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Evaluating the Effect of Product Traceability on Operational Performance: A Cross-Sectional Survey of Food and Beverage Manufacturing Firms in Tanzania

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Abstract

The study aimed to determine the relationship between product traceability and performance of food and beverage manufacturing firms in Tanzania. The research utilized a cross-sectional design, targeting 480 individuals from 120 food and beverage manufacturing companies in Tanzania. This included managers from procurement, inspection, quality, production, and operations departments. A total of 218 individuals were sampled using a stratified random sampling method. Data analysis was carried out with the Statistical Package for the Social Sciences, version 27, applying both descriptive and inferential techniques to the quantitative data. The findings indicate that product traceability significantly enhances the efficiency of food and beverage manufacturing firms in Tanzania (R^2=.609, p=.000), suggesting that approximately 60.9% of the variance in the dependent variable can be attributed to product traceability. This offers insights into how traceability systems function as strategic assets promoting competitive advantage. The notable benefits of product traceability on the performance of food and beverage manufacturing companies offer empirical support for viewing traceability as a strategic asset within a resource-based view theory. This data reinforces the idea that investing in traceability systems generates sustainable competitive advantages, as these systems are difficult for rivals to replicate and can evolve to adapt to market changes. Therefore, managers should emphasize the importance of investing in strong traceability systems, acknowledging them as strategic resources that improve company performance. Additionally, policymakers in Tanzania ought to create supportive regulatory frameworks that encourage the implementation of effective traceability systems. This may involve tax incentives for companies that invest in advanced traceability technologies. Furthermore, clear guidelines for traceability practices should be developed to ensure alignment with international standards, aiding compliance for manufacturing firms and facilitating their access to global markets.

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1. Introduction

Product traceability is a vital component of supply chain traceability, serving as a method for companies to monitor the movement and location of a product at each stage of the supply chain, to enhance transportation and inventory management (Schuitemaker & Xu, 2020). It acts as a quality control tool within quality management (Zhou et al., 2022). The primary aim is to ensure the product is safe, high-quality, and complies with all necessary standards and regulations. These traceability systems can authenticate a product throughout its lifecycle, reducing recall costs and preventing the distribution of unsafe items (Cocco et al., 2021). When implemented, these systems facilitate the identification of counterfeit products in the marketplace (Cavite et al., 2022). Nonetheless, it has emerged as an increasingly promising approach to product labelling (Marozzo et al., 2022). Product identification entails assigning a distinct identification number or code to each product or batch, which assists in tracking throughout production and distribution (Schuitemaker & Xu, 2020). The labelling is formally governed by barcodes, the most commonly used product identifiers worldwide. This method is user-friendly and cost-effective, making it prevalent in sectors such as aerospace, automotive, healthcare, food, and beverages (Colledani & Angius, 2020). Furthermore, this guarantees that each product can be traced back to its origin, with every step of the production process documented via a unique identification code, simplifying the tracking of the product's journey from the manufacturer to the end users (Bhatnagar et al., 2020). It also assists in maintaining accurate records of processes such as manufacturing, packaging, and shipping, enabling each product to be traced back to a specific production batch and location, which is essential for identifying the source of any production issues (Barata et al., 2018). As a result, traceable labels on products serve as crucial markers of quality and safety for consumers, with blockchain technology playing a significant role in combating counterfeit goods (Li et al., 2022).

However, traditional product traceability systems often depend on a centralized data storage model, where a third-party organization frequently manages traceability information. Maintaining data transparency and integrity in these systems is often difficult, leading to issues such as single points of failure, increased risk of data tampering, and reduced credibility (Mitani & Otsuka, 2020). As global food supply chains grow more intricate and consumer expectations shift, the shortcomings of conventional traceability systems are becoming clear (Li et al., 2022). Manufacturers face pressure to adopt robust, transparent, and tamper-proof systems that boost performance and reduce operational risks (Marozzo et al., 2024). As a result, merging traditional product traceability systems with RFID and blockchain technologies significantly improves transparency and data integrity (Colledani & Angius, 2020). The combination of blockchain's decentralized ledger with RFID's real-time tracking capabilities greatly enhances consumer trust and satisfaction by safeguarding the authenticity and reliability of traceability data (Li et al., 2024). Consequently, food and beverage manufacturers must

embrace modern traceability technologies, including RFID, Blockchain, the Internet of Things, and other budget-friendly options (Zhuang et al., 2021).

