Journal of International Trade, Logistics and Law, Vol. 10, Num. 2, 2024, 251-265

DETERMINANTS OF MARKET ACCESS AMONG VANILLA FARMERS IN KAGERA, TANZANIA

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Received: October 28, 2024 Accepted: November 25, 2024 Published: December 01, 2024

Abstract:
The study aimed at examining determinants of market access among vanilla farmers in Kagera region of Tanzania. The study achieved specific objectives as follows; (i) to examine determinants for market access of vanilla produce in Kagera region and (ii) to determine the effect of market access determinants on market access of vanilla produce in Kagera region. The use of a mixed-methods approach was considered appropriate with integration of both qualitative and quantitative data whereas a sample of 385 vanilla farmers and key agricultural informants were included. Stratified sampling followed by simple random sampling and purposive sampling were adopted in selecting the sample selection. Data collection made use of structured questionnaires and semi-structured interviews. Analysis of qualitative data was achieved using content analysis whereas application of logit model in determining the effect of market access determinants on market access of vanilla produce was considered relevant. The findings revealed that cooperative engagements, transportation infrastructure, access to credit and geographic factor positively and significantly influence market access ($p<0.05$). The study urges to the government, policymakers and partners in development to focus on infrastructure development, cooperative engagement and extending more credit facilities aiming at improving access to vanilla market and the economic well-being of vanilla farmers, thereby contributing to the sustainable development of the agricultural sector in Kagera.

Keywords:
Market access, Vanilla produce, Vanilla farmers, Tanzania

1. Introduction
Vanilla, derived from the orchid species Vanilla plan folia, is one of the most sought-after and economically valuable spices globally (Teoh & Teoh, 2019). Known for its distinct flavour and fragrance, vanilla is a key component in several industrial processes such as pharmaceuticals, cosmetics and food and beverage. The demand for vanilla globally has surged in recent years, driven by changing consumer preferences, increased industrial applications, and the growing popularity of natural flavours (Yao, 2023). Market access serves as a pivotal component in the development and livelihoods of vanilla farmers. It enhances the possibility of connecting farmers with buyers to sell their produce at fair prices, ensuring the economic viability of their agricultural endeavors (Yao, 2023). In the context of vanilla farming, market access extends beyond the local level, involving national and international trade channels. Securing effective market access enables farmers to reap the benefits of their labor, leading to increased incomes, improved living standards, and overall community development (Ferris et al., 2014).
The global vanilla market has experienced remarkable growth in recent years. Vanilla is not only a staple ingredient in the food industry but has also found extensive use in the fragrance and pharmaceutical sectors (Barragán-Ocaña et al., 2024; Ahmad et al., 2020). Global vanilla production increased from 4 thousand tons in 2000 to 7.2 and 6.9 thousand tons in 2015 and 2021 respectively (FAOSTAT, 2023). This growth is fueled by the rising demand for organic and natural products, with vanilla being a preferred choice due to its authenticity and versatility. Main producing countries in the world being Madagascar which produced about 3 thousand tons in 2021, Indonesia which

produced about 1.5 thousand tons in 2021, and other countries being Mexico, Papua New Guinea, and China (FAOSTAT, 2023). In 2024, Madagascar continued to be the leading country in the world in vanilla production with an average production of 2,964.9 tons followed by Indonesia which continued to be second producer of vanilla with an average production of 2,398.1 tons while Mexico being the third producer of vanilla with an average production of 475.1 tons followed by China with an average production of 454.6 tons. The size of the vanilla market globally in 2024 in estimation is USD 2.16 billion and is forecasted be USD 2.46 billion in 2029 which is equivalent to 13.9% increase (Mordor Intelligence, 2024). Globally, the market size for importation of vanilla is large whereas the United States of America, Germany and France being the major vanilla importers (Mordor Intelligence, 2024). Such large market size for importation of the vanilla globally poses potential market for African countries including Tanzania to import vanilla.

Africa stands out as a significant player in the global vanilla market, contributing substantially to both production and export. Countries with large vanilla production in brackets are Madagascar (2,964.6 tons) and Uganda (185 tons) (Barragán-Ocaña et al., 2024; Mordor Intelligence, 2024; Yao, 2023). Other countries in Africa that produce vanilla though in small scale include Malawi (20 tons) and Kenya (11.5 tons) (Barragán-Ocaña et al., 2024; Yao, 2023). Vanilla production increased from 1.1 thousand tons in 2000 to 3.3 thousand tons in 2021. Madagascar, in particular, is renowned for its high-quality Bourbon vanilla, commanding a substantial share of the global vanilla market.

