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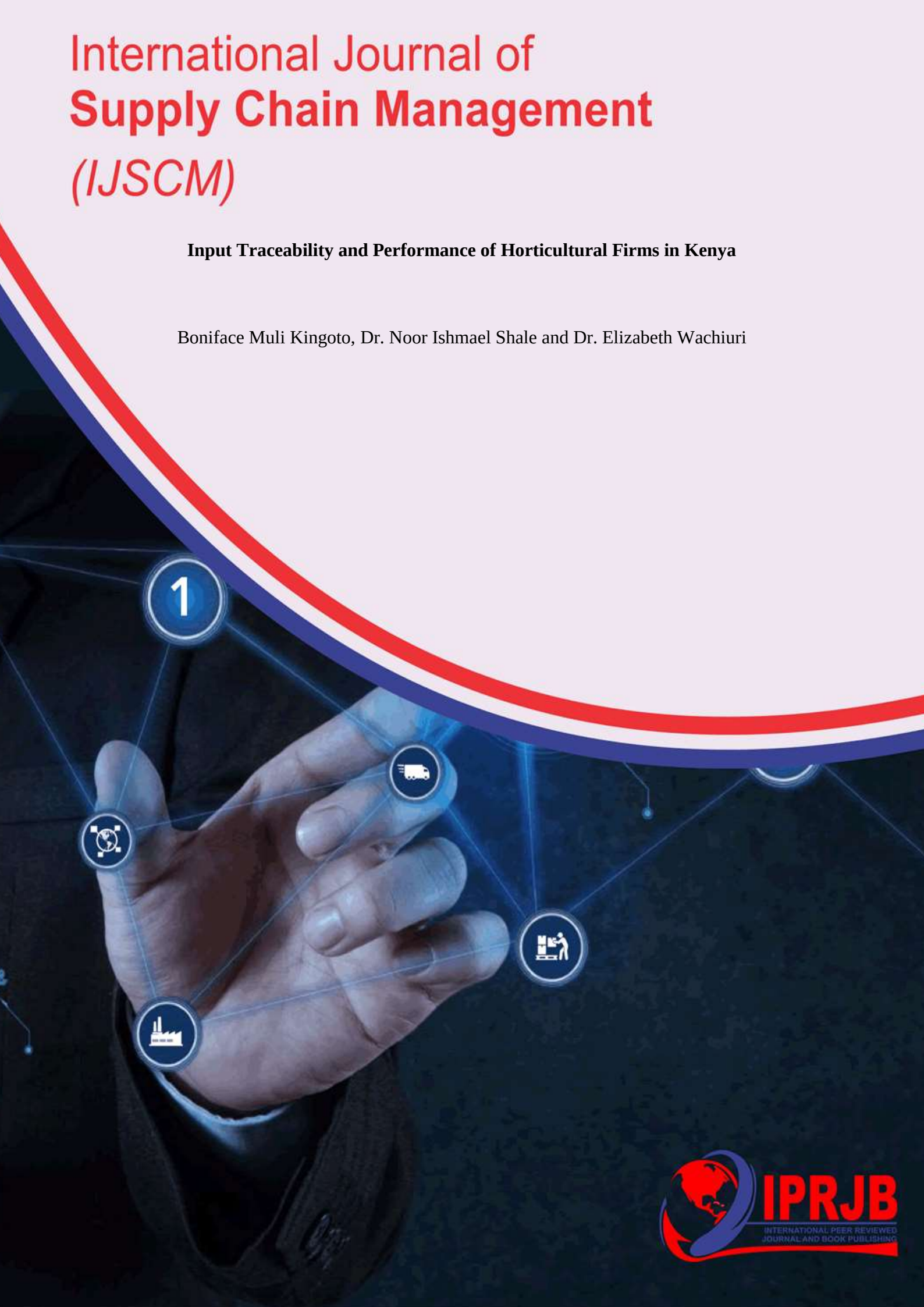

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Abstract

Purpose: This study therefore sought to examine the effect of input traceability on performance of Horticultural Firms in Kenya.

Methodology: This study adopted a cross-sectional survey research design. The unit of analysis for this study was 658 registered Horticultural firms in Kenya. The heads of procurement, quality assurance, production, information and communication technology as well as marketing departments in horticultural firms in Kenya formed the unit of observation. The target population was 3,290 heads procurement, quality assurance, production, information and communication technology as well as marketing departments from 658 registered Horticultural firms in Kenya. The sample size was determined using Slovin's Formula and stratified random sampling in the selection of 355 respondents from the target population. The study used both primary as well as secondary data. Secondary data was collection from the annual reports of different horticultural firms in Kenya. Primary data was obtained using semi-structured questionnaires. A pilot test was conducted to assess the validity and reliability of the research instrument. The semi-structured questionnaires generated qualitative and quantitative data. Thematic analysis was used to analyze qualitative data and the results will be presented in a prose form. Descriptive as well as inferential statistics were used in analysing quantitative data with the help of SPSS version 28.0 statistical software. Descriptive statistics comprised of frequency distribution, percentages, standard deviation and mean. Inferential statistics included correlation analysis and linear regression analysis.

Findings: The study found that input traceability positively and significantly affects the performance of horticultural firms in Kenya.

Unique Contribution to Theory, Practice and Policy: Horticultural firms should ensure that comprehensive tracking of the source of all inputs used guarantees quality and safety, which are important for consumer trust. In addition, regular audits of suppliers should be implemented to confirm adherence to ethical and sustainable practices.

Keywords: *Input Traceability, Performance, Horticultural Firms, Customer Satisfaction*

JEL Classification Codes: *L25, M31, Q13*

INTRODUCTION

Horticultural firms play a crucial role in society and the economy by engaging in the cultivation, production, and distribution of plants and plant-based goods (Maharjan & Kato, 2023). These businesses are integral to both local and global markets, contributing significantly to food security, employment, and economic growth.

The horticultural sector faces challenges in profitability, market share, and customer satisfaction due to supply chain inefficiencies, logistical disruptions, and intense competition, requiring businesses to adapt to evolving consumer preferences. Horticultural firms are responding to evolving consumer preferences for organic and locally sourced products by adopting supply chain traceability. This strategy enhances transparency, ensures product quality, and reduces risks, helping businesses meet sustainability demands and stay competitive (Schuitemaker & Xu, 2020; Gupta & Boyd, 2018). Traceability enables firms to adapt effectively, boosting performance while addressing global challenges in quality assurance and shifting market dynamics. The components of supply chain traceability include product traceability, process traceability, input traceability and output traceability.

