia, revealing that poor storage, pests, and diseases cause significant losses. These studies identified the need to review policies and investments in storage and transportation infrastructure to improve market quality compliance.

Aremu et al. (2015) found in Nigeria that although various packaging materials were available however, farmers lacked knowledge of their appropriate use, hindering export market access. Arah, Amaglo, Kumah, and Ofori (2015) reviewed quality control strategies for tomatoes, highlighting the importance of pre-harvest practices, which was a precursor to product quality in the post harvest stage management. Mukarambwa et al. (2017) examined Zimbabwean farmers' participation in post-harvest practices, finding that knowledge gaps and costs influence supply chain decisions which were imperative in export market access. Wakholi et al (2015) focused on East Africa, noting the limited acceptance of post-harvest technologies due to inadequate policies and infrastructure.

Fresh Produce Logistics (2021) identified supply chain bottlenecks and inefficiencies in managing fresh produce value chains. Ridolfi, Hoffmann, and Barak (2018) in Kenya highlighted challenges in production and harvesting due to irregular water supply and inadequate storage. They suggest collaborative facilities and investment partnerships to enhance post-harvest handling. Similarly, Onwude et al. (2020) reviewed technological advancements in cold chain management, advocating for modern tools like imaging and spectroscopy to improve product quality and market accessibility. Rajapaksha et al. (2021) examined Sri Lanka's post-harvest handling, recommending optimized supply chain activities and government support to enhance product quality and market competitiveness.

Workineh and Lemma (2020) found out in Ethiopia that, inadequate packaging and storage was greatly impacting market performance, while, Sodhi, Singh, and Agnihotri (2016) revealed high costs of cold storage in India, suggesting government incentives and efficient distribution networks to reduce food losses. Guillaume et al. (2021) in Cameroon focused on post-harvest handling challenges, recommending training for farmers to reduce wastage and improve product quality and market access. Kendurkar and Tiwari (2017) emphasized the importance of cold chain supply in India, advocating for public-private partnerships and policy frameworks to support small-scale farmers.

Mvumi, Matsikira, and Mutambara (2016) identified significant losses in Zimbabwe's banana value chain, proposing contract farming and quality standard enforcement to improve market access. Negi & Anand (2015) found fragmentation in India's cold chain infrastructure, complicating management processes which in the end compromised on quality and market access and brought in the element of stakeholder engagement and government measures to performance. Hausen et al. (2017) examined post-harvest strategies, emphasizing the importance of training and transparency in cost-benefit sharing. Shuck et al. (2022) in Kenya highlighted significant food losses due to poor agricultural practices, suggesting government support for technical training and modern storage facilities. Abong, Hartwg, and Keding (2021) studied

packaging preferences in East Africa, recommending improvements in packaging quality to ensure product safety and marketability.

It was noted that, research into the relationship between post-harvest handling practices and the growth of the export market in the agricultural sector remains limited. Additionally, most studies do not address the challenges faced by small-scale farmers in Kenya. This gap indicates that stakeholders lack sufficient knowledge in this area. Therefore, this study aims to investigate the role of post-harvest handling practices in the growth of the export market among small-scale farmers in Kenya.

2.2 Hypothesis Development

Post-harvest handling practices are critical to maintaining the quality and safety of agricultural products, particularly within the horticultural sector. Effective post-harvest handling not only reduces losses but also extends the shelf life of produce, thereby ensuring that it meets the high standards required for export markets. While extensive research has examined market dynamics as a key factor influencing growth and performance in agriculture, less attention has been paid to the role of post-harvest handling practices in driving these outcomes.

Recent studies underscore the importance of adopting advanced post-harvest handling practices to minimize losses and enhance the quality of horticultural produce. For example, Kumar et al. (2020) highlight that post-harvest losses in developing countries remain high due to inadequate handling, storage, and transportation facilities, with losses ranging from 30% to 40% in fruits and vegetables. These losses significantly impact small-scale farmers, who often lack access to modern post-harvest technologies and infrastructure.

