ESJ Social Sciences Peer-reviewed

The Impact of Transportation on The Avocado Market in Tanzania

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Doi:10.19044/esj.2024.v20n22p1

Submitted: 27 July 2024
Accepted: 20 August 2024
Published: 31 August 2024

Cite As:
Tumaini S., Ghahula R. & Macha S. (2024). *The Impact of Transportation on The Avocado Market in Tanzania.* European Scientific Journal, ESJ, 20 (22), 1.
https://doi.org/10.19044/esj.2024.v20n22p1

Abstract

Avocado (Persea americana) is grown in many nations throughout Africa, Asia, Europe, and South America. The climate of Tanzania offers a perfect habitat for growing avocados. This paper investigates how transportation affects the Tanzanian avocado industry. Data were gathered from 505 farmers and 37 categories/groups using a cross-sectional design. Data analysis was done using SPSS where descriptive statistics and the chi-square test. A one-way analysis of variance (ANOVA) with Tukey's Honest Significant Difference (HSD) test at $p < 0.05$ was also done. According to the results, local avocado output is dominated by men (79% male vs. 21% female). The result of the binary logit model revealed that the participation of avocado producers in a high-value market was influenced by age, educational status, the number of avocados sold, the price of avocado, and market information. With sorting (12%), grading (7%), and packaging (9%), quality during production was judged most important (25%), followed by harvesting (16%), storage (16%), and transportation (15%) with less relevance were factors impacting quality. Improving the avocado market for growers depends on addressing these problems at the national, regional, and district levels. Hence,

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

transportation has a big influence on the avocado industry since smallholder growers have great difficulties influencing market access and produce quality. Improvement of transport infrastructure and support systems at the national, regional, and district levels will help to boost the avocado market.

Keywords: Avocado, Transportation, Hass, Market, Farmers

Introduction

Avocado Persea americana is a popular tropical fruit rich in nutrients and bioactive compounds. The avocado is the sixth important subtropical crop and it is cultivated in over 55 different countries in the world with Mexico and Central America as the leading producers Majid et al., (2020). There are various varieties of avocado, however, the Hass variety has proved to be an excellent source of nutrients and storage stability due to the presence of thick, bumpy skin compared with other avocado varieties. Besides the mentioned advantages, the avocado is a climacteric fruit with respiratory and internal metabolic processes, and external factors easily damage avocados Lieu et al. (2024). Fruits are often regarded as a crucial nutritious and energy source in the diets of individuals residing in tropical and wet environments (Van et al., 2023).

Avocados have a high concentration of vital and unsaturated fatty acids, vitamins, potassium, and fibre as well as low total soluble solids content. The avocados are nutritious fruits, nevertheless, the fruits attract more investors and businesses in the global food trade Anagnostopoulou et al., (2024). Owing to its commercial value, the nutritious and popular, avocado is sometimes referred to as "Green Gold." With global output increased at a compound annual growth rate (CAGR) of over 7% during the past decade, to just over 8.4m metric tonnes in 2022 Van et al. (2023). The agriculture sector has seen a notable expansion in avocado production. The expanding output in areas was driven by attractive prices and returns on crop investment. Currently, the avocado sector accounts for 30% of the world's avocado output, Mexico's production increased at a CAGR of about 6% over the past ten years. Mexico is accounting for 12%, 9%, and 6% of current global production, respectively, production rose by around 15%, 12%, and 11% in Colombia, Peru, and Kenya (Taramuel-Taramuel, et al. 2024).

Latin America which includes Mexico, Colombia, Peru, the Dominican Republic, and Brazil the giant avocado supplier to Europe. After decades of strong growth, they grow and supply over 75% of total European imports, valued at 2.16 billion euros CBI, (2022). Africa has grown at a similar rate and faster. The main suppliers to Europe are South Africa, Kenya and Morocco. Kenya leads the supply from East Africa and exported 148 million euros worth of avocados to Europe in 2020 (CBI,2022). Currently, there are

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

more than 500 varieties of avocado that are different in size, texture, shape, and maturity rate around the world, and the Choquette, Lula, Hass, X-Ikulu, Fluert, Reed, Pinkerton, Gwen and Maluma are the most commonly known varieties Boniphace et al., (2023). However, the Hass is the most popular variety cultivated around the world and the Hass market is estimated to reach USD 19.20 billion in 2024 and is expected to reach USD 33.40 billion by 2029, growing at a CAGR of 5.30% during the forecast period (2024-2029) (Mordol Intelligence, 2024).

Avocado production is a significant agricultural activity in the Tanzanian economy. Tanzania ranks third major avocado producer in Africa after South Africa and Kenya and the 19th country in the world. Tanzania produces an average annual production of 190,000 tons of avocado fruits per annum (Boniphace et al., 2023). Avocados are mostly grown in Kilimanjaro, Mbeya, Arusha, Iringa, Kagera and Kigoma. Other producing Regions are Songwe and Njombe Rukwa, Tanga, Manyara and Ruvuma. About 19% of avocados produced in Tanzania are produced by smallholder farmers and ten per cent by large-scale commercial farmers. About fifty per cent of Avocados produced in Tanzania are of Fuerte type, followed by Hass which is produced by thirty per cent. Other varieties such as X-Ikulu, Zutano, Dulu, X-Muna, Tonnage, and Mwaikokyesa; and improved ones like Gem, Bacon, Nabal, Pinkerton, DUSA and Carmen are produced by twenty 20%. Hass type is mostly preferred in foreign markets due to several attributes boosting marketability. The mentioned attributes include high yield, oil content, rich flavour, longer shelf life due to rough outer skin and resilience in logistics (Tan Trade,2024)

Tanzania's avocado investment creates opportunities in the avocado value chain development. We have evidenced the increase of investors buying and processing fresh avocados such as PERSEA oil and Orchard LTD the owner from Kenya, they process avocado oil from three varieties Hass, Fuert and local varieties. They source fruits from Mbeya, Njombe and Kagera, Agri promises Co LTD buys and exports avocados to Kenya, Europe and India. Others are Avo Master Co LTD, BENLE Resource, East Africa LTD, Formal Agro LTD, Gibri Business Solution LTD, Heso Agri Co LTD, Home fresh TZ LTD, JL&CHRIS, Co LTD, Kuza Africa Co LTD, Layaan Dream Traders LTD, LIMA ltd, Lupembe Africa Fruits Mbembati and Sons Co LTD, Nanine Business Enterprises Co LTD, Parachichi Fresh Product LTD, Plus Tanzania Ventures LTD, Riziki Fresh LTD, Avo Africa and Season Orchards and recently emerging company established under the support of TAHA in Arusha called FRESH FIELD MANYATTA. --Horticulture Company deals with the Farming and Export of vegetables and fruits. Investors are attracted to good investment opportunities and policies which favour the investors in Tanzania.

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Development organisations such as Tanzania Horticulture Association in collaboration with TANTRADE and the Ministry of Agriculture should engage in promoting the available opportunities to support the development of the value chain such as; the establishment of manufacturing of inputs especially but not limited to improved seeds, pesticides, fungicides, fertilizers, farming equipments and machines. The emphasis should also make an additional effort to invest in value addition facilities such as sorting, cleaning, grading, packaging and processing, packaging materials, cold rooms, horticulture, and logistic support services. Other opportunities include the establishment of common-use cold room facilities, investment in refrigerated trucks, investing in Avocado processing and canning industries, and other industries for the production of related products such as cooking oil, packaging crates and boxes, food pastes and supplements, cosmetics, bio-fuel, and animal feeds (Tan Trade., 2024).