Input traceability refers to the process of tracking the origin and flow of raw materials or components within a supply chain, from the initial source to the point of use in production. This process ensures transparency and accountability, allowing businesses to verify the quality, safety, and compliance of the inputs they receive (Liao & Kwaramba, 2020). It helps mitigate risks, such as the use of substandard materials, and supports the overall integrity of the production process (Bae & Cho, 2019). Input traceability involves tracking the origin and movement of raw materials or components throughout the supply chain. Key elements include source identification, which ensures that materials are traceable to their original supplier, and storage tracking, which monitors the conditions and locations where inputs are kept (Maharjan & Kato, 2023). Additionally, supplier transparency is vital, as it allows firms to verify the practices of their suppliers, ensuring compliance with quality and sustainability standards (Masudin, Ramadhani & Restuputri, 2021). These elements collectively improve the overall quality and safety of the production process.

Traceability is becoming increasingly important in global supply chains, with various industries implementing systems to ensure transparency and traceability of inputs. In Europe, the General Food Law mandates food businesses to have traceability systems, ensuring the origin of products and components is tracked from farm to consumer (European Commission, 2016). Similarly, Canada uses Supply Chain Traceability (SCT) in agriculture to guarantee food safety and quality from farm to table, supporting both food safety and sustainable practices (Smith & Pearce, 2022). In Pakistan, SCT is vital in the textile industry to monitor raw material journeys and address quality assurance challenges (Khan et al., 2021; Ahmad & Akbar, 2022). Furthermore, in Tanzania, Ethiopia, and Kenya, traceability systems are implemented to ensure the quality and origin of horticultural products, promoting efficiency and compliance with export standards (TAHA, 2021; EHPEA, 2021). In Nigeria, SCT in agriculture and oil sectors helps track products like cocoa and palm oil, ensuring compliance with international standards and reducing fraud (Adeoye & Ojo, 2022; Okoro et al., 2021). Across these regions, SCT plays a crucial role in promoting transparency, improving efficiency, and enhancing competitiveness in global markets. These global examples highlight the critical role of traceability in enhancing transparency, improving efficiency, and strengthening market competitiveness. For Kenya's horticultural industry, which heavily relies on exports, adopting and strengthening SCT can improve compliance with international market standards, reduce post-harvest losses, and

enhance customer confidence. By learning from these global best practices, Kenya can further develop its traceability systems to maintain its position as a leading exporter of horticultural products.

Statement of the Problem

The horticultural sector in Kenya plays a key role in economic development as it contributes about 26% of the agricultural GDP, which is the main pillar of the national economy (Horticultural Crops Directorate, 2022). Despite the growth of the sector in the last 10 years, the sector has been experiencing challenges such as increased competition in the export market, increase in foreign exchange rate, climatic change and the changing needs of the consumers (Fresh Produce Exporters Association of Kenya, 2022). To remain competitive in the horticultural export market, horticultural firms in Kenya have in the last one decade been adopting various elements of supply chain traceability including input traceability. Masudin et al. (2021) indicate that input traceability leads to an improvement in supply chain performance.

Despite the growth of the sector, the performance of Horticultural Firms in Kenya has been fluctuating for the last five years (Horticultural Crops Directorate, 2022). An Agricultural Sector Survey by the Central Bank of Kenya (2023) revealed that earnings in horticultural industry in Kenya declined by 8.23% from Ksh. 144. billion in 2020 to Ksh. 133 billion in 2021, which decreased by 10.59% in 2022 to Ksh. 120.3 billion and 10.39% in 2023 to Ksh. 107.8 billion. The Horticultural Crops Directorate (2023) indicates that customer satisfaction in the horticultural industry increased from 85.3% in 2019 to 89.1% in 2020, but decreased to 86.2% in 2021, decreased to 81.3% in 2022 and 78.9% in 2023. Fresh Produce Exporters Association of Kenya (2022) observed that the return on assets among horticultural firms in Kenya decreased from 13.9% in 2019 to 12.0% in 2020, 11.6% in 2021 and 11.3% in 2022. In addition, Dae and Wamugo (2022) found that return on investments in the horticulture industry declined from 21.6% in 2019 to 19.2% in 2020, which increased to 20.0% in 2021, but decreased to 18.5% in 2022 and 17.9% in 2023. The Fresh Produce Exporters Association of Kenya (2022) also indicates that the average market share of horticultural firms in 2019 was 26.21%, but it dropped sharply to 12.69% in 2020, increased to 18.72% in 2021, increased to 32.78% in 2022, but decreased to 26.76% in 2023. It is therefore important to examine input traceability and performance of horticultural firms in Kenya.

Various studies have been conducted on supply chain and performance of firms. For instance, Kariuki et al. (2019) investigated the effect of input traceability on the performance of manufacturing firms in Nairobi County; and Mukolwe and Onyango (2017) examined the effect of input traceability on the performance of small and medium-sized enterprises in the food processing industry in Kenya. However, Kariuki et al. (2019) looked at manufacturing firms in Nairobi County while Mukolwe and Onyango (2017) looked at small and medium-sized enterprises in the food processing industry. In addition, both Kariuki et al. (2019) and Mukolwe and Onyango (2017) studies made use of descriptive research design. Therefore, previous studies were limited to different sectors and have used different methodologies. In addition, these studies did not show how input traceability affects performance of horticultural firms, and this is what necessitated the research.

The null hypothesis in this study was;

H_0: Input traceability has no significant effect on performance of horticultural firms in Kenya

LITERATURE REVIEW

Theoretical Review

This study will be anchored on the Resource-Based View (RBV) Theory and Transaction Cost Economics (TCE) Theory, which provide a foundation for understanding how input traceability influences the performance of horticultural firms in Kenya.

Resource Based View Theory

Resource Based View Theory was developed by Wernerfelt (1984). The resource-based view (RBV) the theory focuses on highlighting the organization's competitive advantage. It indicates that firms can only gain competitive advantage through utilization of resources as well as capabilities available in the organization (Hinkes & Peter, 2020). RBV focuses attention on an organization's internal resources as a means of organizing processes and obtaining a competitive advantage. Barney stated that for resources to hold potential as sources of sustainable competitive advantage, they should be valuable, rare, imperfectly imitable and not substitutable (Vasudevan, 2021).