Moreover, research by Opara and Al-Ani (2021) demonstrates that the adoption of improved post-harvest technologies, such as controlled atmosphere storage and modified atmosphere packaging, can significantly enhance the marketability of horticultural products. These technologies help maintain the freshness and quality of produce, thereby increasing its competitiveness in export markets.In addition, Tadesse and Bahiigwa (2019) argue that investments in post-harvest infrastructure, including cold storage and efficient transportation systems, are essential for reducing post-harvest losses and increasing the profitability of horticultural exports. Their study indicates that small-scale farmers who adopt these practices can achieve higher returns and better market access, particularly in global markets where quality standards are stringent.

Despite the clear link between post-harvest handling practices and improved market outcomes, there is a notable gap in the literature regarding the direct impact of these practices on the growth of horticultural export markets. Most existing studies focus on external factors, such as global trade policies and consumer behavior, leaving a gap in understanding how internal practices like post-harvest handling influence growth. Therefore, we hypothesize the following:

H01: There is no statistically significant relationship between post-harvest handling practices and the growth of horticultural export markets.

3.0 Methodology

The investigation utilized an explanatory research design. A total of 1,891 small-scale farmers from Bomet and Narok Counties in the South Rift region of Kenya were identified as the study population. The study area was selected due to its significance in producing fruits and vegetables for the export market. Horticultural production in Kenya has seen consistent growth over the

years, with a notable 9% increase in exports of these products in 2023 alone (Growth Market Reports, 2023). Horticulture is one of the primary economic activities for residents of the South Rift. Therefore, any interventions, such as research aimed at supporting horticulture in the region, are likely to enhance the livelihoods of these residents.

Population and Sampling

From the population of 1,891, the study applied Yamane's 1967 formula to determine a sample size of 367 small-scale farmers. The sample was then stratified by county, and respondents were chosen using a simple random sampling technique.

Survey Instruments and Validation

The study variables were evaluated using a multi-item scale to test the hypotheses. Constructs for data analysis were measured on a 5-point Likert scale, ranging from "Strongly Disagree" (1) to "Strongly Agree" (5). The instrument was validated through a pilot study involving 37 small-scale farmers in Kericho County, with the data analyzed for both validity and reliability. Key metrics such as standardized factor loadings, Cronbach's Alpha, average variance extracted (AVE), and composite reliability were reported. For the indicators to be retained, their loadings needed to exceed 0.50 at the t-value, which all did. The final data analysis utilized means, standard deviation, and regression analysis.

Data Management

At the beginning of the data analysis, the researcher carefully reviewed the data to ensure it was complete, consistent, and accurate. A decision was then made on whether to proceed with data processing. Following these initial checks, the data was entered into the Statistical Package for Social Sciences (SPSS V22) for analysis. The study identified and addressed missing values to prevent inaccuracies in the inferential analysis. During this process, 13 cases with missing data were found. Additionally, outliers were identified and removed to ensure the data was clean and accurate. As a result, the study retained 334 units of inquiry for the final analysis.

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 small scale, to sustain the global demand, there was need for the farmers to undertake aggregation of their produce through cooperative and self help groups. On age, majority (48.5%) of the small-scale farmers was above 51 years; they were followed (32.6%) by those between 41-50 years. The number of farmers decreased with age as 11.7% were between 31-40 years and while 7.2% were 30 years and below. These findings show that farming was not attractive to the younger generations, and they pursue 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 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 Secondary level of education and 26.3% primary). Another sizable number had tertiary level of education (24.9% had 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 post harvest handling practices in small scale farms, the study used Means and Standard Deviation (SD) as presented in Table 2.