Apart from the opportunity available in the avocado market in Tanzania the avocado market is faced with major challenges which hamper its development and growth. In Tanzania, the climate is favourable, production costs are low. But, becoming a preferred supplier to the market takes more than competitive prices and a seasonal gap. Quality problems have affected the reputation of Tanzania avocados. This is due to the long transit times, issues in the supply chain, and a large number of uncontrolled outgrowers (CBI,2024). Another issue is logistics as the transit time of East African avocados is relatively long compared to other exporting countries. Often, avocados have to travel a long way from the fields to the packing house and the port. Mombasa is the main port for avocados from Tanzania, but the available shipping options are limited. Most freight lines have transshipments, and there is no weekly, direct refrigerated container service. Exporters have to send fruit with acceptable maturity but prevent it from ripening in transit; this is not easy (Mordol Intelligence., 2024).

Hence, this study addresses the avocado market and transportation must be prioritised as the postharvest of avocado consists of several stages including multiple instances of handling and transportation which are considered important in maintaining the physical integrity and quality of the avocado products during the distribution throughout the supply chain, from farms to consumers (Ríos-Mesa et al., 2020). For avocado fruits, unnecessary losses occur due to the postharvest transportation of avocados from farm to packhouse. Damage done to avocados may only become visible during the later stages of the fruit's ripening, making it difficult to detect damage during the early stages of the supply chain (Milne and Steyn,.2021).

The transportation of avocado fruit from southern Tanzania has improved since Tanzania has invested in the establishment of a road network. The total number of road passengers in Tanzania rose by 32%, from 8,750km

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in 2015 to 11,546km in 2016. The road network in Tanzania currently comprises 86,472 km of roads, of which 12,786 km are trunk roads, 21,105 km are regional roads and the remaining 52,581 km are district, urban and feeder roads. As of 2013, 19% of Tanzania's national roads (6,439.29km) and 2% of its district roads (1,069.2km) are paved (Tanzania Invest,2024). However for the country to remain regionally and globally competitive, further improvements may be necessary. While it has been ascertained that to maintain the quality of the avocado fruits the breaking of the transportation chain from farm to market is to be avoided during avocado transportation (Blakey & Bower, 2009).

The impact of transportation on the Avocado market at various points has not been studied in Tanzania. Successful transportation of avocados requires the earliest possible to avoid the field heat and maintain the optimal temperature throughout the transportation (Blakey, & Bower, 2009). The National Horticulture Development Strategy and Action Plan 2021-2031 has recommendations and provides guidelines for the commercialization and value addition of horticulture products. This strategy serves as a master plan to develop the horticulture industry in the country. The strategy will guide a horticultural sub-sector in the next ten years (2021-2031) towards a vibrant and sustainably competitive in the domestic, regional, and international markets. That will outline the correct handling of fruit concerning refrigerated trucks to minimize the increases in pulp temperature (National Horticulture Development Strategy, 2021)

Numerous exporters in Tanzania have improved their cold chain management and use refrigerated containers straight from the packing house. Despite the increasing exports, East Africa is still not the preferred origin for many European buyers. Exporters need to keep working on the reputation of East African avocados (CBI,2022). Some research has shown that it is important to analyze the avocado market and transportation as an overview to identify key improvement points and potential trends that could be exploited based on the transportation and the market sustainability (Affleck, 1992; Quiceno Orozco, C. A. 2024; Yakeen and Oguntimehin, 2024). These authors' study revealed that the major challenges of the fruit supply chain include poor logistics management practices, poor storage systems, and a lack of storage facilities.

These publications offer evidence of synthesising transportation in the Avocado Market. However, they do not thoroughly investigate the Impact of Transportation on the Avocado Market in Njombe and Mbeya. In our present study, we aim to directly assess the impact of transportation on the Avocado Market in Njombe and Mbeya, even in the presence of the market challenges impacted by COVID-19 and the Ukraine and Russia war. The research was carried out in the Njombe and Mbeya regions to assess the impact of

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

transportation on the Avocado Market in Tanzania. The study sought to gain a deeper understanding of the factors that contribute to the market challenges, specifically in terms of transportation. Additionally, the study aimed to provide suggestive evidence for the public, especially avocado farmers, various private sectors investing in the avocado value chain, and non-governmental sectors to facilitate the development project to capacitate and transfer the knowledge to all players in the value chain.

Literature Review

The global market for avocados is substantially important in the international food and economy in general. The avocado fruits are native to Mexico and Central America. However, the fruit is also grown in many different regions across the world, such as Colombia, Peru, Dominican Republic, Kenya, Tanzania, Uganda, Indonesia, Brazil, Vietnam, Israel, Haiti, Chile, Ethiopia, the United States of America and South Africa, to mention a few. Avocado consumption has observed swift growth because of the change in human consumption lifestyle, leading to significant fluctuations in sales volumes and prices (Sina et al., 2024).

Avocados have become a core ingredient in many United States of America households, with their popularity driven by their perceived health benefits and versatility in various culinary applications (Johnson,2016). Apart from being delicious and rich in nutrients, it was also found the avocado intake of one avocado per day in adults with abdominal obesity increased adherence to the dietary guidelines for the Americans-supplement diet group (Petersen et al.,2024).

The avocado fruit belongs to the genus Persea in the Lauraceae family and the tree is typically cultivated in Central Mexico. Besides the advantages and values of the fruit, the avocado tree takes a significant number of resources to cultivate, since an avocado tree takes between three and five years before it begins bearing fruit (Shahbandeh., 2024). In 2022, Mexico accounted for the highest share in global production of avocados with a production volume amounting to just over 2.5 million tons. Colombia and Peru were also ranked among the major avocado-producing countries with production volumes of about 1.1 million and 866 thousand tons. In the year 2022, over 252 thousand hectares of avocado trees were planted in Mexico, up from 168.11 thousand hectares in 2013. The global avocado market was valued at over nine billion U.S. dollars in 2021 and is forecast to reach more than 19.9 billion U.S. dollars by 2026 (Shahbandeh., 2024). North and Central America are at the top of the list with over 800,000 metric tons of avocado each year, which is about 57% of the worldwide population in total, and the top producing countries are Mexico and the United States. South America is the second largest producing area with 20% of the total, followed by Asia and Africa, each around 1.0%.

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Europe produces lower quantities of avocados, accounting for 3% of the world's production (FAO, 2023).

Avocado production in India increased by almost 1100 per cent as compared to 1961. In India, the avocado was introduced in Bangalore and hill stations like Kallar near Nilgris, Palani hills of Kodaikanal, Shrevaroy hills of Yercaud, and Coorg between 1912 and 1940. Later, the seedlings of those varieties spread over humid subtropical regions but remain neglected. Avocado cultivation has gained overwhelming popularity during the last decade due to the nutritional properties of the fruit. Presently, around 7000 tons of avocados annually and the production is increasing rapidly as added areas are being brought under cultivation (Tripathi, 2024).