Putra and Wiagustini (2021) indicated that resources are different from capabilities in that capabilities are non-transferrable special resources of the firm and are specifically for a certain organization. The key function of these resources is to ensure proper functioning of the other resources owned by the company. Resources refer to all the assets that a certain firm owns while capabilities are the abilities owned by the firm which facilitate usage of the firm resources. Firm capabilities originate from the building process of the company's resources (Vasudevan, 2021). Firm resources are among the key determinants of the firm success. A company is most likely to succeed if the available resources are in line with the operations and the strategies of the firm. In this theory an organization is known in terms of the available resources as well as capabilities. It facilitates the understanding on firms and their role in the market (Hong, Cho & Kim, 2015).

The Resource-Based View (RBV) theory explains how input traceability affects the performance of horticultural firms in Kenya by analyzing it through the VRIN framework (Valuable, Rare, Inimitable, and Non-substitutable). First, input traceability is valuable because it ensures quality control, enhances compliance with export standards, and improves operational efficiency, leading to higher customer satisfaction and increased market access (Karani, 2022). Second, it is rare as not all horticultural firms have invested in comprehensive traceability systems due to the high costs and technical expertise required, giving firms that adopt it a competitive advantage in quality assurance and premium pricing (Putra & Wiagustini, 2021). Third, it is inimitable since effective traceability systems require a unique combination of technology, established supplier networks, and process integration, making replication difficult for competitors (Issack & Noor, 2020). Lastly, input traceability is non-substitutable, as no alternative system can provide the same level of transparency, regulatory compliance, and supply chain accountability. Therefore, firms that implement traceability systems can sustain a long-term competitive advantage, aligning with the RBV framework.

Transaction Economics Theory

Transaction Cost Economics (TCE) Theory was developed by Ronald Coase in 1937 and later expanded by Oliver Williamson in 1975. The theory examines the costs associated with economic exchanges, particularly those arising from coordinating transactions within or between firms. It posits that firms exist because they can often conduct transactions more

efficiently than the open market, reducing costs related to searching for suppliers, negotiating contracts, and enforcing agreements (Ketokivi & Mahoney, 2020). TCE distinguishes between market transactions and hierarchical governance, arguing that firms will internalize transactions when market costs become too high. It also emphasizes asset specificity, uncertainty, and frequency as key factors influencing transaction costs. The theory is widely applied in supply chain management, where reducing transaction costs enhances efficiency and competitiveness (Rindfleisch, 2020). In horticulture, where supply chains involve multiple intermediaries, applying TCE helps firms assess whether internalizing processes, such as input traceability, is more cost-effective than relying on external suppliers.

TCE is based on three key assumptions: bounded rationality, opportunism, and asset specificity (Cuypers & Ertug, 2021). Bounded rationality suggests that decision-makers have cognitive limitations, meaning they cannot process all relevant information perfectly when making economic choices. This limitation increases the likelihood of inefficiencies and contractual risks in transactions. Opportunism assumes that individuals and firms may act in self-interest with guile, leading to potential issues like fraud, contract breaches, or misrepresentation in supply chain relationships. This makes transaction governance mechanisms crucial to mitigate such risks. Asset specificity refers to the extent to which an investment is specialized for a particular transaction (Ketokivi & Mahoney, 2020). High asset specificity, such as specialized technology for traceability, increases dependency between parties, making contractual safeguards necessary. These assumptions highlight the risks and costs associated with market transactions, emphasizing why firms may choose to internalize functions like input traceability to reduce uncertainties and improve operational control.

TCE explains the effect of input traceability on horticultural firm performance by highlighting how reducing transaction costs improves efficiency and competitiveness. Horticultural firms require high levels of coordination due to perishable products, stringent export standards, and complex supply chains. Implementing input traceability minimizes uncertainty by ensuring that all agricultural inputs, from seeds to fertilizers, meet quality and regulatory requirements. Additionally, traceability systems reduce opportunism by discouraging fraudulent activities, such as mislabeling products or supplying substandard inputs. High asset specificity also plays a role, as firms investing in digital traceability systems create specialized infrastructure that enhances operational control but requires long-term commitment. Rindfleisch (2020) indicates that by internalizing traceability processes rather than relying on external verification, firms can reduce transaction costs, enhance compliance, and improve supply chain transparency. Ultimately, input traceability strengthens firm performance by improving market access, reducing risks, and ensuring efficient resource utilization within Kenya's horticultural industry.

Conceptual Framework

Conceptual framework is a diagrammatic representation of the relationship between the independent variables and the dependent variable (Devi, 2019). The independent variable in this study was input traceability. The dependent variable was performance of Horticultural Firms in Kenya. Figure 1 shows the relationship between the independent variable and the dependent variable.

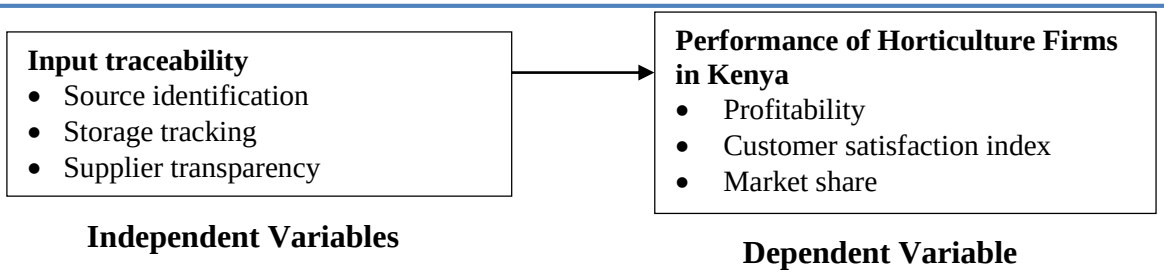

Figure 1: Conceptual Framework

Empirical Review

Ngoc et al. (2019) explored the relationship between input traceability and firm performance in the Vietnamese aquaculture sector. The study aimed to investigate the effect of input traceability on firm performance, specifically financial and non-financial performance. The target population for this study was aquaculture firms in the Mekong Delta region. A sample of 230 aquaculture firms was selected through a stratified random sampling technique. The data was collected using structured questionnaires, and the data analysis was conducted using regression analysis. The study found that input traceability had a significant positive effect on both financial and non-financial performance. The findings also indicated that input traceability allows aquaculture firms to monitor the origin and handling of food, water quality, and other factors that influence the health and growth of aquatic organisms. This leads to improved product quality and consistency. Methodologically, the study relied solely on structured questionnaires, which may not fully capture the complexities of input traceability, as qualitative insights from key industry stakeholders were not incorporated. Conceptually, the study focused on financial and non-financial performance but did not account for broader industry-specific factors such as regulatory compliance, supply chain efficiency, or customer trust, which are critical in horticulture. Contextually, the study was conducted in the Vietnamese aquaculture sector, which differs significantly from Kenya's horticultural industry in terms of production processes, perishability, and export requirements, making it difficult to generalize the findings. These gaps further justify the need for this study to provide empirical evidence specific to Kenya's horticultural sector.