Product traceability is essential for both the company and supply chain levels (Li et al., 2024). At the company level, systems offer insights into a product's current location and history. Meanwhile, at the supply chain level, understanding the origins of components and product location is equally important (Li et al., 2024). Food and beverage companies must recognize the distinct characteristics of product batches and their historical connections. This enhanced transparency allows for the delivery of detailed information to buyers and consumers, significantly contributing to the development of consumer trust (Yao & Zhu, 2020). However, studies indicate that Tanzanian food and beverage manufacturers have yet to fully adopt traceability systems in their operations. This gap highlights the need for increased awareness and investment in technology that improves tracking mechanisms, particularly regarding product traceability.

1.1 Problem Statement

In the food and beverage manufacturing industry, product traceability is crucial for guaranteeing safety, quality control, and regulatory compliance (Marozzo et al., 2022). However, traditional traceability systems are increasingly inadequate in fulfilling the rising expectations for data transparency, real-time tracking, and operational efficiency. Additionally, the risk of data tampering escalates, especially with limited visibility throughout the supply chain and the absence of independent verification methods (Mitani & Otsuka, 2020). These challenges can greatly compromise the reliability of traceability systems, resulting in diminished consumer trust, ineffective recall operations, and possible regulatory fines (Li et al., 2022). Manufacturers are more focused than ever on verifying the authenticity of the products they sell and protecting their reputation (Li et al., 2024). Although blockchain technology presents a viable solution to tackle product counterfeiting, manufacturers in developing countries often find it difficult to balance intrusive practices with the related costs across various sales channels (Centobelli et al., 2022). Furthermore, selecting appropriate distribution channels for products featuring traceability labels presents another significant challenge they must manage (Yao & Zhu, 2020). Thus, there is a need for cost-efficient traceability systems to be adopted by manufacturers in developing countries like Tanzania.

Moreover, the food and beverage industry is confronted with several challenges, including the need to ensure product quality, safety, and regulatory compliance, all while achieving operational efficiency and maintaining competitiveness (Centobelli et al., 2022). Furthermore, implementing effective traceability systems in the food and beverage industry is complicated by inadequate technological infrastructure and the high expenses of adopting advanced traceability solutions (Kittipanya-ngam & Tan, 2020; Hastig & Sodhi, 2020; Hald & Kinra, 2019). Nevertheless, there is an increasing acknowledgement of how essential traceability is for improving product safety, reducing recall issues, and operational efficiency (Marozzo et al., 2024). As a result, product traceability has become vital in overcoming these challenges, allowing companies to monitor and verify the origins, processing, and distribution of their products across the supply chain (Marozzo et al., 2024). Consequently, this study seeks to evaluate the impact of product traceability on the performance of food and beverage manufacturing firms in Tanzania, illustrating how the adoption of advanced traceability technologies can act as a strategic asset for these companies. Furthermore, it aims to provide

practical insights into how such systems can enhance supply chain visibility, mitigate operational risks, ensure compliance, and ultimately lead to competitive advantages.

1.2 Research Hypothesis

H_{01}: Product traceability has no significant effect on the performance of food and beverage manufacturing firms in Tanzania.

2. Literature Review

2.1 Theoretical Review

The Resource-Based View (RBV) of the firm has its roots in the work of Penrose (1980) and Nelson and Winter (1982), who assert that a company's strong behaviours stem from the development of its distinctive resources. The RBV theory explains how a firm can leverage its Valuable, Rare, Inimitable, and Non-substitutable (VRINN) resources to achieve a sustainable competitive advantage (Barney, 1991). It posits that a firm's competitive edge arises from its unique resources and capabilities, which are difficult for competitors to replicate. In the realm of product traceability, a firm's ability to track products from the source of raw materials to the end consumer can be regarded as a distinctive capability (Flynn et al., 2016). This capability is cultivated through investments in technology, infrastructure, and organisational processes that enable the firm to efficiently monitor products throughout the supply chain. Furthermore, with respect to product traceability, RBV theory can be employed to ensure that the products manufactured meet the organisation's standards of value compared to its rivals. Similarly, it is crucial to guarantee that the products are unique by featuring diverse designs and packaging styles that are hard to imitate and more appealing to potential customers (Bromiley & Rau, 2014). By adopting innovative technologies for seamless traceability, a firm can foster considerable confidence among its consumers regarding safety concerns and counterfeit products in the marketplace, as such technology is pivotal for a firm's success (Flynn et al., 2016). Consequently, product traceability may be viewed as a unique capability that provides firms with a competitive advantage in the marketplace.

2.2 Empirical Review

According to a study by Schuitemaker and Xu (2020) on the traceability of products in manufacturing: a technical review, the research indicates that modern product traceability, supported by Industry 4.0 practices, provides a valuable digital mechanism for a comprehensive understanding of the process, stringent quality control, efficient management and resolution of complaints, damaged products, and inefficiencies in production, as well as a clear distribution of responsibilities. Furthermore, product traceability in production acts as a risk management tool employed for tracking, tracing, and verifying the authenticity of a product. While it is prevalent in the food and agriculture sectors due to regulations and standards, it is becoming increasingly popular in other industries to meet compliance and quality requirements and to adopt contemporary Industry 4.0 practices.