Transportation Avocado farming in Kenya is mainly practised by small-scale holders for subsistence and income from local markets. The main varieties grown in Kenya are Hass and Fuerte, with Hass dominating the export market, especially to the European Union and South Africa. Avocado production from Kenya has increased massively in recent years, surpassing 320,000 tonnes annually. It is estimated that up to 30% of this produce is exported, earning valuable income for thousands of small-scale producers. Kenyan avocado production is projected to reach nearly 450,000 metric tonnes by 2026, representing an annual growth of 3.5 per cent Mwangi, (2024). Apart from the successful history of the avocado culture, farmers expressed concerns about possible effects on annual crops. Limited access to grafted seedlings and low technical expertise in the propagation of avocado cultivars and farmers' concerns about potential resource competition between avocados and annual crops had a significant influence on farmers' decisions on avocado integration Kuyah et al., (2024). Thus, understanding the impact of the market and transportation on the Avocado Market in Tanzania is crucial for promoting the avocado market in the country.

The avocado markets are an emerging opportunity in Ethiopia to improve household income and food security. Farmers participating in high-value crops, which include avocado, are more food secure than those who participate in traditional markets. The study conducted by Kuyah, et al., (2024) in Ethiopia by randomly selecting 389 avocado producers using a semi-structured questionnaire. Descriptive statistics, inferential statistics, and propensity score matching models were used to analyze the data. The result of the binary logit model revealed that the participation of avocado producers in a high-value market was influenced by age, educational status, the number of avocados sold, the price of avocado, and market information. Thus, this study suggested that Ethiopian farmers should encourage more households to participate in the high-value markets (Kuyah, et al., 2024).

Tanzania has a diverse agroecological area suitable for growing tropical fruits, including avocados. Mbeya and Njombe have been emerging

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as one of the most important avocado producers in Tanzania due to their unique geographical and climatic conditions and the promotion effort of the Tanzania Horticulture Association, donors in collaboration with the United Republic of Tanzania, investors, and producers becoming a crucial part of the avocado market. Europe, Kenya, South Africa, and Asia are major markets for Tanzanian avocados. The country is also experiencing a huge consumption rise in the past years. Likewise, it is expected that the avocado market will rise in the following years in terms of export, production, and consumption due to its emerging popularity, nutritional facts, and the efforts of each stakeholder to promote the various nutritious values within the fruit. Therefore, it is important to analyze the avocado market and transportation as an overview to identify key improvement points and potential trends focused on transportation and market context which could be exploited based on the preservation of transportation sustainability.

In Northern and Southern Tanzania, avocados have been growing under variable soil and altitudinal characteristics for over 100 years, allowing the naturalization of this crop in these regions Yangaza, et al., (2024). Avocado farming has grown into a significant agricultural industry in Mbeya - Rungwe District, significantly contributing to the local economy. Based on this, a recent study was conducted on avocado farmers in Hai and Rungwe to investigate the profitability of avocado production among the smallholders. Primary data were collected from 120 smallholder farmers producing avocados for exportation. The study employed a multistage random sampling method to select farmers. The study findings suggest that the production of avocado for exportation yielded a high net profit value, which was far higher than the Bank of Tanzania rate for fixed accounts of 2.16%, indicating that the investment value in avocado production for foreign trade was economically viable (Boniphace et al., 2023).

The previous studies conducted in Njombe through field observation have shown that avocado farming has been gradually replacing tree plantations in the district through two main ways thus; the uprooting and replacement of young trees with avocado trees, and the establishment of avocado farms on most newly cleared land. The high global market value, the high price of avocado fruits, and the relatively improving market access for avocado farmers are essential to raising rural incomes and enhancing their standard of living Nyamboga et al., (2023). However, in respect of Malekela, (2022) conducted the study in Njombe and reviewed different challenges from Avocado Farmers and traders in Njombe town, Tanzania. It was established that along the value chain, avocado farmers and traders experienced low prices, unreliable markets, damaging avocados and poor transport systems. Despite the extensive research on avocados, little attention has been paid to the impact of transportation on the avocado market in Njombe and Mbeya. In

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recognizing the previous work, this study extends the work on Njombe and Mbeya targeting avocado smallholder farmers and other potential actors in the value chain to come up with conclusions and recommendations for improvement.

Theoretical Literature Review

Having had an opportunity to study the horticulture market and the chance to work with Avocado farmers in Njombe and Mbeya at a different stage in the Avocado value chain. Initially, beginning with farmers' mobilization, forming them into groups, training them on good agricultural practices, linkage, and access to the market in several of those practical aspects that are demanding attention at the present day. It is fair to say that, if one was ever to understand the effect of transport on the avocado market, he must begin and go beyond what authors of it were familiar with doing. This study is based on the work of Cooley, (1894) with a particular focus on the Theory of Transportation to make the study argument that, in the Avocado market, the relations between the transport of avocado produce from farmers to market, at a certain time, the transport affects the supply and purchase of avocado produce, including services, quality, stocks, money, and the set of all institutions and instruments that act on the sale and other transactions realized at the avocado market point.

Transport is the main farmers' produce distributor in the farming and transportation systems of horticulture produce Nino, (2024). The integration between market locations and avocado production regions is crucial for achieving price efficiency and optimal trade. In his words, Cooley describes the market as the area over which commodities or farmers produce competition extends, and though it has no sharp boundaries it is determined by facility of inbound and outbound transportation and communication. In the developed market economy, the conditions of production have become adjusted to the market requirements. Over some time, individuals acting through the market have succeeded in setting up an organization of production and exchange which, in turn, has widened the market until it has embraced the bulk of all economic activity in the society Kirzner, (2007). The means of quick movement enable things distributed over a wide area to be offered simultaneously in one place, or they enable things collected in one place to be offered simultaneously in many places.

Therefore, this paper is guided by the theory of transportation that unfolds the most important of its relations to the avocado market and avocado farmers' lives. It was also reviewed in the work of Cowie, (2009) and Sina et al., (2024) where farmers have faced various market-related challenges, such as limited market access, short shelf life, poor road networks, and inadequate means of transportation. Sina et al., (2024) noted that poor market conditions

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contributed to high postharvest waste and low profitability for farmers in the avocado market. Moreover, the author considers the ongoing reform in the organization of all aspects of transport provision. These aspects seek to move transport delivery away from the model of high state intervention towards a more market-focused approach, thereby increasing private sector and individual responsibilities for their transport responsibilities.

According to Cooley, (1894), the best way to understand the effect of transport in the avocado market is by approaching it from several points of view as the supplies and demand of the market, prices, and competition. If the Avocado logistics and movement are difficult to overcome transportation becomes quick and affordable at all levels in the value chain. The reach of effective demand extended affordable facilities to move the produce. Moreover, basic means of transportation prevent the movement of goods. The demand of the people of a single place is limited in its working to the close area of that place while the needs of other places are not felt as a demand.

The avocado production movement by extending the scope of demand depends also on other things to make it uniform and to give more varied characters and it became more uniform because not so much affected by accident local changes on the way to the market. Therefore, the demand for avocados in the present market in Tanzania and overseas is inconsistent and fluctuating than in those previously before the rise of production and adoption of many farmers engaging in avocado farming. It is not because of better transportation, which always tends to be inconsistent. The avocado demand character is diversified because things that become accessible become desired and we have witnessed the sharp rise of Banana demand from Kilimanjaro, Kagera, Mbeya, and onion from Arusha have recently become necessary to the East African market (Tumaini et al., 2024).