Furthermore, a study by Mwakaje and Mugisha (2020) investigated the effect of input traceability on the competitiveness of smallholder farmers in Tanzania. The study employed a mixed-methods research design and a sample of 400 smallholder farmers was selected using purposive and random sampling techniques. Data was collected using a structured questionnaire and focus group discussions. The study found that input traceability positively influences the competitiveness of smallholder farmers. Traceability enables smallholder farmers to tell their farm-to-table stories, highlighting their commitment to quality, sustainability, and local production. Traceability generates valuable data on crop performance, input effectiveness, and market demand. Smallholder farmers can use this data to make informed decisions about crop selection, planting schedules, and resource allocation. Conceptually, the study focused primarily on competitiveness, overlooking other key performance indicators such as operational efficiency, cost reduction, and compliance with international market standards, which are crucial in the horticultural sector. Contextually, the study was conducted in Tanzania and focused on smallholder farmers, whose scale of operations, supply chain complexity, and market structures differ significantly from Kenya's commercial horticultural firms.

There is limited empirical literature on the effect of input traceability on the performance of Horticultural Firms in Kenya. However, a study by Kariuki et al. (2019) investigated the effect of input traceability on the performance of manufacturing firms in Nairobi, Kenya. The study employed a descriptive research design and a sample of 200 manufacturing firms was selected through stratified random sampling. Data was collected using a structured questionnaire and analyzed using descriptive statistics and regression analysis. The study found a positive and significant relationship between input traceability and firm performance. Traceability systems can help track variations and customizations in products, allowing manufacturing firms to cater to specific customer demands. In addition, through the identification of inefficiencies and delays in the production process, traceability systems enable manufacturing firms to streamline operations and reduce costs. Conceptually, the study focused on manufacturing firms, where traceability primarily tracks variations in product customization and production efficiency, rather than factors critical to horticulture, such as compliance with export standards, perishability management, and quality assurance. Contextually, manufacturing firms operate under different regulatory frameworks and supply chain structures compared to horticultural firms, which deal with perishable products and international market requirements.

Similarly, a study by Mukolwe and Onyango (2017) examined the effect of input traceability on the performance of small and medium-sized enterprises in the food processing industry in Kenya. The study used a survey research design and a sample of 196 SMEs was selected using stratified random sampling. Data was collected using a structured questionnaire and analyzed using descriptive statistics and regression analysis. The study found a positive and significant relationship between input traceability and firm performance. With input traceability, SMEs can provide consumers with information about the sourcing and processing of ingredients. This transparency builds consumer trust in the safety and quality of the products, fostering loyalty and repeat purchases. Traceability systems enable SMEs to monitor and evaluate the performance of suppliers. This helps ensure that suppliers adhere to quality standards and timely deliveries, supporting SMEs' production schedules and reducing disruptions. However, the study focused on small and medium-sized enterprises (SMEs) in the food processing industry, where traceability ensures ingredient sourcing transparency, unlike horticultural firms, where traceability plays a crucial role in export certification, quality control, and perishability management. In addition, food processing SMEs operate in a controlled production environment, whereas horticultural firms face challenges related to farm-level input tracking, multiple handling points, and compliance with stringent global market standards.

Although input traceability is increasingly recognized as essential for enhancing firm performance, there is limited empirical literature specifically focusing on its effect in Kenya's horticultural sector. Most existing studies on traceability in Kenya, such as those by Kariuki et al. (2019) on manufacturing firms and Mukolwe and Onyango (2017) on food processing SMEs, provide insights into its impact on efficiency and competitiveness but do not directly address horticulture. While international studies, such as Ngoc et al. (2019) on aquaculture in Vietnam and Mwakaje and Mugisha (2020) on smallholder farmers in Tanzania, demonstrate the benefits of input traceability in agricultural value chains, Kenyan horticultural firms face unique challenges such as stringent export standards, perishable products, and complex supply chains. The lack of sector-specific research on input traceability in Kenyan horticulture highlights a critical knowledge gap, further justifying the need for this study to provide empirical evidence tailored to the industry.

METHODOLOGY

The study adopted a positivism research philosophy and a cross-sectional survey research design. The unit of analysis for this study was 658 registered Horticultural firms in Kenya as per the Horticultural Crops Directorate (2022). Horticultural Firms were used in this study because the horticultural sector in Kenya contributes 26% of the agricultural GDP in Kenya, which in turn contributes about 34% of the national economy. The heads of procurement, quality assurance, production, information and communication technology as well as marketing departments in horticultural firms in Kenya formed the unit of observation. The target population was 3,290 heads procurement, quality assurance, production, information and communication technology as well as marketing departments from 658 registered Horticultural firms in Kenya.

This study made use of Slovin's Formula to determine the study's sample size. Slovin's formula is a mathematical equation used to determine the sample size needed for a simple random sample when the population size is known.

$$n = \frac{N}{1 + NE^2}$$

Where by:

n = no. of samples;

N = total population;

E = error margin / margin of error (0.05)

$$n = \frac{3290}{1 + (3290 * 0.05^2)} = 355$$

This study adopted stratified random sampling in the selection of 355 respondents from the target population. The strata in this study were procurement, quality assurance, production and sales and marketing departments in horticultural firms in Kenya. This sampling technique will be used because horticultural firms have distinct departments such as procurement, quality assurance, production, and sales and marketing, each with its unique responsibilities and challenges. Stratifying the sample based on these departments ensures that the study captures the diversity and specific dynamics within each functional area. Different departments may have varying levels of expertise and involvement in supply chain activities. Stratified sampling allows for the inclusion of respondents with specific knowledge and experience related to their department's role in the supply chain, providing a more nuanced understanding of the research questions.