The study by Barata et al. (2018) focuses on product traceability in the ceramic sector within Industry 4.0, outlining a design framework and featuring a prototype of a cloud-based Manufacturing Execution System (MES). The findings reveal that incorporating product traceability in ceramics can significantly boost overall performance. By utilizing this cloud-based MES prototype, the company efficiently monitored and tracked products throughout the entire production cycle, from raw materials to finished items. Additionally, the authors

emphasize the importance of a customer-centric perspective on product traceability in Industry 4.0. Nevertheless, although several product traceability options exist in ceramic manufacturing, the authors did not find a single unified technology that caters to internal and external stakeholders. Thus, product traceability emerges as a vital tool for improving performance in Industry 4.0 ceramics, allowing manufacturers to observe and trace products during production, which leads to enhanced quality, safety, and efficiency.

Zhou et al. (2022) conducted a study on how food supply chain traceability affects sustainability performance. Their findings suggested that product traceability improves economic sustainability. Moreover, monitoring downstream distribution networks aids in detecting and tracking instances of unethically sourced products within the food supply chain. End-to-end traceability is crucial for analyzing product lifecycles, which helps understand and monitor the social impacts of different product types. Additionally, companies that implement product traceability can quickly learn about and share information regarding downstream customers' inventory plans, logistics, and destinations. This can lead to increased transaction efficiency, reduced production redundancy, enhanced product transparency, and protection of consumers' rights to information (Matzembacher et al., 2018).

2.3 Conceptual Framework

A conceptual framework is an analytical tool that highlights different contexts and variations. It clarifies the connection between independent and dependent variables. In this case, product traceability is the independent variable, and the dependent variable relates to the performance of food and beverage manufacturing firms in Tanzania.

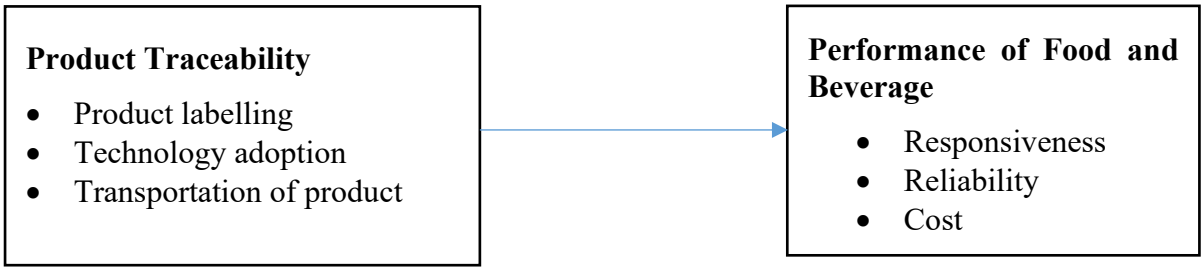

Figure 1: Conceptual framework

3. Methodology

The researcher adopted a cross-sectional design (Siedlecki, 2020). A cross-sectional survey was carried out as it is regarded as useful for gathering data at a specific time, is effective for studying relationship effects, and allows for inferences about the entire population (Yan et al., 2019). Furthermore, the researcher employed a selective survey design across various regions of mainland Tanzania (i.e., Arusha, Kilimanjaro, Tanga, Mwanza, Mbeya, Morogoro, Pwani, and Dar es Salaam), concentrating on the food and beverage manufacturing industry. The target population consisted of 480 managers from 120 food and beverage manufacturing firms in Tanzania. A sample size of 218 respondents was established using a formula provided by Miller and Brewer (2006). A pilot study involving 10% of the sample size was conducted by purposively selecting 6 firms and including 22 respondents from food and beverage manufacturing firms in the Dar es Salaam region. The researcher utilised semi-structured and self-administered questionnaires. The collected data were processed using SPSS version 27 and analysed with descriptive and inferential statistics.

4. Results and Discussion

4.1 Descriptive Analysis

4.1.1 Descriptive Statistics for the Construct Product Traceability

The study's aim was to evaluate the effect of product traceability on performance of food and beverage manufacturing firms in Tanzania. Respondents were, therefore, asked to express their level of agreement with various statements regarding product traceability and the performance of these firms. Table 1 presents a summary of the findings obtained.