The supply tends to become more uniform at different times and placed the quick and valuable transport. Quick and reliable transportation reduces the need for holding large stocks of avocados and it reduces post-harvest loss and in return creates demand and increases avocado customer satisfaction. Improved Njombe and Mbeya rural roads, railways, and airways will boost the market for the avocado produced in the Southern corridor of Tanzania.

After reviewing the theory, we realise the different facts from different points of view on the global avocado market, which has experienced a considerable increase not only in demand but also in production due to the rising popularity of healthy eating habits and the adoption of avocados into several cuisines around the world, Quiceno Orozco, (2024). Avocado production and market locations are crucial for achieving price efficiency and optimal trade in the avocado and horticulture sectors. Moreover, the impact of the transport aspect in the avocado market can also hinder market integration. The present paper critically synthesises and puts this argument

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together in comparison with the reviewed theory of transportation from a market standpoint. Various issues of the avocado farmers have been discussed and synthesised by Guo et al., (2024) in their work on the Evaluation of the Hass Avocado Board's Assessment Rate Tripathi, (2024) Status and prospects of Avocado cultivation in India and are the subject of discussion. Others have received discussion, however, with little attention to transportation and the market in Tanzania.

Although these studies provide insights into avocado cultivation and evaluation of the Hass avocado board's assessment rate, they do not address the effect of transportation on the avocado market by focusing on the theory of transportation of the Njombe and Mbeya markets to measure its efficiency. Therefore, in this paper, we will cover what needs to be known about this connection and how transportation affects the avocado market in Njombe and Mbeya.

Methods

Four local government authorities undertook government field surveys: Njombe Town Council (TC) and Njombe DC in the Njombe region; Busokelo District Council (DC) and Rungwe DC in the Mbeya region. These sites were selected because of their importance for growing avocados in their particular locales. The cross-sectional approach of the study allowed data to be gathered at one moment in time. Bornman (2009) and Mosia (2000) emphasize that this method is regarded as appropriate for home surveys because of its efficiency in identifying the population of interest, cost-effectiveness, and time-saving character.

The study used both probabilistic and non-probabilistic sampling approaches, therefore using a mix of deliberate and random sampling strategies, to guarantee thorough data collecting. Four phases comprised the multistage random sampling technique used. A multistage purposive sampling technique first helped to choose areas and their respective LGAs, divisions, and wards. The main factor guiding this choice was each area's avocado output.

Regardless of the population size, a sample or subsample of 30 cases is the bare minimum for meaningful statistical inference Eng, (2003). Thus, for this study, at least thirty (30) avocado farmers were purposely randomly selected from the list of avocado farmers for each division for interview (sampling frame i.e., the list of respondents was obtained from LGAs extension officers), making a total of 505 farmers (Table 1).

Various documents were reviewed to provide an understanding of the state of the sector in Tanzania. Documents reviewed include the avocado industry development guide (Mwongozo wa uendelezaji wa tasnia ya parachichi), and published and unpublished research reports. Additionally,

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secondary data were collected from the study districts (LGAs), avocado farmer group/AMCOS and avocado company. Some of the data collected included production data, the number of farmers and price trends of avocado.

The avocado farming household's survey was carried out using a semi-structured questionnaire programmed into KoboCollect and the survey was administered using mobile to collect quantitative data from 505 avocado farming households. With the help of the district agricultural extension agents, the research team visited the sampled avocado farming households for the interviews. Before the actual interview, the research team/enumerator was trained on how to use the Kobo data collection tool (KoboCollect App) and the questionnaire was preteste.

Table 1: Regions, LGAs, divisions, wards and Sample size

Region	LGAs	Divisions	Wards	Sample size (n)
Mbeya	Busokelo	Busokelo	Kabula	36
			Lupta	38
			Isange	28
			Lwangwa	31
	Rungwe	Ukukwe	Kiwira	35
			Kyimo	31
			Suma	31
		Pakati	Kisondela	30
Subtotal	*2*	*3*	*8*	*260*
Njombe	Njombe TC	Njombe mjini	Mjimwema	27
		Igominyi	Matola	25
			Uwemba	35
			Kifanya	31
	Njombe DC	Makambako	Mtwango	27
			Ikuna	33
		Lupembe	Lupembe	43
			Mfriga	24
Subtotal	*2*	*4*	*8*	*245*
Total	**4**	**7**	**16**	**505**

To triangulate the results obtained from interviews, different categories/groups of stakeholders along the avocado production system were interviewed as well. The distribution of sample sizes for each category is shown in Table 2, making a total sample size of 542 including different actors with the avocado production system.

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Table 2: Distribution of respondents involved in the study

Sn.	Category	Details	Number
1.	Farmers	Avocado farming households	505
2.	Extension agents	Key informants' LGAs extension officers	17
3.	Farmer groups	Key informant's avocado farmers' group leaders	6
4.	Buyers/collectors	Key informants' avocado buying companies/Locally aggregating for others and sometimes for own sale	8
5.	Transporters	Key informants' shipping avocado consignments within and outside the country	6
		Total	**542**

Data Analysis

Following Taanila., (2013) and Saleh (2023), the gathered data was handled and analyzed using SPSS Statistics (version 23, USA) to show the levels of variables and the links among them. Proportions, frequencies, percentages, tabulations, and cross-tabulations of variables and their associations were among the descriptive statistical analyses carried out. As advised by Aslam (2024), a chi-square test of independence ($p < 0.05$) was conducted to ascertain the relationship among the variables of interest broken out by respondent location (district councils/LGAs). For every one of the several-response questions, this test was administered separately. Following Wang's (2024) approach, a one-way analysis of variance (ANOVA) with Tukey's Honest Significant Difference (HSD) test at $p < 0.05$ was computed to evaluate significant variations between district councils/LGAs for numerical variables such the acreage under avocado production and its productivity data.

Results

The social-economic and demographic profile of the respondents Out of the 505 respondents, 79% were male and 21% female with a similar pattern (i.e., less than 26% female) in all four district councils. The age range was dominated by an adult group between 41–55 years (40%) of those interviewed, implying that the dominant age category is those contributing actively to avocado production, with 73.5% attaining primary education (Table 3).