Table 1: Sample Size Distribution

Departments	Target Population	Sample Size
Procurement	658	71
Quality assurance	658	71
Marketing	658	71
Production	658	71
Information and communication technology	658	71
Total	**3290**	**355**

The study used both primary as well as secondary data. Secondary data, including profitability, market share and customer satisfaction index, was collected from the annual reports of different horticultural firms in Kenya.

Primary data was obtained using semi-structured questionnaires. To ensure the validity and reliability of the research instrument, a pilot test was conducted with 35 respondents (10% of the sample) from 10 horticultural firms in Kenya. Validity was examined through content, face, and construct validity. Content validity was enhanced by expert feedback, ensuring the questionnaire addressed all relevant aspects of the study. Face validity was improved by refining ambiguous questions identified during the pilot test. Construct validity was evaluated using Confirmatory Factor Analysis (CFA) to confirm the relationships between variables and constructs. Reliability was assessed using Cronbach's alpha, ensuring internal consistency.

Semi-structured questionnaires were used to gather both qualitative and quantitative data. Thematic analysis was used to analyse qualitative data and the results were presented in a narrative form. On the other hand, quantitative data analysis involved the use of SPSS version 28.0 statistical software to apply both descriptive and inferential statistics. Descriptive statistics were employed to summarize and describe the key characteristics of the dataset, including measures of central tendency such as means and medians, and measures of variability such as standard deviations and ranges. In addition to descriptive statistics, inferential statistics were utilized to make broader inferences about the population from the sample data. Techniques such as correlation and regression analysis were employed to explore and quantify the relationships between variables and test research hypothesis. The regression model that was used to test is shown below:

$$y = \alpha + \beta_1 x_1 + \varepsilon$$

Where,

Y = Performance of Horticultural Firms in Kenya

α = Constant

β_1= the slope representing degree of change in independent variable by one unit variable.

X_1 = Input traceability; and

ε = error term

Key assumptions of regression models and their testing methods ensure robust and accurate analysis. Linearity, which posits a direct relationship between independent and dependent variables, was assessed using scatterplots to visually confirm straight-line trends. Normality of residuals was tested through skewness, kurtosis, Shapiro-Wilk, and Kolmogorov-Smirnov tests, supplemented by histograms and normal probability plots. Heteroscedasticity, reflecting unequal variance in error terms, was checked using the White General Test, with p-values indicating potential issues. Autocorrelation, the dependence among residuals, was tested using the Durbin-Watson statistic, where values between 1.5 and 2.5 signaled independence. Addressing these assumptions ensures credible regression outcomes.

FINDINGS AND DISCUSSIONS

The sample size for this study included 355 heads of procurement, quality assurance, production, and marketing departments from registered horticultural firms in Kenya. Out of these, 307 questionnaires were returned, reflecting a high response rate of 86.48%. However,

2 of the returned questionnaires were deemed unusable due to incomplete responses or other issues, reducing the total number of usable questionnaires to 305. This results in a usability rate of 85.92%. The high response and usability rates suggest strong participation and engagement from the targeted department heads within the horticultural firms, ensuring that the data collected is both reliable and representative of the intended population.

Latwal (2020) indicates that a response rate of 50% is considered sufficient for effective analysis, a rate of 60% is viewed as good, and anything 70% or higher is deemed excellent. The study achieved a notable response rate of 86.48%, which significantly exceeds these benchmarks. This high response rate not only indicates that the level of participation was more than adequate but also reflects a strong engagement from the respondents. Furthermore, with 85.92% of the returned questionnaires deemed usable, the reliability of the collected data is enhanced, reinforcing the strength and credibility of the study's findings. This robust engagement and high usability underscore the effectiveness of the data collection process.

Table 2: Response Rate

Responses	No.	Percentages
Administered questionnaires	355	100%
Returned	307	86.48%
Unusable questionnaires	2	0.56%
Usable questionnaires	305	85.92%

Input Traceability

The respondents were asked to indicate their level of agreement with various statements on the input traceability at horticultural firms in Kenya. The results were as shown in Table 3. With a mean of 4.272 (SD=0.807), the respondents agreed that their firms traces the source of all inputs used. These findings agree with Hadaya & Marchildon (2020) observations that source identification involves capturing and recording the origin of each input, ensuring that it can be traced back to its source. Also, with a mean of 4.186 (SD=1.000), the respondents agreed that source identification process in their organization is transparent. The respondents agreed with a mean of 4.127 (SD=1.009) with the statement indicating that in their firm all products in the store are tracked.

Further, the respondents agreed with the statement indicating that their firm tracks all goods in transit as shown by a mean of 4.065 (SD=0.832). Similarly, with a mean of 4.065 (SD=0.964), the respondents agreed that they are confident that the suppliers of this horticultural firm adhere to ethical and sustainable practices. With a mean of 3.977 (SD=0.950), the respondents agreed that their firm's transparency regarding its suppliers positively influences their perception of the company. In addition, with a mean of 3.950 (SD=1.016), the respondents agreed that they are satisfied with the effectiveness of tracking transportation and storage in their firm. These findings are in agreement with Tanpure & Soni (2022) observations that storage tracking provides visibility into the inventory levels, locations, and status of items in storage. The respondents agreed with a mean of 3.773 (SD=1.131) that they are satisfied with the effectiveness of source identification process in our organization. The respondents agreed with a mean of 3.862 (SD=1.0320 with the statement indicating that their firm communicates openly about its relationships with suppliers, including their names and locations.