Table 2: Post-Harvest Handling Practices

Item	N	Mean	SD
Utilization of Packaging Materials			
There are recommended Packing Materials which are cost-effective and market compliant	334	3.85	1.055
Packing done according to customer and market standards	334	3.21	1.245
Storage Facilities and Energy Supply			
There are adequate and accessible storage facilities meeting export market Standards:	334	1.72	0.714
There is constant supply of reliable energy for cooling:	334	1.77	0.640
Hygiene and Transportation Facilities			
There are hygienic sites not meeting export market requirements	334	2.24	1.126
There are farmers' owned transport cooling facilities:	334	1.87	0.760

Source: Survey, Data, 2023

The data reveals that cost-effective and market-compliant packing materials received a mean of 3.85 and a standard deviation of 1.055, indicating general agreement that these materials meet market standards, though with some variability in responses. In contrast, packing practices according to customer and market standards had a mean of 3.21 and a standard deviation of 1.245, reflecting moderate agreement and higher variability regarding adherence to these standards. For storage facilities meeting export market standards, the mean was 1.72 with a standard deviation of 0.714, indicating a general consensus that these facilities fall short of export standards. Similarly, the constant supply of reliable energy for cooling had a mean of 1.77 and a standard deviation of 0.640, highlighting a significant issue with energy reliability and a consensus on its inadequacy. On hygienic sites not meeting export market requirements had a mean of 2.24 and a standard deviation of 1.126, showing some agreement on deficiencies in hygiene practices, with considerable variation in responses. Lastly, farmers' owned transport cooling facilities scored a mean of 1.87 with a standard deviation of 0.760, suggesting widespread dissatisfaction with their adequacy.

These data suggest that, while packing materials are somewhat effective and compliant, significant issues remain with storage facilities, energy supply, transportation cooling, and hygiene practices, all of which fall short of export market requirements in the way small-scale

farmers in South Rift, Kenya, handle horticulture products after harvesting. The findings are consistent with Adhikari & Aarati (2021), who observed that although there has been an increase in production, farmers' incomes continue to be low due to difficulties in accessing markets caused by the restricted availability and use of contemporary and cost-effective storage facilities. Punjari et al. (2015) shared similar perspectives, including the need for the establishment of cold chain infrastructure, suitable packaging methods, the utilization of advanced communication technology, and the promotion of knowledge awareness among farmers. According to Etefa, Forsido, and Kebede (2022), suboptimal harvesting procedures, insufficient storage infrastructure, transportation challenges, unsuitable packing, and a lack of market awareness are the primary factors contributing to post-harvest losses. Their research advocated for intentional approaches to mitigate these losses, augment product quality, and promote the promotion of fruits and vegetables in global marketplaces.

4.2 Hypothesis Testing Results

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

Table 3: Model Summary for Post-Harvest Handling

					Change Statistics				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.374[a]	.133	.130	.38099	.133	50.827	1	332	.000

a. Predictors: (Constant), Post-harvest handling practices

Table 3 presents a summary of a statistical model for post-harvest handling. The correlation coefficient (R) is 0.374, indicating a moderate positive relationship between the predictor(s) and the outcome variable, where changes in the predictor(s) are associated with corresponding changes in the outcome. The R Square value, at 0.133, reveals that the model explains approximately 13.3% of the variance in the dependent variable, suggesting that while the model captures some of the variability, a significant portion remains unexplained, likely due to factors not included in the analysis. The Adjusted R Square, slightly lower at 0.130, accounts for the number of predictors in the model, indicating that the model's explanatory power is modest even after considering the complexity of the model. The standard error of the estimate, 0.38099, shows the average distance that the observed values fall from the regression line, with a lower value indicating a more precise fit. The R Square Change value of 0.133 suggests that the addition of the predictors to the model explains an additional 13.3% of the variance in the outcome variable. The F Change statistic of 50.827, tests whether this additional explained variance is statistically significant. With degrees of freedom (df1) of 1, associated with the predictors added, and df2 of 332, associated with the sample size minus the number of predictors, the model's F Change is found to be statistically significant with a p-value of 0.000. This significance level indicates that the inclusion of the predictors significantly improves the model's ability to predict the outcome, although the overall explanatory power remains modest. The ANOVA findings was generated and presented in table 4.