Regarding product labelling, participants were asked to indicate their level of agreement with the statement that the firm's products possess unique identifiers such as barcodes, QR codes, or serial numbers to aid in easy tracking and follow-up of the products throughout the supply chain. The results revealed that the majority, accounting for 54.8% (85) of the participants, agreed, followed by 28.4% (44) who strongly agreed, with an additional 10.3% (16) taking a neutral position. Furthermore, 5.8% (9) of the respondents expressed disagreement, and 0.6% (1) strongly disagreed. These responses yielded a mean value of (M= 4.05) and a standard deviation of (SD= 0.824). Furthermore, participants were asked to indicate their agreement that product labels from firms include information about the product's ingredients, manufacturing date, and expiry date, thus enhancing transparency and adhering to the Tanzania Bureau of Standards. The results revealed that the majority, 51% (79), agreed, 28.4% (44) strongly agreed, 13.5% (21) were neutral, and 5.8% (9) disagreed, while a minority of 1.3% (2) strongly disagreed. The mean (M) was 3.99, with a standard deviation (SD) of 0.879. Similarly, when questioned about their level of agreement regarding whether a firm’s product label includes security features like a tamper-evident seal that helps detect counterfeit items in the market using a company name, the outcomes demonstrated that a majority of 45.2% (70) of the participants strongly agreed. This was followed by 38.1% (59) who agreed, while 11.6% (18) remained neutral. Additionally, 2.6% (4) of the respondents equally disagreed and strongly disagreed. These responses yielded a mean value of M= 4.21 and a standard deviation of SD= 0.931. Furthermore, the participants were asked to indicate their level of agreement regarding the claim that the firm’s product label contains information on contact details and return instructions to aid the firm in swiftly addressing customer complaints. The results showed that a majority of 46.5% (72) of the respondents strongly agreed, while an additional 34.2% (53) agreed, with 10.3% (16) remaining neutral. Additionally, 7.7% (12) disagreed, and a small percentage of 1.3% (2) strongly disagreed. These responses produced a mean value (M) of 4.17 and a Standard Deviation (SD) of 0.986. These research findings align with those of Ominde *et al.* (2022).

In the realm of technology adoption, participants were asked to indicate their level of agreement with the assertion that respondents were requested to show their level of agreement regarding the statement that the firm utilises innovative technologies such as barcodes, scanners, RFID (Radio Frequency Identification) tags, and IoT (Internet of Things) devices to capture real-time data about product movement, location, and status at various stages of the supply chain. The results demonstrated that a majority of 49.7% (77) of the respondents concurred, followed by 30.3% (47) who strongly agreed, with an additional 14.8% (23) taking a neutral stance. Conversely, 3.9% (6) of the respondents dissented, while 1.3% (2) expressed strong disagreement. The data yielded a mean value of 4.04 and a standard deviation (SD) of 0.852. Furthermore, participants were prompted to express their level of agreement with the statement

that the firm employs platforms like cloud-based systems, including advanced software and data analytics, to capture, store, and analyse information regarding product origins, movement, and destinations, facilitating effective follow-up in the supply chain. The findings revealed that a significant proportion of 55.5% (86) of the respondents strongly agreed, followed by 25.2% (39) who agreed, 12.9% (20) who adopted a neutral position, 2% (3) who disagreed, and a small fraction of 1.3% (2) who strongly disagreed. The mean value was calculated to be M= 4.28 with a standard deviation of SD= 0.984. Lastly, participants were asked to indicate their level of agreement with the firm's use of cloud-based traceability platforms to store and retrieve information about products, suppliers, and processes for easier follow-up. Results indicated that the majority, 52.3% (81), strongly agreed, followed by 32.9% (51) who agreed, 9% (14) who were neutral, and 3.9% (6) who strongly disagreed, while a minority of 1.9% (3) disagreed. The mean (M) was 4.28, with a standard deviation (SD) of 0.984. These research findings align closely with the study conducted by Rosado and Cruz (2020).

When transporting the product, participants were asked to indicate their level of agreement with the statement that the firm employs GPS (Global Positioning System) technology for tracking the movement of products in transit using trucks. The results showed that the majority, 40% (62) of the participants, strongly agreed, followed by 34.8% (54) who agreed, while 17.4% (27) remained neutral, and 5.8% (9) disagreed, with a small minority of 1.9% (3) who strongly disagreed. This was reflected in a mean of (M= 4.05 and a standard deviation of SD= 0.992). Similarly, participants were asked to indicate their agreement with the statement that the firm retains transport-related documents, such as delivery receipts, as they contain vital information in the supply chain. The results showed that the majority, 43.9% (68), strongly agreed, 32.9% (51) agreed, 14.8% (23) were neutral, and 7.1% (11) disagreed, while a minority, 1.3% (2), strongly disagreed. The mean (M) was 4.11, with a standard deviation (SD) of 0.991. Likewise, respondents were requested to demonstrate their level of agreement with the statement that the firm collaborates with its stakeholders, including carriers/logistics providers and customers, to ensure that products reach customers in good condition. The data revealed that the majority, 41.3% (64), strongly agreed, followed by 36.1% (56) who agreed, with an additional 13.5% (21) remaining neutral, 5.8% (9) expressing disagreement, and a small fraction of 3.2% (5) strongly disagreeing. The mean was 4.06, and the standard deviation was 1.036. Finally, when participants were prompted to express their level of agreement regarding whether the firm manages returns and recalls of products through adequate record-keeping for easy follow-up, the findings showed that 40% (62) of the participants strongly agreed, followed by 38.1% (59) who agreed. Additionally, 13.5% (21) were neutral, 6.5% (10) voiced disagreement, and 1.9% (3) strongly disagreed, with a mean of M = 4.08 and a standard deviation of SD = 0.984. This research discovery aligns with the study of Hastig and Sodhi (2020).