Table 3: Statements on Input Traceability

n=305	Mean	Std. Deviation
Our firms traces the source of all inputs used	4.272	.807
Source identification process in our organization is transparent	4.186	1.000
Am satisfied with the effectiveness of source identification process in our organization	3.773	1.131
Our firm tracks all goods in transit	4.065	.832
In our firm all products in the store are tracked	4.127	1.009
Am satisfied with the effectiveness of tracking transportation and storage in our firm	3.950	1.016
I am confident that the suppliers of this horticultural firm adhere to ethical and sustainable practices.	4.065	.964
Our firm communicates openly about its relationships with suppliers, including their names and locations.	3.862	1.023
Our firm's transparency regarding its suppliers positively influences my perception of the company.	3.977	.950
Composite Mean and Standard Deviation	**4.031**	**0.970**

The respondents were asked to indicate any other issue related to input traceability effect on the performance of horticultural firms. The respondents indicated that input traceability significantly enhances the performance of horticultural firms by improving quality assurance (86%), resource management (82%), regulatory compliance (80%), supply chain transparency (84%), risk management (78%), and market differentiation (77%). They also indicated that it fosters a culture of continuous improvement (83%) and innovation (81%). Additionally, respondents indicated that input traceability is a critical component of sustainable agriculture practices, supporting long-term success in the competitive horticultural industry. They further indicated that input traceability enhances performance by ensuring quality assurance (85%), optimizing resource management (80%), enhancing supply chain transparency (83%), mitigating risks (79%), facilitating regulatory compliance (81%), building consumer confidence (87%), and driving innovation (82%). These benefits collectively contribute to sustainable growth, competitiveness, and profitability in the agricultural sector.

Performance of Horticultural Firms in Kenya

The respondents were asked to indicate their level of agreement with various statements on the performance of horticultural firms in Kenya. The results were as shown in Table 4. The respondents agreed with a mean of 4.442 9 (SD=0.927) with the statement indicating that changes in market share are indicative of shifts in consumer preferences and competitive dynamics. These findings are in agreement with Alsharairi, Mezher & Wehbe (2020) observations that market share changes show shifts in consumer preferences. Similarly, with a mean of 4.423 (SD=0.925), the respondents agreed that the taste and appearance of the horticultural products reflect the high standards set by the firm. With a mean of 4.262 (SD=1.049), the respondents agreed that the taste and appearance of the horticultural products reflect the high standards set by the firm.

With a mean of 4.245 (SD=1.045), the respondents agreed that the horticultural firms offer a wide range of products and services that cater to specific needs and preferences of customers. In addition, with a mean of 4.157 (SD=0.990), the respondents agreed that they feel that the

horticultural firm's offerings meet or exceed customers' expectations for the cost involved. With a mean of 4.154 (SD=0.802), the respondents agreed that return on investment in their company have been increasing in the last five years. The respondents also agreed with a mean of 4.065 (SD=0.823) with the statement indicating that the horticultural products and services offered by the firms provide good value for the price paid. These findings are in agreement with Kosgei (2020) observations that customers are more likely to be satisfied when they believe they are receiving good value for their money.

The respondents agreed with a mean of 3.967 (SD=1.006) that the growth of our market share demonstrates their effectiveness in capturing consumer interest. In addition, the respondents agreed with a mean of 3.947 (SD=0.995) that the horticultural products offered by the firms meet the quality and taste standards expected. Also, the respondents agreed that return on assets in their firm has improved in the last five the years as shown by a mean of 3.891 (SD=0.982). With a mean of 3.744 (SD=1.307), the respondents agreed that the cost of production has been decreasing in the last five years. These findings are in agreement with Karani (2022) observations that return on assets shows how effectively the company uses its assets to generate profits.

Table 4: Statements on Performance Horticultural Firms in Kenya

n=305	Mean	Std. Deviation
Return on assets in our firm has improved in the last five the years	3.891	.982
Return on investment in our company have been increasing in the last five years	4.154	.802
The cost of production has been decreasing in the last five years	3.744	1.307
The horticultural products and services offered by the firms provide good value for the price paid.	4.065	.832
I feel that the horticultural firm's offerings meet or exceed customers' expectations for the cost involved.	4.157	.990
The horticultural firms offer a wide range of products and services that cater to specific needs and preferences of customers	4.245	1.045
The horticultural products offered by the firms meet the quality and taste standards expected.	3.947	.995
The taste and appearance of the horticultural products reflect the high standards set by the firm.	4.423	.925
Our company's market share accurately reflects our competitive standing in the industry.	4.262	1.049
The growth of our market share demonstrates our effectiveness in capturing consumer interest.	3.967	1.006
Changes in market share are indicative of shifts in consumer preferences and competitive dynamics.	4.442	.927
Composite Mean and Standard Deviation	**4.118**	**0.987**

Figure 2 shows the average profitability of the horticultural firms (return on investment) for the period between 2019 and 2023. The average profitability (Return on Investment) of horticultural firms in Kenya has shown a general decline from 2019 to 2023. In 2019, the ROI was relatively high at 21.6%, but it decreased to 19.2% in 2020. While there was a slight recovery to 20.0% in 2021, the downward trend continued in the subsequent years, with

profitability dropping to 18.5% in 2022 and further down to 17.9% in 2023. This consistent decline in profitability over the five-year period suggests that horticultural firms in Kenya may be facing increasing challenges, such as rising operational costs, market competition, or other economic factors impacting their financial performance.

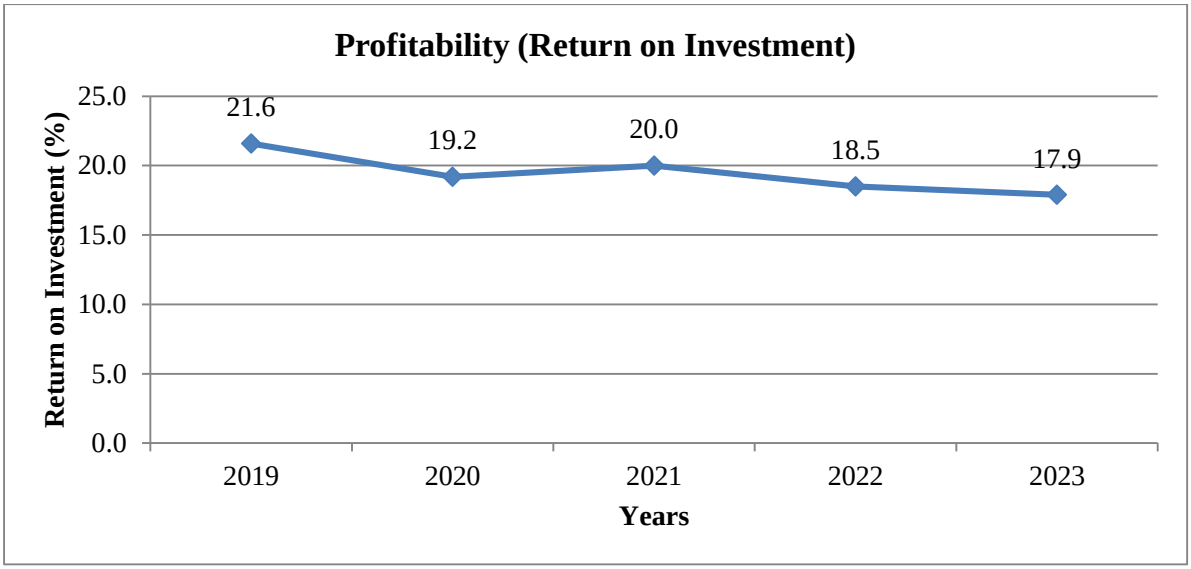

Figure 2: Trend of Profitability (Return on Investment)