Table 3: Socioeconomic and demographic profile of the avocado farmers

Parameter	District Councils				Overall	χ^2 statistics
	Busokelo	Rungwe	Njombe TC	Njombe DC		
Respondent	133	127	118	127	505	
Sex						
Male	88.7	78.0	74.6	74.0	79.0	10.959 (0.012) †*
Female	11.3	22.0	25.4	26.0	21.0	
Marital status						
Not married	6.0	3.1	9.3	3.9	5.5	9.575 (0.386)
Married	86.4	89.8	83.1	86.6	86.5	

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Separated/divorced	3.8	1.6	0.8	2.4	2.3	
Widow/widower	3.8	5.5	6.8	7.1	5.7	
Age group (years)						
18-24	0.0	0.0	5.9	1.6	1.8	34.177 (0.001) *
25-40	21.1	18.9	28.8	22.0	22.6	
41-55	39.8	37.0	41.5	45.7	41.0	
56-70	33.1	34.6	22.9	27.6	29.6	
above 70	6.0	9.4	0.8	3.1	5.0	
Education level						
Informal	1.5	3.9	1.7	2.4	2.4	15.993 (0.067)
Primary (1-7)	76.7	72.4	68.6	75.6	73.5	
Secondary	16.5	13.4	24.6	20.5	18.6	
College/university	5.3	10.2	5.1	1.6	5.5	
Land ownership¥						
Owned land	91.0	88.2	85.6	89.0	85.5	1.824 (0.610)
Leased land	3.8	0.0	4.2	0.0	2.0	10.398 (0.015) *
Family-owned land	21.8	10.2	21.2	12.6	16.4	9.646 (0.022) *
Organization/Church	1.5	2.4	0.8	1.6	1.6	0.909 (0.823)

¥ More than one answer possible; †values in the brackets are p-values; *significant at 5% level;

Table 3, indicates land ownership to be mainly owned by individual respondents (85.5%), followed by 16.4% as family-owned land; of which 84.3% of the total land (i.e., an average of 4.3 acres) that is used for avocado production is owned land (Table 4). This has an implication on the land suitability and reliability for avocado productivity, including the type of agricultural technologies farmers can invest in, as well as the number of financial services a farmer can access.

Table 4: The proportional of the owned land and household members' distribution

Parameter	**District Councils, Mean ± Std. Error**				**Overall**
	Busokelo	**Rungwe**	**Njombe TC**	**Njombe DC**	
Respondent (n)	133	127	118	127	505
Total land for avocado production (acre)	3.4 ± 0.3a	3.8 ± 0.4a	4.3 ± 0.6ab	5.9 ± 0.7b	4.3 ± 0.3
Owned land (%)	79.2 ± 3.3a	90.5 ± 2.6b	78.6 ± 3.6a	88.8 ± 2.8ab	84.3 ± 1.6
People living in homestead (n)	5	5	4	4	5
Household member distribution (%)					
Children (0-17 years)	46.0 ± 2.2a	43.5 ± 2.4a	40.7 ± 2.5a	42.5 ± 2.3a	43.3 ± 1.2
Adults (18-59 years)	45.5 ± 2.4a	36.9 ± 2.6ab	51.1 ± 2.7b	45.6 ± 2.4ab	44.6 ± 1.3
Elders (>60 years)	8.5 ± 1.6a	19.6 ± 2.6b	8.2 ± 1.8a	11.8 ± 2.1a	12.1 ± 1.1

Values within rows bearing different letters are statistically different ($p < 0.05$, One Way ANOVA test) among district councils.

In addition, the labour force is among the factors that contribute to the production cost of avocado crops; the easy availability and its quality, the low production cost, and hence profit realization by avocado farmers. However, up to 55.4% belong to the dependent/non-productive age group (i.e., 43.3%

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children and 12.1% elders), causing a risk of labor shortage in the study area (Table 4).

Quality controls in the avocado value chain

Quality control was found to involve seven critical aspects of quality management. The farmer does the first two steps on their premises thus are On-farm quality management of avocado fruits and harvesting. The other five include sorting to remove poor quality fruits and any foreign matter, grading, packaging, storage ready for marketing, and transport/shipping at the Agriculture Marker Cooperation Society (AMCOS) or collection center and the company premises, with the engagement of middlemen.

On-farm quality management of avocado fruits starts from the onset of flowering and extends to the ripening stage; where crop and farm management activities – such as watering, fertilizer applications, and pests and disease control are critical at this stage. However, some farmers lack the knowledge/expertise of pest and disease control which leads to producing poor quality fruit, as observed during the survey. Table 5 shows about 89% of farmers harvest avocado fruits without conducting a maturity test (i.e., dry matter test); harvesting during the rains, with limited access to the best harvesting equipment. This results in the harvesting of immature (14.3% of farmers), bruised and bursting fruits, and broken pods. In addition, some farmer's trees with over 10 years of are complicated to harvest given the height of avocado trees surpasses the required and recommended agronomic practices hence is the consequence of not pruning and causing damage to the fruits when they fall.

Table 5: Frequency of performing maturity tests and harvesting of immature fruits

Parameter	District Councils				Overall	χ^2 statistics
	Busokelo	**Rungwe**	**Njombe TC**	**Njombe DC**		
Respondents	133	127	118	127	505	
Maturity test						
Not at all	80.5	98.4	80.5	96.9	89.1	48.489 (0.000) †*
Rarely	19.5	1.6	16.1	3.1	10.1	
Mostly	0.0	0.0	3.4	0.0	0.8	
Harvest immature fruits						
Not at all	86.5	96.9	89.0	70.9	85.7	39.413 (0.000) *
Rarely	13.5	2.4	9.3	26.8	13.1	
Mostly	0.0	0.8	1.7	2.4	1.2	

†Values in the brackets are p-values; *significant at 5% level

In the value chain of the avocado crop, the sorting of fruit is done by the brokers, by separating the fruits with required and undesirable parameters. The unwanted/low-quality fruits are left to the farmers regardless of whether

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the brokers have used their pickers to harvest or the farmers. However, some farmers (28.3%) do perform the sorting themselves after harvesting the fruits (Table 5). Although grading is done by buyers using machines or by hand, few farmers (25.6%) grade their fruits after harvest (Table 6). The planning of different grades takes into account the needs of the market, where the success of the work depends on the quality of the machine used and the attention of the people doing the work. The use of poor-quality tools and machines affects fruit quality.

Table 6: Frequency of performing sorting, grading, packaging, and storage of avocado fruits

Parameter	District Councils				Overall	χ^2 statistics
	Busokelo	Rungwe	Njombe TC	Njombe DC		
Respondent	133	127	118	127	505	
Sorting						
Not at all	85.0	70.1	72.0	59.1	71.7	
Rarely	15.0	3.9	12.7	21.3	13.3	52.857 (0.000) †*
Mostly	0.0	26.0	15.3	19.7	15.0	
Grading						
Not at all	83.5	69.3	77.1	67.7	74.4	
Rarely	16.5	4.7	10.2	18.9	12.7	49.271 (0.000) *
Mostly	0.0	26.0	12.7	13.4	12.9	
Packaging						
Not at all	97.7	72.4	78.8	55.1	76.3	
Rarely	2.3	3.1	5.9	16.5	6.9	76.628 (0.000) *
Mostly	0.0	24.4	15.3	28.3	16.8	
Storage						
Not at all	98.5	97.6	99.2	88.2	95.8	
Rarely	1.5	1.6	0.8	10.2	3.6	25.978 (0.000) *
Mostly	0.0	0.8	0.0	1.6	0.6	

†Values in the brackets are p-values; *significant at 5% level

The packaging used to pack fruits is crates and boxes. Crates are used to pack fruits transported from farmers to the collection center and/or pack house and bags/cartons are used to transport fruits to oil extraction and processing machines as well as fruits sold in the local market. Like sorting and grading, packaging is mostly done by buyers/brokers, and few farmers (23.7%) do packaging, especially for fruits destined for local market supply (Table 6). The evaluation has shown that the storage of fruits designated for the export market is done by some companies with equipped fruit storage infrastructure. However, the following were observed after visiting the company premises; some fruits are affected by diseases, disregarding the required temperature, and unreliable electricity which affects the retaining of required cold-chain storage. Few farmers (4.2%) store avocado fruits destined for the local market at ambient temperature (Table 6).