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Table 1: Descriptive Statistics on Product Traceability

Statement	1	2	3	4	5	Mean	Std. Dev.
The firm's products have unique identifiers such as barcodes, QR codes, easy tracking, and follow-up in the supply chain.	0.6% N (1)	5.8% N (9)	10.3% N (16)	54.8% N (85)	28.4% N (44)	4.05	0.824
The product label contains information about the product ingredients, manufacturing date, and expiry date, enhancing transparency and compliance with the Tanzania Bureau of Standards.	1.3% N (2)	5.8% N (9)	13.5% N (21)	51% N (79)	28.4% N(44)	3.99	0.879
The firm's product label contains security features like a tamper-evident seal to prevent counterfeit items in the market using our company name.	2.6% N (4)	2.6% N (4)	11.6% N (18)	38.1% N (59)	45.2% N (70)	4.21	0.931
The firm's product label provides information, details, and instructions for returns to assist the firm in responding quickly to customer complaints.	1.3%N N(2)	7.7% N(12)	10.3% N (16)	34.2% N (53)	46.5% N (72)	4.17	0.986
The firm uses innovative technologies such as barcode scanners, RFID (Radio frequency identification) tags, and IoT (Internet of Things) devices to capture real-time data about product movement, location, and status at various stages of the supply chain.	1.3% N (2)	3.9% N (6)	14.8% N (23)	49.7% N (77)	30.3% N (47)	4.04	0.852
The firm uses digital tracking systems such as advanced software, cloud-based platforms, and data analytics to capture, store, and analyze information about product origins, movement, and destination to allow effective follow-up in the supply chain.	1.9% N (3)	4.5% N (7)	12.9% N (20)	25.2% N (39)	55.5% N (86)	4.28	0.984
The firm uses platforms like Cloud-based traceability to store and retrieve information about products, suppliers, and processes for easy follow-up.	3.9% N (6)	1.9% N (3)	9% N (14)	32.9% N (51)	52.3% N(81)	4.28	0.984
The firm uses GPS (Global Positioning System) technology when transporting their products using trucks for easy tracking of the movement of products in transit.	1.9% N (3)	5.8% N(9)	17.4% N (27)	34.8% N (54)	40% N (62)	4.05	0.992
The firm keeps transport-related documents like delivery receipts since they contain important information used in the supply chain.	1.3% N (2)	7.1% N (11)	14.8% N (23)	32.9% N (51)	43.9% N(68)	4.11	0.991
The firm collaborates with our stakeholders, such as carriers/logistic providers and customers, to ensure our products reach customers in good condition.	3.2% N (5)	5.8% N (9)	13.5% N (21)	36.1% N (56)	41.3% N (64)	4.06	1.036
The firm manages returns and recalls of products through proper record-keeping for easy follow-up.	1.9% N (3)	6.5% N (10)	13.5% N (21)	38.1% N (59)	40% N(62)	4.08	0.984
Aggregate Score						**4.12**	**0.949**

Strongly Disagree =1, Disagree = 2, Neutral = 3, Agree = 4, Strongly Agree = 5

4.1.2 Descriptive Statistics for the Construct of Performance of Food and Beverage Manufacturing Firms

The study's primary aim was to determine the relationship between product traceability and the performance of food and beverage manufacturing firms in Tanzania. Respondents were, therefore, asked to indicate their level of agreement with statements concerning this performance. Table 2 provides a summary of the findings obtained.