Figure 3 shows the average market share of the horticultural firms for the period between 2019 and 2023. The average market share of horticultural firms in Kenya experienced significant fluctuations between 2019 and 2023. In 2019, the market share was 26.21%, but it dropped sharply to 12.69% in 2020, likely due to disruptions caused by global events such as the COVID-19 pandemic. The market share recovered somewhat in 2021, increasing to 18.72%, and saw a substantial rise in 2022, reaching a peak of 32.78%. By 2023, the market share slightly decreased to 26.76%, aligning closely with the 2019 level.

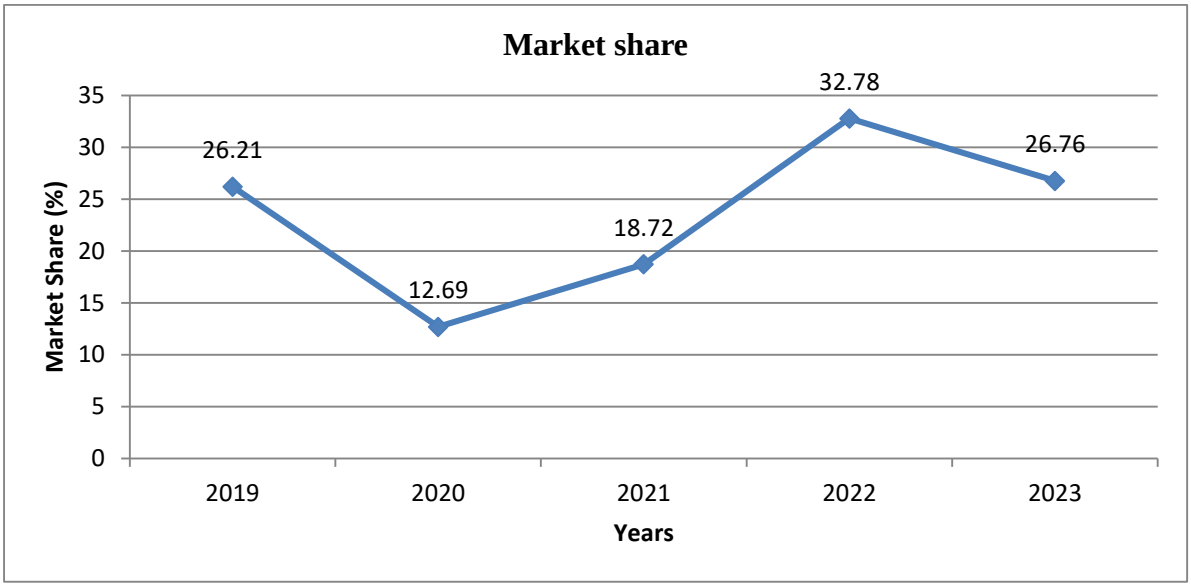

Figure 3: Trend of Market Share

Figure 4 shows the average customer satisfaction index among horticultural firms for the period between 2019 and 2023. The average customer satisfaction index of horticultural firms in Kenya displayed a fluctuating trend between 2019 and 2023. Starting at 85.3 in 2019, the satisfaction index peaked at 89.1 in 2020, indicating a high level of customer satisfaction during that year. However, from 2021 onwards, there was a gradual decline, with the index dropping to 86.2 in 2021, further down to 81.3 in 2022, and reaching its lowest point at 78.9 in 2023. This downward trend suggests that customer satisfaction has decreased over the years, potentially reflecting challenges or changes in the industry that may have impacted service quality or customer expectations.

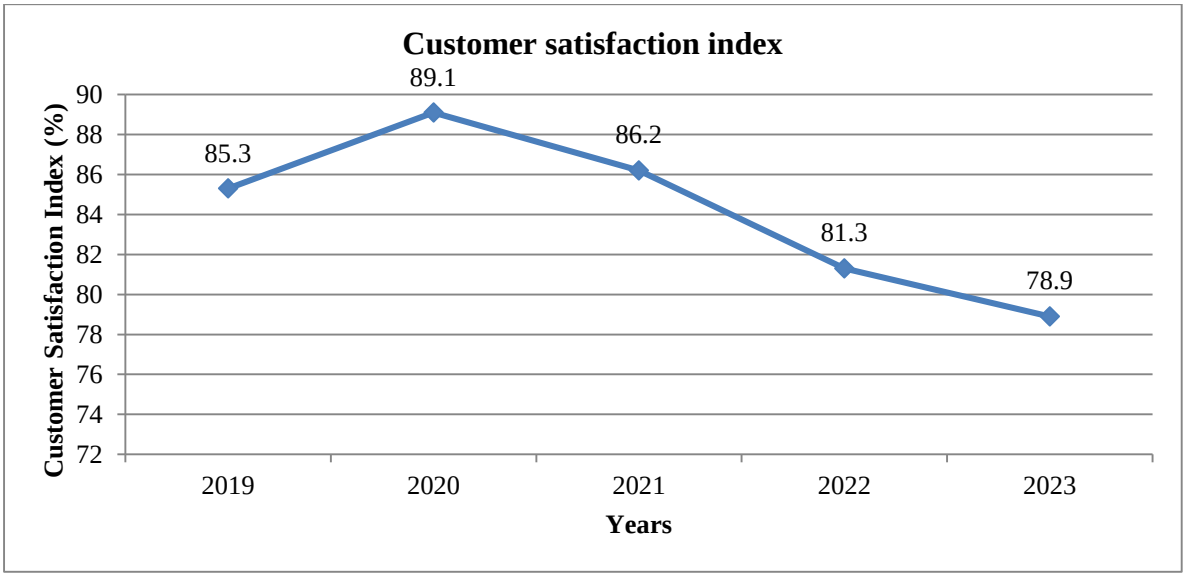

Figure 4: Trend of Customer Satisfaction Index

Correlation Analysis

Pearson correlation analysis was used to assess the strength and direction of the linear relationship between Input Traceability (IT) and performance of horticultural firms in Kenya.