The assessment revealed that avocados sold in local markets are transported using normal vehicles (without refrigeration) to the market while

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export fruits are transported from the farm to the 'pack house' using both means of transport, normal vehicles, and refrigerated vehicles delivery to the packhouse and then to ports or airports. Tanzania records a significant increase in avocado exports to China, Kenya, South Africa, Europe, India, and South Africa.

The official statistics indicate that fruit exports have soared from $ 51 million to $ 77 million. This is an average of 30 million tons in total The Citizen, (2024). Avocado fruits are sold in the domestic market and the foreign market. Avocados sold in the local market are Weso, Ikulu, Fuerte, and local/natural avocados. The type of avocado sold in the foreign market is Hass and Fuerte. In addition, Hass avocados that do not meet the criteria are bought from the farmer at a low price and sold in the local market as well as avocados selected to factories for oil extraction. Most farmers sell avocados at the farm to traders (81.0%), whereas middlemen/brokers (81.2%) dominate the marketing supply chain at the farmer level (Table 7).

Table 7: Market location and avocado customers in the study areas

Parameter	District Councils				Overall	χ^2 statistics
	Busokelo	**Rungwe**	**Njombe TC**	**Njombe DC**		
Respondent	117	119	76	114	426	
Market location						
At the farm get to traders	94.9	78.2	84.2	67.5	81.0	
Village weekly market	0.0	5.9	9.2	10.5	6.1	33.443 (0.000) †*
Collection center	5.1	16.0	6.6	21.9	12.9	
Avocado customers¥						
Collectors/ middlemen	94.9	83.7	72.4	70.7	81.2	27.178 (0.000) *
Processors	3.4	4.9	11.8	8.6	6.7	6.556 (0.087)
Other farmers	0.9	0.0	1.3	1.7	0.9	2.088 (0.554)
Exporters/company	29.1	21.1	51.3	41.4	34.0	23.300 (0.000) *
Local market	2.6	0.8	5.3	4.3	3.0	4.108 (0.250)
AMCOS	0.9	1.6	0.0	3.4	1.6	4.113 (0.249)
Source of market information¥						
Friends	17.2	12.3	19.7	9.5	14.2	5.279 (0.152)
Mobile	10.3	2.5	23.7	6.9	9.5	25.745 (0.000) *
Traders	39.7	55.7	48.7	33.6	44.2	13.441 (0.004) *
Extension staff	45.7	27.9	18.4	15.5	27.7	30.628 (0.000) *
Radio	0.0	2.5	1.3	0.0	0.9	5.395 (0.145)
Family members	1.7	1.6	2.6	0.9	1.6	0.910 (0.823)
Other farmers	39.7	23.0	40.8	16.4	28.8	22.739 (0.000) *
Social media	1.7	0.8	6.6	1.7	2.3	7.640 (0.054)
VICOBA/AMCOS	7.8	16.4	38.2	49.1	26.7	62.759 (0.000) *

¥ More than one answer possible; †Values in the brackets are p-values; *significant at 5% level

All the councils visited have a system of setting indicative prices at the beginning of the harvest season. Rungwe and Busokelo DC's indicative price was 1700-1500 shillings per kg, while Njombe TC was 2000 shillings and

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Njombe DC was 1500 shillings per kg, respectively.

Along with the Council setting the price, it has been found that the actual price of Avocado is set by the brokers as they are the ones who have dominated the market and the price varies from one area to another. The actual price per kg of avocado in Rungwe DC ranged from 300-1700 shillings, Busokelo DC started from 200-1700 shillings and Njombe TC together with Njombe DC was 250-1500 shillings.

The overall, low price (76% of the respondents) and poor quality (40%) of the avocado fruits, as well as few buyers (38.8%), inadequate policy and institutional support to the avocado market (35.6), and lack of market information and access to market outlets (28.9), are the major challenges of avocado marketing in the study area (Table 8). The discussion from key informant interviews compliments the findings, where the following were noted; the avocado market is dominated by brokers, farmers' competition in getting to the market due to the lack of buyers leads to picking unripe fruits, fruits past maturity by waiting for the price to rise, brokers picking unripe fruits and leave them as reject causing unnecessary loss to farmers lack of official fruit collection centers causes the fruits to be exposed to the sun or rained on, thus losing quality.

Table 8: Challenges in avocado marketing

Parameter	District Councils				Overall	χ^2 statistics
	Busokelo	Rungwe	Njombe TC	Njombe DC		
Respondent	133	127	118	127	505	
low price	81.2	80.3	66.1	75.6	76.0	9.631 (0.022) †*
Seasonality of the crop	7.5	10.2	5.9	10.2	8.5	2. 146 (0.543)
Few buyers	34.6	38.6	27.1	54.3	38.8	20.676 (0.000) *
Lumbesa (lack of standard measurement)	18.0	20.5	11.0	4.7	13.7	16.459 (0.001) *
Lack of market information and access to market outlets	27.8	22.0	35.6	30.7	28.9	5.752 (0.124)
Absence of farmer's organization	8.3	12.6	14.4	10.2	11.3	2.714 (0.438)
Inadequate policy and institutional support	30.8	55.1	21.2	34.6	35.6	33.149 (0.000) *
Poor quality of avocado fruits	39.8	43.3	29.7	46.5	40.0	8.042 (0.042) *
Payment delay	9.8	9.4	6.8	9.4	8.9	0.873 (0.832)
weighing malpractices	5.3	13.4	5.1	7.9	7.9	7.790 (0.050) *
Poor road infrastructure	1.5	4.7	0.8	13.4	5.1	25.781 (0.000) *

¥ More than one answer possible; †Values in the brackets are p-values; *significant at 5% level

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Main factors affecting the avocado market

In monitoring the quality challenges of the avocado fruit from the farm to the consumer, the survey assessed the factors affecting avocado quality along the major avocado production and postharvest handling operations along with their percentage contribution and suggestions by farmers, as summarized in Table 9. Factors affecting quality at production operation were rated as the out most important (25%) followed by harvesting (16%), storage (16%), and transportation (15%), whereas those at sorting (12%), grading (7%) and packaging (9%) operations were least rated.