Tanzania, as a key player in the African agricultural landscape, has also emerged as a noteworthy contributor to the vanilla market. The country's diverse climate and fertile soils provide an ideal environment for vanilla cultivation. The production of vanilla in Tanzania increased by 748.1% in a period of five years starting from 2015 in which the production was 229.8 tons (229,800 Kg) to 1,949 tons (1,949,000 Kg) in 2020 (Muzanila & Assenga, 2022). Such rapid increase in vanilla production sets economic advantage to both farmers and the nation at large. This rapid growth in vanilla production in Tanzania is the result of increased global demand for vanilla. According to World Integrated Trade Solution (WITS) (2019-2023), in a period of five years (2019-2023), Tanzania exports for Vanila have increased from 925 Kg in 2019 to 15,878 Kg in 2023 (Figure 1), an increase of 1,616.5%, implying that such an increase in exports was 16.2 suggesting availability of large vanilla market for exports. In a similar situation, Tanzania exports value in terms of USD grew from USD 365.96 "1,000" in 2019 to USD 594.1 "1,000" in 2023 (Figure 1), making an increase of USD 228.14 "1,000", equivalent to 62.3% increase in exports value in terms of USD. Such an increase in exports value connotes availability of profitable vanilla business in a foreign market. In comparison between vanilla production in Tanzania in 2020 for instance which was 1,949,000 Kg and vanilla exports in the same year which was 3,447 Kg poses a significant mismatch which implies that a total of 1,914,553 Kg of vanilla were not known if they were locally consumed or wasted. As the result, this formed basis for the interest to undertake this study to address this discrepancy.

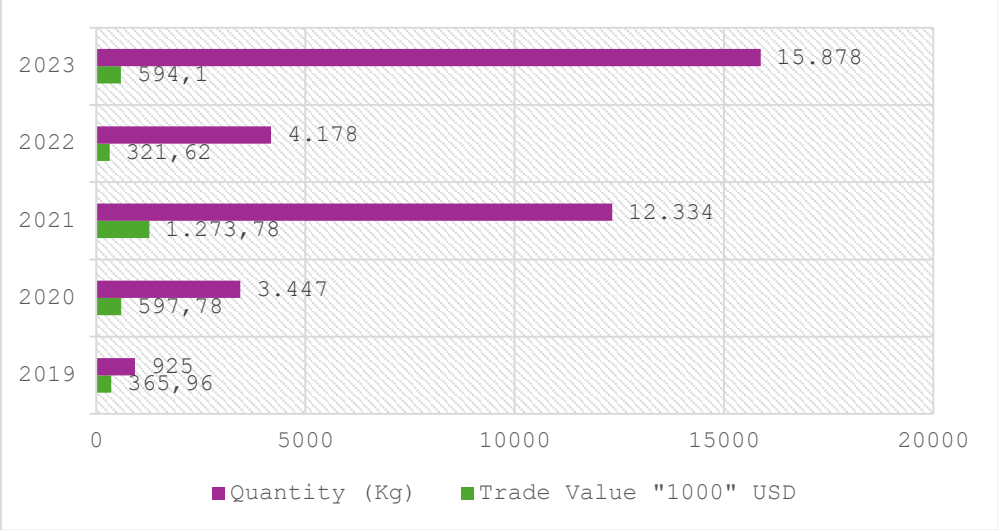

Figure 1. Tanzania vanilla exports (2019-2023)

Source: World Integrated Trade Solution (WITS) (2019-2023)

Following this profitable trend accruing from vanilla in current years, Tanzania has witnessed a notable shift in agricultural practices, with a significant number of farmers, particularly in the Kilimanjaro, Kagera, and Njombe regions, transitioning from traditional coffee cultivation to vanilla production (Mordor Intelligence, 2024; Muzanila & Assenga, 2022). This transitional shift from other traditional crops to vanilla has been accelerated with higher profits accruing from vanilla in comparison to other traditional crops including coffee, such higher profits have helped smallholder vanilla farmers to cover losses emanating from other traditional yields like coffee (Mordor Intelligence, 2024). Such an agricultural shift from other cash crops to vanilla production again poses interest for the study to undertaken to address market related issues for vanilla. While this shift underscores the adaptability of farmers to market demands and the potential profitability of vanilla cultivation, a critical challenge persists on the reliable access to markets (Yao, 2023).