The correlation results show that Input Traceability (IT) exhibits a strong positive correlation with PHF performance ($r = 0.689$, $p < 0.001$). This finding implies that firms that track and trace their input materials, such as seeds, fertilizers, and pesticides, throughout the supply chain, are likely to experience enhanced operational efficiency and product quality. Effective input traceability helps in identifying and mitigating risks related to product safety, compliance with regulatory standards, and environmental sustainability, all of which are critical factors influencing firm performance in the horticultural sector. The findings collaborate Yao et al. (2017) assertion that there is appositive relationship between input traceability and performance of the Chinese food industry.

Table 5: Correlation Coefficients

		PHFK	IT
Performance of Horticultural Firms in Kenya (PHF)	Pearson Correlation	1	
	Sig. (2-tailed)		
	N	305	
Input Traceability (IT)	Pearson Correlation	.689**	1
	Sig. (2-tailed)	.000	
	N	305	305

**. Correlation is significant at the 0.01 level (2-tailed).

Regression Analysis

Linear regression analysis was used to assess the strength of the relationship between input traceability and the performance of horticultural firms in Kenya. The R-squared value of 0.474 suggests that 47.4% of the variance in the performance of horticultural firms can be explained by input traceability. This indicates a moderate model fit, with the remaining 52.6% of the variance in firm performance unexplained by input traceability alone.

Table 6: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.689[a]	.474	.473	.32846

a. Predictors: (Constant), Input Traceability

The Analysis of Variance (ANOVA) demonstrates how well input traceability predicts performance. Since the F-statistic (273.389) is significantly greater than the critical value of 3.94 from the F-distribution table, the regression model is highly significant. The p-value of 0.000, which is much lower than the significance level of 0.05, indicates that the model is valid for predicting the effect of input traceability on the performance of horticultural firms in Kenya.

Table 7: Analysis of Variance

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	29.495	1	29.495	273.389	.000[b]
	Residual	32.690	303	.108		
	Total	**62.186**	**304**			

a. Dependent Variable: Performance of Horticultural Firms in Kenya
b. Predictors: (Constant), Input Traceability

From the findings, regression equation was as follows;

Y=1.270+ 0.673 (Input Traceability)

The results reveal that input traceability has a positive and significant effect on the performance of horticultural firms in Kenya ($\beta = 0.673$, p-value = 0.000). This coefficient suggests that improvements in input traceability lead to a significant increase in firm performance. Specifically, for each one-unit increase in input traceability, firm performance increases by 0.673 units. The effect is highly statistically significant ($p < 0.001$), which highlights the importance of effectively managing and tracking inputs in achieving better performance outcomes for horticultural firms in Kenya. The findings are in line with Mwakaje and Mugisha (2020) assertion that input traceability has a positive effect on the competitiveness of smallholder farmers in Tanzania. The findings are also in concurrence with Kariuki et al. (2019) observation that input traceability has a positive effect on the performance of manufacturing

firms in Nairobi, Kenya. The findings also agree with Mukolwe and Onyango (2017) argument that input traceability has a positive effect on the performance of small and medium-sized enterprises in the food processing industry in Kenya.

Table 8: Regression Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.270	.151		8.415	.000
	Input Traceability	.673	.041	.689	16.534	.000

a. Dependent Variable: Performance of Horticultural Firms in Kenya

CONCLUSION AND RECOMMENDATIONS

Conclusion

The study concludes that input traceability positively and significantly affects the performance of horticultural firms in Kenya. The findings revealed that source identification, storage tracking, and supplier transparency play a crucial role in the performance of horticultural firms. By improving the traceability of inputs, such as clearly identifying the source of materials, carefully tracking storage conditions, and fostering transparency with suppliers, firms can enhance their operational efficiency. This approach leads to better product quality, reduced risks, and greater accountability, ultimately contributing to the overall success and competitive advantage of horticultural firms in the industry.

Recommendations

The study found that input traceability positively and significantly affects the performance of horticultural firms in Kenya. The study recommends that horticultural firms in Kenya should enhance their input traceability systems to further improve performance. Horticultural firms should ensure that comprehensive tracking of the source of all inputs used guarantees quality and safety, which are important for consumer trust. In addition, regular audits of suppliers should be implemented to confirm adherence to ethical and sustainable practices.

The study also found that firm's transparency regarding to suppliers positively influences the perception of the company. The study recommends that horticultural firms should prioritize transparent communication about their supplier relationships. In addition, horticultural firms should actively share information regarding suppliers' names and locations in order to enhance the firm's credibility and foster greater consumer confidence. Further, horticultural firms should promote their commitment to ethical sourcing and sustainability to positively influence public perception and attract customers who value responsible practices. Moreover, leveraging marketing strategies help strength brand loyalty and differentiate the firm in a competitive market, making it more appealing to environmentally conscious consumers.

The study found that the effectiveness of tracking transportation and storage in the firm is satisfactory. The study recommends that horticultural firms should continuously evaluate and enhance the effectiveness of their tracking systems for transportation and storage. Horticultural firms should ensure that all goods in transit are monitored to minimize losses and increase operational efficiency. In addition, training staff on best practices for input traceability and transportation management will further improve implementation. Further regular reviews of these processes will help identify areas for improvement, leading to better management of

inputs, reduced waste, and hence contribute to overall organizational success and performance in the industry.

Recommendations for Further Studies

The primary objective of the study was to assess how input traceability affects performance of horticultural firms in Kenya. However, the study focused on horticultural firms and therefore the findings cannot be applied to other firms in Kenya. Therefore the study recommends that further research be conducted to assess how input traceability affects performance of other firms in Kenya. In addition, the study found that input traceability can collectively explain 47.4% of variation in performance of horticultural firms. Therefore, further studies should be conducted to determine other factors that affect performance of horticultural firms in Kenya.

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