Table 4: ANOVAa for Post-Harvest Handling Practices

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	7.378	1	7.378	50.827	.000[b]
Residual	48.192	332	.145		
Total	55.569	333			

a. Dependent Variable: Market Growth, b. Predictors: (Constant), Post-harvest handling practices

Table 4, shows that post-harvest handling 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 post-harvest handling practices. 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 for Post-Harvest Handling

	Unstandardized Coefficients		Standardized Coefficients		
Model	**B**	**Std. Error**	**Beta**	**T**	**Sig.**
1(Constant)	2.693	.096		28.005	.000
Postharvest Handling Practices	.222	.031	.374	7.129	.000

a. Dependent Variable: Market Growth

Table 5 presents the coefficients for the statistical model on post-harvest handling. The unstandardized coefficient (B) for the constant is 2.693, with a standard error of 0.096. This constant represents the expected value of the dependent variable when all predictors are zero. The corresponding t-value is 28.005, which is statistically significant with a p-value of 0.000. For the variable "Postharvest Handling Practices," the unstandardized coefficient (B) is 0.222, indicating that for each unit increase in post-harvest handling practices, the dependent variable is expected to increase by 0.222 units, holding all other variables constant. The standard error for this coefficient is 0.031. The standardized coefficient (Beta) is 0.374, showing the relative importance of this predictor in the model. The t-value for this variable is 7.129, with a p-value of 0.000, indicating that the relationship between post-harvest handling practices and the dependent variable is statistically significant. The study revealed that the way small-scale farmers in South Rift, Kenya handle horticultural items after harvesting significantly influences their market expansion as result the null hypothesis was rejected.

The findings align with those of Sodhi, Singh, and Agnihotri (2016), who suggested that investing in storage facilities is a strategic step to access new markets. Kendurkar and Tiwari (2017) proposed a public-private partnership approach to share knowledge about cold chain supply technologies and develop a policy framework for managing cold chain facilities. They also recommended conducting further research to expand the knowledge base on cold chain supply and market access. The findings align with those of Hausen, Durkee, Fulwider, Diaz &

Christiansen (2017), who suggest the need for comprehensive training and transparent communication regarding the costs and benefits of any post-harvest technique implemented. They also propose the involvement of extension officers who are skilled in utilizing information and communication technology (ICT) to manage horticultural supply chains. In general, implementing appropriate post-harvesting practices would lead to an improvement in the market expansion of horticulture products among small-sale farmers in the South Rift region.

5.0 Conclusion

The findings revealed that, most of the farmers used both recommended and cost-effective packaging materials for packaging and were diligently packaging fruits and vegetables after precisely selecting and grading them according to customer and market requirements. However it was noted that, there were insufficient storage facilities owned by farmers that met the criteria required for exporting fruits and vegetables. They also highlighted the need for a consistent electricity source for cooling these storage facilities. Respondents also expressed disagreement regarding the availability of farmer-owned facilities that are suitable for transporting fruits and vegetables from farms to the appropriate destination in the export market supply chain. It was established that, there was a moderate and favorable relationship between post-harvest handling and market expansion. This indicated that post-harvest handling has a notable impact on the market expansion of horticultural products among small-scale farmers in South Rift.

6.0 Recommendation

Small-scale farmers in the South Rift region should prioritize conforming to market standards in order to greatly improve their prospects for market expansion. This entails making strategic investments in suitable post-harvest handling facilities, implementing appropriate and modern technologies at every stage of the supply chain, and strictly adhering to international regulations and protocols for handling export products. It is also essential to establish collaborations with export-focused institutions, agricultural producer associations, and government agencies. These collaborations enable farmers to collectively create shared-use facilities, resulting in reduced investment costs per farmer. Adopting these measures fully, will improve market access and enhance competitiveness 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 post-harvest handling practices: the utilization of packaging facilities, storage facilities and energy supply, and hygiene and transportation facilities. However, it is important to acknowledge that several other factors influencing post-harvest handling practices were not addressed. Given these limitations, we recommend that future research explore additional factors that may pose challenges to post-harvest handling practices. 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 post-harvest handling practices.

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