On the matter of responsiveness, respondents were asked to indicate their level of agreement regarding the assertion that their firm promptly responds to customer demands and changing market conditions. The data revealed that a majority of 49% (76) of the respondents strongly agreed, followed by 43.9% (68) who agreed, while a small 7.1% (11) of the respondents remained neutral. The mean was recorded as (M= 4.42 with a standard deviation of SD= 0.623). Similarly, participants were asked about their stance on whether the firm makes accurate forecasts that lead to better inventory management and reduced risk of stock-outs. The results indicated that the majority of 47.7% (88) of the respondents strongly agreed, with an additional 42.6% (66) in agreement, while a small fraction of 9.7% (15) remained neutral. The mean was calculated as (M= 4.38 with a standard deviation of SD= 0.657). Furthermore, respondents were asked to provide their level of agreement concerning the assertion that the firm shortens lead time by reducing cycle time and enhancing faster order fulfilment. A small 1.3% (2) of the respondents disagreed, 11.6% (18) remained neutral, while a majority of 45.2% (70) agreed, and 41.9% (65) strongly agreed. The mean and standard deviation were reported as 4.28 and 0.717, respectively. Respondents were subsequently queried about their level of agreement regarding the firm's collaboration with suppliers to enhance flexibility; the majority, 52.3% (81), strongly agreed, followed by 45.8% (71) who concurred, while a small percentage, 1.9% (3), remained neutral. The mean was calculated at (M= 4.50) with a standard deviation of (SD= 0.539). Finally, respondents were also asked to indicate their agreement regarding firms' flexibility in adapting to new market changes. A small percentage, 2.6% (4), of the respondents remained neutral, while 47.1% (73) strongly agreed, and the majority, 50.3% (78), agreed, resulting in a mean of 4.45 and a standard deviation of 0.548. These research findings are consistent with the findings made by Kamanga (2024).

Regarding reliability, the participants were asked to indicate their level of agreement with the assertion that their firm meets delivery requirements as part of their commitment to customer satisfaction. The results indicated that the majority, comprising 55.5% (86) of the participants, strongly agreed, followed by 43.2% (67) who agreed, while a small percentage of 1.3% (2) remained neutral. The data produced a mean of M = 4.42 with a standard deviation of SD = 0.521. Similarly, the participants were asked to express their level of agreement with the statement that the firm ensures accurate order fulfilment, thereby minimising returns, replacements, and rework. A small percentage of 1.3% (2) of the participants remained neutral, while the majority, accounting for 50.3% (78), strongly agreed, and 48.4% (75) agreed. The mean was found to be 4.49, with a standard deviation of 0.527. Furthermore, the participants were asked about their level of agreement regarding whether the firm ensures consistent delivery of high-quality materials, meets delivery deadlines, and adheres to agreed specifications. The results indicated that the majority, comprising 58.7% (91) of the participants, strongly agreed, alongside an additional 40% (62) who agreed, while only 1.3% (2) remained neutral. The mean score was (M= 4.57), with a standard deviation of SD= 0.522. Similarly, respondents were requested to share their views on the firm’s ability to provide

a continuous supply of products to customers to minimise supply chain disruptions. A significant majority of 51% (79) concurred, with 47.7% (74) in strong agreement, while a small proportion of 1.3% (2) remained neutral. This was accompanied by a mean of 4.46 and a standard deviation of 0.526. Lastly, participants were asked to express their level of agreement with the statement that customers trust the firm's products and services because the firm is attentive to the needs and preferences of its customers. The majority, 61.3% (95) of the participants, strongly agreed, followed by 37.4% (58) who agreed, with a minority of 1.3% (2) remaining neutral. This corresponded with a mean of 4.60 and a standard deviation of 0.517. These research findings are consistent with those of Chepleting (2024).

When considering cost, the respondents were asked to express their level of agreement on whether the firm effectively manages supplier relationships for cost reduction. The results showed that the majority, 62.6% (97) of the participants, strongly agreed, followed by 36.1% (56) who agreed, and a small percentage of 1.3% (2) remained neutral, with an average of 4.61 and a standard deviation of 0.515. Subsequently, they were asked to indicate their agreement regarding the firm's negotiations with suppliers for favourable pricing to enhance the competitiveness of their products in the market. The findings revealed that the majority, 65.2% (101) of the participants, strongly agreed, followed by 33.5% (52) who agreed, while 1.3% (2) remained neutral, with an average of 4.64 and a standard deviation of 0.508. Additionally, participants were tasked with indicating their degree of agreement regarding the idea that a firm eliminates non-value-adding activities, which leads to cost reduction through the implementation of a continuous improvement policy. A minority of 8.4% (13) of the participants remained neutral, while the majority, comprising 60.6% (94) of the respondents, strongly agreed, and 31% (48) of the participants agreed, with an average of 4.52 and a standard deviation of 0.648. Similarly, participants were invited to express their level of agreement on whether the firm accurately plans and forecasts demand for its products, enabling alignment with actual demands and thus minimising costs along the supply chain. The results illustrated that the majority, 60% (93) of the participants, strongly agreed, followed by 38.7% (60) who agreed, and a small percentage of 1.3% (2) remaining neutral, with an average of 4.59 and a standard deviation of 0.520. Lastly, respondents were also asked to express their agreement regarding the firm's ability to collaborate with their supply chain partners, thereby assisting in cost savings. A small percentage of 1.9% (3) of the respondents remained neutral, while 36.8% (57) agreed, and the majority, 61.3% (95), strongly agreed, resulting in a mean of 4.59 and a standard deviation of 0.531. These research results are consistent with those of Rajab (2024).