Table 9: Factors affecting avocado quality along the major avocado production and postharvest handling operations

Operation/Activity	Factors affecting quality	Score % (average)	Suggestions for improvement
Production	Pests and diseases infestations Improper application of fertilizer and pesticides High input prices Less availability of manure and fertilizers Lack of knowledge/skills on avocado management practices Limited water availability during the dry season Lack of irrigation facilities Poor quality of avocado seedlings/planting materials Extreme weather events (e.g., floods, drought, hail, and high temperature/warm conditions)	25	More avocado research Training on avocado crop management skills and knowledge, including pesticides and fertilizer applications Input subsidy to include pesticides Installation of irrigation facilities/infrastructures Extension officers to visit farmers frequently Use of seedlings. from an accredited source (i.e., registered by TOSCI) Easy access to loan/credit by farmers
Harvesting	Immature harvest of avocado fruits Improper harvesting techniques/skills which lead to bruising, scars, pod breakage, and damage to fruits Using cups/fruit size as a sign of maturity Lack of proper harvesting tools/facilities Tall avocado trees	16	○ Knowledge on the optimum maturity of avocado fruit ○ Training on harvesting skills and proper handling ○ Use of proper harvesting techniques and methods ○ Perform maturity test before harvest ○ Availability of harvesting tools e.g., cutting scissors ○ Pruning of avocado trees
Sorting	Improper/extensive sorting Small but mature fruits are	12	Training on proper sorting All the fruits should be taken as long

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	considered rejects Long figure nails by worker Sorting to be done until night hours		as are fully mature Have short figure nails during sorting Sorting should not be done at night hour
Grading	Improper handling during grading Hand holding/pressing while checking the size	7	Training to create awareness on grading techniques Avoid hand holding/pressing while checking the size
Packaging	Improper handling during packaging in trays Lack of crates/trays Use of poor quality or defective crates/trays causing scratches on fruits Mixing the bad (scarred/bruised) with the good fruits. Use of bags tends to peel the fruit Putting too many fruits/pressing the fruits on the trays/crates	9	Exfoliation due to improper packaging Available crates/trays Use good quality crates/trays or they should be inspected before delivery Avoid mixing good fruits with bad ones Use of crates/trays instead of bags Arrange the fruits properly on the trays/crates depending on the size
Storage	Lack of proper storage facilities i.e., cold chain storage Improper storage practices	16	Availability of good storage facilities Training on proper avocado storage
Transportation	Poor road infrastructure causes fruit bruising/damage Poor transport facilities Improper stacking of avocado crates/trays Pressing the fruit on the tray/crate	15	Good road infrastructure Use of special transport facilities/vehicles Proper stacking of avocado trays/crates Avoid pressing the fruits on the trays/crates

A similar trend was observed from general factors affecting avocado quality (Table 10), where factors related to production and harvest operations such as pests and disease control, extreme weather events (e.g., shortage of rainfall, hail, drought), and lack of knowledge /skills on avocado post harvesting, highly rated by farmers at 81.0%, 51% and 46%, respectively.

Road obstructions: Cars carrying avocados are stopped for a long time at "checkpoints" causing the fruits to deteriorate in quality. Also, vehicles carrying fruit are considered as abnormal width vehicles (abnormal wide load) with strict conditions, including not traveling beyond 6 pm, thus leading to the fruits being damaged due to being in transit for a long time.

Poor road infrastructure causes avocados to collide due to strong shaking and creates bruises on the fruit, thus leading to the fruit not having the desired

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quality. Also, frequent car breaks due to poor road infrastructure cause fruits to stay for a long time without reaching the park-house, thus losing quality.

Market competition: Lack of buyers and farmers who target the early market window to seize the high price, tend to harvest immature avocado fruits, causing the deterioration of the quality of the fruits. Brokers' operating system of collecting more, getting high commission Brokers are paid according to the load they collect, influencing farmers to pick even unmatured fruits to fulfill their goals. This leads to the loss of the quality of picked fruits due to immature fruits. Also, the use of the cup to measure the size of the fruit as an indication of maturity (i.e., maturity test) is not an appropriate method as avocado fruits can be large in shape but not yet fully matured, depending on the varieties, and vice versa is true i.e., small fruit in size and fully mature, which are considered as a reject in most cases it is recommended to use a dry meter test for maturity and dry matter test.

Table 10: General factors affecting avocado quality

Parameter	District Councils				Overall	χ^2 statistics
	Busokelo	Rungwe	Njombe TC	Njombe DC		
Respondent	133	127	118	127	505	
Extreme weather events (e.g., shortage of rainfall, drought)	42.1	50.4	48.3	63.8	51.1	12.871 (0.005) †*
Lack of knowledge/skills on avocado post-harvesting	70.7	25.2	56.8	32.3	46.3	69.774 (0.000) *
Poor access to plating materials (improved seedling)	16.5	7.9	21.2	3.1	12.1	23.359 (0.000) *
Pests and diseases (specify?)	75.2	85.8	76.3	86.6	81.0	9.154 (0.027) *
Inadequate transportation facility	15.8	41.7	16.9	40.2	28.7	37.747 (0.000) *
Improper storage condition	9.8	22.0	11.0	9.4	13.1	12.184 (0.007) *
Lack of irrigation facilities	14.3	4.7	5.9	7.9	8.3	9.276 (0.026) *
none	3.8	0.8	7.6	7.9	5.0	9.182 (0.027) *
Lack of capital	4.5	0.0	0.0	3.1	2.0	10.234 (0.017) *
Poor road infrastructures	0.0	8.7	0.0	4.7	3.4	20.410 (0.000) *

†Values in the brackets are p-values; *significant at 5% level

Lack of collection centers: the lack of official centers to collect fruits causes the fruits to be hit by sun and rain, thus losing quality due to not having a safe and proper place to collect fruits.

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Conclusion and Recommendation

The current research findings and analysis on the impact of transportation on the avocado market in Tanzania are considered, it becomes clear that the avocado industry needs rigorous efforts to develop tailor-made solutions to address the existing transportation challenges and other related quality aspects issues mentioned in the report which affects market and production of avocado fruits to comply with national and international market standards. The study confirms that the avocado industry needs interventions to address local context, production, and poor road infrastructures which affect transportation, lack of irrigation, improper storage facilities, and avocado handling practices. Therefore, it is essential to upgrade transportation and the storage conditions during transportation to comply with the fruit requirements: a concept that was practiced by different players for years in the industry and proved to be effective (Davies et al, (1935); Eksteen, & Bester, (1987).

For long-distance transportation from Njombe and Mbeya to Dar es Salaam, Tanga, and Mombasa, indicator factors are determined, similar to those in the previously outlined process. Notably, avocados undergo refrigeration using reefer containers, drawing power from the truck's auxiliary supply at an assumed 90% efficiency Blaauw et al., (2024) ; (Fitzgerald et al. 2011). The 1,128 km journey from Mbeya to the Mombasa port takes over 25 hours considered for on-road checkpoint delays.

The interventions to address local context, production and handling practices, and market dynamic should include but not be limited to capacity building on knowledge and skills of avocado production at all stages from farmers, extension officers, certification officers, customs and ports officers, police officers, drivers, buyers and the people involved in avocado sorting and grading, traffic, transport handling practices, sustainable mechanization of the avocado production system along with road infrastructures, and policy and institutional support to avocado production and temperature management is essential to ensure high-quality avocados on the overseas market.

The extension system has a great influence on avocado development in Njombe and Mbeya. The engagement of the extension officers in the avocado value chain sector and horticulture in general, in particular, should be prepared to meet the avocado and fresh fruits market and transportation challenges. Therefore, there is a need for more skilled extension officers with avocado technical knowledge and professional competency throughout the entire avocado value chain to meet the ever-changing market and economic dynamic requirements. Avocado fruits are perishable by nature.

That means the quality deteriorates fast due to a lack of appropriate transport handling. Inadequate post-harvest handling of avocado produce as mentioned in Table (10) has caused a severe problem in marketing avocado fruits in the Njombe and Mbeya region. However, the study appreciates and

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recognizes the effort made by the Tanzania government to implement different programs and strategies to create a conducive environment for investment and business to realize the goals. Some of the programs include the Business Environment Strengthening Tanzania (BEST) Program, the Roadmap for Improvement of Business Environment and Investment Climate in Tanzania, the Blue Print for Regulatory Reforms to Improve the Business Environment, and the Agricultural Sector Development Program ASDP (II) (Ministry of Agriculture,2021).

Apart from the reforms undertaken by the government, there are still some issues that need to be addressed to improve the business environment in the industry, including:- Transporters loaded avocado products with permits should not be restricted on the road, including frequent stops by road safety officers as well as tax restrictions to avoid impact on the quality of avocados. Also, the government should develop guidelines for vehicles transporting avocados from farms to pack-houses and the government should improve the infrastructure of Dar es Salaam port to be able to receive horticulture shipments (i.e., perishable consignments) as an alternative to the currently used Mombasa port. Moreover, the government should establish a uniform policy and law for all Councils to levy collections to avoid corruption in the market. Furthermore, The Council should prepare a training plan related to the entire value chain of the avocado crop in terms of the best use of seedlings (recognition of seedling types) and methods of good avocado cultivation.

For areas that do not have cooperatives, mobilization should be done so that there is a cooperative of farmers to increase their ability to negotiate with buyers and to have the power to present the issues of the avocado industry. Farmers should relate to financial institutions to access finance so that they can get individual loans. To control the market quality and avoid physical injury during the transportation of avocados, the government and private sectors should be encouraged to establish pack-houses closer to the production areas. It is recommended to have one to two packhouses in each avocado cluster to enhance proper handling of freshly harvested avocado fruits at the farm level, including marketing i., e., traders and buyers of avocado fruits at pack-house to enhance the quality management and to reduce the postharvest losses at all levels in the value chain.

Recommendations for Policymakers, private sectors, and Practice

Tanzania is among the avocado producers in Africa after South Africa and Kenya, and the 19th country in the world for avocado production. The Njombe and Mbeya regions are growing as a giant among the six production regions which includes Arusha, Mbeya, Kilimanjaro, Njombe, Kagera and Iringa. Avocado ranks as the first most significant horticulture crop in terms of export and revenue generation. Remarkably, horticulture is a fast-growing

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sector in Tanzanian agriculture. It is growing at a rate of 11% per annum compared to a 4% growth in the overall agriculture sector Rashmi, & Bertha, (2020).

With the availability of both tropical and climate temperate along with different altitudes and temperatures, Tanzania grows a very wide variety of fruits and vegetables. Apart from the opportunity available in the avocado market in Njombe and Mbeya, the avocado market is facing major challenges that hinder its development and growth. The Root rot disease is caused by the soil-borne fungus Phytophthora cinnamomi. Without root rot management the tree will lack an adequate root system and affects the tree growth performance. The lack of market information farms harvest immature fruits. Poor post-harvest handling, fruits are not handled properly, no collection centre and they pack avocados in bags, also the trucks they use for loading and transporting avocados are not made for perishable fruits. There is a weak organization at the farmer organization level thus affecting the organization's growth.

Moreover, there is no structured and organised management to manage the market before and during the harvest season. Structured management is required to manage quality management and production techniques, low production quality and safety assurance, inadequate financial services, unreliable transport and electricity supply, and high postharvest losses. The postharvest losses are estimated between 40-50% in the horticulture sector by Rashmi & Bertha, (2020). Tanzania Horticultural Association (TAHA), a member-based trade association established in 2004, has been working to tackle several of these challenges in the horticulture supply chain. TAHA is accredited for boosting the increase in horticulture exports for the last decade. After working with TAHA, farmers have reported a reasonable reduction in food losses from 50-60% to 5-10%. The main reasons for the decrease have been the low usage of low-cost techniques such as screen houses, which protect the produce from pests, and charcoal coolers, which keep the produce cool after harvest.

The research findings aligned with the objectives outlined in The Tanzania Development Vision 2025, which aims to eradicate poverty and elevate Tanzania from the category of the least developed countries (Tandari, 2004). Hence, the Tanzanian government must provide subsidies for refrigerated containers, trucks and packhouse materials. In addition, private entities such as the Tanzania Development Bank, cooperatives, Tanzania Agricultural Research Institute (TARI), Tanzania Horticulture Association (TAHA), the Southern Agricultural Growth Corridor of Tanzania (SAGCOT), and other stakeholders must increase their investment in the market promotion and private sector investment promotion system practice to improve the extension services systems. This initiative aims to stimulate the development of sustainable food systems throughout Tanzania by exerting influence and

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leveraging partnerships to establish a strong and supportive agricultural environment Tumaini et al., (2024).

It is advised to borrow a leaf from Kenya by introducing the avocado regulations and guidelines, where the emphasis will focus on controlling and strengthening The Tanzania Plant Health and Pesticides Authority (TPHPA) to have a technical laboratory testing capacity to test all fruits and avocado trees and issue certificates before harvest and transporting the avocado to the market. The regulation should also introduce the ship chandler who will be registered and authorized by the authority to supply avocado produce to ship or by aircraft. The regulation should also introduce traceability for trucking avocado produce and processing from the farm or packhouse to the final destination. A truck or vessel for transporting avocado produce shall be built, inspected, and equipped to ensure maintenance of optimal temperature and hygiene and to prevent damage, pollution, and spoilage of produce (Kenya Crop Regulation,2020).

Transport regulations shall apply to all avocado produce and avocado by-products specified as processed or transported to eat as fresh, and the control should focus on avocados imported or exported from Tanzania. The objective of Tanzania avocado regulations will focus on the promotion and development and regulate the growth of the avocado value chain to ensure all the institutions such Cereals and Other Produce Regulatory Authority (COPRA), The Tanzania Plant Health and Pesticides Authority (TPHPA), Tanzania Food and Drugs Authority (TFDA), Tanzania Bureau of Standards (TBS), Tanzania Horticulture Association (TAHA), The Tanzania National Roads Agency (TANROAD), Local government authority and Tanzania Rural and Urban Roads Agency (TARURA) ensure that the growers, dealers and all value chain actors meet the avocado produce quality and food safety to provide for the improved market access. These recommendations align with Cooley, (1894) and Nino, (2024). They ascertained that, in the market, the relationship between the transport of produce from farmers to market at a certain time affects the supply and purchase of avocado produce. The effects include services, quality, stocks, and money. Moreover, transportation is the major component of farmers' produce and service distribution from farm to market. Integrating market locations and avocado production regions is crucial for achieving quality, price, and optimal trade efficiency. Finally, the regulation will achieve goals and create an environment where farmers, transporters, private sector entities, and government organizations can flourish, and smallholder farmers have the resources and empowerment to produce to feed the country, Africa, and the entire world to complement the president of Tanzania's effort.

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Recommendation for Further Research

Further research is required to explore the extent to which we can accurately measure the effects and results of the transportation in the avocado market, specifically in other regions of Tanzania Kagera and neighboring countries such as Uganda and Rwanda.

Conflict of Interest: The authors reported no conflict of interest.

Data Availability: The data results are included in the content of the paper.

Funding Statement: The authors did not obtain any funding for this research.

Declaration for Human Participants: This study has been approved by the Tanzania Ministry of Agriculture and Mbeya and Njombe regional agriculture advisory from the regional administrative secretary's office to collect data with the ethical identification number, Ref BA.12/101/12 & Ref CA.9/275/01 and the principles of the Open University of Tanzania declaration were followed.

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