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Table 2: Descriptive Statistics on Performance of Food and Beverage Manufacturing Firms

Statement	1	2	3	4	5	Mean	Std. Dev.
The firm can promptly respond to customer demands and changing market conditions.	0% N (0)	0% N (0)	7.1% N (11)	43.9% N (68)	49% N (76)	4.42	0.623
The firm makes accurate forecasts that lead to better inventory management and reduction of risk for stock-outs.	0% N (0)	0% N (0)	9.7% N (15)	42.6% N (66)	47.7% N (74)	4.38	0.657
The firm shortens lead time by reducing cycle time and enhancing faster order fulfilment.	0% N (0)	1.3% N(2)	11.6% N (18)	45.2% N (70)	41.9% N (65)	4.28	0.717
The firm collaborates with suppliers to increase flexibility.	0% N (0)	0% N(0)	1.9% N (3)	45.8% N (71)	52.3% N (81)	4.50	0.539
The firm is flexible in adapting to new changes in the market.	0% N (0)	0% N(0)	2.6% N (4)	50.3% N (78)	47.1% N (73)	4.45	0.548
The firm meets delivery requirements as we are committed to customer satisfaction.	0% N (0)	0% N (0)	1.3% N (2)	55.5% N (86)	43.2% N (67)	4.42	0.521
The firm ensures accurate order fulfillment, thus minimizing returns, replacements, and rework.	0% N (0)	0% N (0)	1.3% N (2)	48.4% N (75)	50.3% N (78)	4.49	0.527
The firm ensures consistent delivery of high-quality materials, meeting delivery deadlines and adherence to agreed specifications.	0% N (0)	0% N (0)	1.3% N (2)	40% N (62)	58.7% N (91)	4.57	0.522
The firm ensures a continuous supply of products to customers to minimize supply chain disruptions.	0% N (0)	0% N (0)	1.3% N (2)	51% N (79)	47.7% N (74)	4.46	0.526
Customers trust a firm's products and services because the firm is focused on the needs and preferences of the customers.	0% N (0)	0% N (0)	1.3% N (2)	37.4% N (58)	61.3% N (95)	4.60	0.517
The firm effectively manages supplier relationships for cost reduction.	0% N (0)	0% N (0)	1.3% N (2)	36.1% N (56)	62.6% N (97)	4.61	0.515
The firm negotiates with its suppliers for favourable price terms to make its products more competitive in the market.	0% N (0)	0% N (0)	1.3% N (2)	33.5% N (52)	65.2% N(101)	4.64	0.508
The firm eliminates non-value-adding activities, which leads to cost reduction by implementing a continuous improvement policy.	0% N (0)	0% N (0)	8.4% N (13)	31% N (48)	60.6% N (94)	4.52	0.648
The firm accurately plans and forecasts demand for its products, which enables its alignment with actual demands, thus minimizing costs along the supply chain.	0% N (0)	0% N(0)	1.3% N (2)	38.7% N (60)	60% N (93)	4.59	0.520
Aggregate Score						**4.49**	**0.563**

Strongly Disagree =1, Disagree = 2, Neutral = 3, Agree = 4, Strongly Agree = 5

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4.2 Correlation Analysis for Product Traceability

The research findings indicated that product traceability has a weak, positive significant linear correlation with the performance of Tanzania food and beverage manufacturing companies. Table 3 presents the correlation coefficients between the variables studied. Product traceability shows a weak positive correlation with firm performance ($r=0.113$, $p<0.05$), indicating that although a connection exists between these two variables, it is not strong. This suggests that firm performance may increase as product traceability rises, but the impact remains slight. The findings align with Zhou et al. (2022) that adopting product traceability enhances firm performance.

Table 3: Correlation Analysis

Variable		Product Traceability	Firm Performance
Product Traceability	Pearson Correlation	1	
	Sig. (2-tailed)		
	N	155	
Firm Performance	Pearson Correlation	.113	1
	Sig. (2-tailed)	.001	
	N	155	155

4.3 Regression Analysis for Product Traceability

The impact of product traceability on the performance of food and beverage manufacturing firms in Tanzania was examined using regression analysis. The research hypothesis, derived from the specific objective, was.

H_{01}: Product traceability has no significant influence on the performance of food and beverage manufacturing firms in Tanzania.

The relationship between product traceability and the performance of food and beverage manufacturing companies was assessed using linear regression to validate the stated hypothesis. Path coefficients were employed to evaluate the direction and strength of these associations, while t-statistics were utilised to determine the significance of the relationships. The findings are summarized in Table 4. An R-squared value of 0.609 indicates that approximately 60.9% of the variance in the dependent variable is attributable to product traceability. This suggests that while product traceability significantly influences performance, other unmeasured factors also contribute. Consequently, the model indicates that product traceability is a crucial predictor of firm performance, accounting for a substantial portion of the variance.

Table 4: Model Summary of Product Traceability

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.780[a]	.609	.606	.0053097

a. Predictors: (Constant), Product traceability

Table 5 below presents the findings of the variance analysis. The F-statistic of 237.870 reveals the ratio of variance explained by the model compared to the unexplained variance. A higher F-value suggests that the model significantly accounts for variability in the dependent variable. The P-value of 0.000 confirms the statistical significance of the regression model, providing strong evidence to reject the null hypothesis. This indicates that product traceability significantly affects the performance of food and beverage manufacturing firms. Consequently, the ANOVA results demonstrate that product traceability significantly predicts firm performance within the food and beverage manufacturing industry, supported by the high F-value and low P-value.

Table 5: ANOVA of Product Traceability

ANOVA [a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.007	1	.007	237.870	.000[b]
	Residual	.004	153	.000		
	Total	.011	154			

a. Dependent Variable: Firm Performance

b. Predictors: (Constant), Product traceability

The standardized regression coefficient for product traceability stands at 0.780. This means that with every one-unit increase in product traceability, firm performance is anticipated to rise by 0.780 units, assuming all other factors remain unchanged. At a 5% significance level, the t-statistic for the regression coefficient of product traceability is 15.423, confirming its significance. The p-value for both the constant and product traceability is 0.000, indicating that these coefficients are statistically significant, suggesting strong evidence that product traceability positively influences firm performance. Hence, the analysis demonstrates that product traceability significantly predicts firm performance in the food and beverage manufacturing industry, with both the unstandardized and standardized coefficients indicating a positive correlation. These findings support the hypothesis that enhancing product traceability improves firm performance. Schuitemaker and Xu (2020) emphasized that product traceability is vital for managing supply chain risks, serving as a valuable tool for tracking, tracing, and verifying a product's authenticity while aiding firms in meeting quality standards. Additionally, Zhou, Pullman, and Xu (2022) highlighted that product traceability improves transparency and

safety, helping to track instances of unethical sourcing and counterfeit products in the marketplace.

Table 6: Coefficients of Product Traceability

Coefficients [a]						
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	.062	.002		37.643	.000
	Product Traceability	.007	.000	.780	15.423	.000

a. Dependent Variable: Firm Performance

The regression model obtained from the output was

Performance = 0.062 + 0.780 product traceability + error

5. Conclusion

The null hypothesis posited that 'Product traceability has no significant impact on the performance of food and beverage manufacturing firms in Tanzania.' Contrary to this assumption, the study's findings disprove the hypothesis. Product traceability plays a statistically significant role in explaining the performance of food and beverage manufacturing firms in Tanzania. The results indicate a positive influence, suggesting that enhanced product traceability improves performance among these firms. The findings highlight that product traceability goes beyond being just a compliance tool; it serves as a strategic asset that enhances operational efficiency, reduces costs, and improves customer satisfaction. This supports the notion that companies can outpace their competitors by leveraging unique internal resources. Likewise, this analysis confirms that product traceability notably affects the performance of food and beverage manufacturers in Tanzania. Consequently, adopting robust product traceability systems greatly bolsters manufacturing firm performance by fostering greater efficiency and transparency.

6. Recommendation

This study suggests that food and beverage manufacturing companies should invest in robust product traceability systems. These systems need to be well-designed to track products from their original supply source to distribution and final consumption. Utilizing technologies such as QR codes, barcodes, and blockchain is essential, as these tools greatly improve the accuracy and reliability of tracking data. By implementing robust traceability systems, these companies can guarantee that each product can be traced back to its origin, thus enhancing quality control and allowing quick responses to emerging issues. Additionally, manufacturing organizations should formulate a unified strategy that links product traceability efforts with their innovation goals from the outset. This connection ensures that both elements complement each other instead of competing for finite resources. Moreover, manufacturing firms should foster collaboration between departments responsible for traceability and those focused on research and development. This will promote knowledge sharing and ensure that innovations are developed with a full understanding of their effects on product tracking.

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