In Kagera region, the average production of vanilla per acre has increased from 30.5 Kg to 37.4 kg in the period from 2001 to 2022, the production which is lower compared to the production of 157 Kg per hactre per annum in Madagascar (Yao, 2023). Though the benefits accruing from vanilla produce have been abundant to farmers' livelihood including venturing and expanding other business such as animal husbandry, fishponds, farm extension, buying motorcycles and cars, building of repairing of houses, payment of school fees and increasing incomes (Yao, 2023). Such benefits that have accrued from vanilla farming have resulted into shift of farming concentration from others crops to vanilla, connoting that vanilla has become a strategic crop that if well supported, its contribution to farmers' livelihood and poverty reduction generally will be realized.

Despite the surge in production, vanilla farmers grapple with the arduous task of finding stable and lucrative markets for their produce. This challenge is further accentuated by the acknowledgment from governmental bodies, attesting to the complexities faced by vanilla farmers in marketing their harvest in Tanzania (Makoye, 2021). The government's recognition of this issue underscores its severity and highlights the urgency for a comprehensive understanding of the factors hindering market access for Tanzanian vanilla farmers. Shagata (2023) documented on the growing potential and high prices for Vanilla in the global market, however farmers in Kagera have continually expressed their inability to fetch such markets despite growing government involvement. This study seeks to delve into the nuanced dimensions of the market access predicament faced by vanilla farmers in Kagera region of Tanzania. The significance of this study focuses on provision of actionable insights that can inform policy interventions, support infrastructure development and facilitate the creation of an enabling environment for sustainable and profitable vanilla farming in Tanzania through improved market access. Ultimately, the goal is to bridge the gap between increased vanilla production and the elusive access to markets, fostering a more resilient and prosperous agricultural sector in the targeted regions. Thus, the study achieved specific objectives as follows; (i) to examine determinants for market access of vanilla produce in Kagera region and (ii) to determine the effect of market access determinants on market access of vanilla produce in Kagera region.

2. Literature Review

2.1 Theoretical Literature Review

The Theory of Transaction Cost Economics (TCE) reinforced this research. The TCE is a theoretical framework developed by economists Ronald Coase in 1937 and later expanded by Oliver Williamson in 2010. TCE seeks to understand the structure and boundaries of economic transactions by focusing on the costs associated with these transactions (Tadelis & Williamson, 2012). The central idea is that economic agents engage in transactions to minimize their costs, and the choice of organizational forms depends on the efficiency of coordinating economic activities given these transaction costs. In TCE, transaction costs are largely classified into three major forms: Search and information costs where the costs incurred in obtaining and processing information about market conditions, prices, and potential trading partners; Negotiation and decision-making costs which associated to the costs associated with the negotiation, decision-making, and contracting process between parties involved in a transaction; and enforcement costs which are the costs incurred in enforcing agreements and ensuring that contractual obligations are fulfilled.

With respect to this study of vanilla farmers seeking market access, TCE helped to analyze the costs in the transactions between farmers and potential buyers or market intermediaries. Transaction costs may arise from the lack of information about market conditions, negotiation complexities, and challenges in enforcing contracts. By

applying TCE, the study can identify transaction cost elements that hinder market access and suggest strategies to minimize these costs, ultimately improving the efficiency of market interactions for vanilla farmers. In view of this, TCE helped to come up with variables under the study that are cost-centers when deriving costs associated with vanilla market accessibility in the study area. These variables include costs for cooperative engagement that are associated with formation and operation of cooperatives, others include costs associated with transportation infrastructure such as transportation costs for vanilla by hiring means of transport to ferry vanilla produce from point of production to market destination. In addition, costs associated with searching for credit facilities and follow up for disbarment of credits. Geographical factors associated with costs like transporting vanilla produce from remote locations to access market were also taken into consideration and costs to participate in training and costs associated with formation of social networks and networking. Finally, costs concerning technological adoption were also considered. In summary, a total of seven costs associated with market access were derived from the TCE, these costs include cooperative engagements, transportation infrastructure, credit facility, geographical factors, training participation, social networks and technological adoption.

2.2 Empirical Literature Review

The term market is generally known as a space or system where buyers and sellers come together to exchange goods, services, or resources. It is a dynamic interaction of supply and demand, influenced by various factors such as pricing, competition, and consumer preferences (Kaplow, 2015). In the context of vanilla farming, market refers to the system or mechanism through which vanilla products are bought and sold. It encompasses the entire process of exchanging goods, including all individuals, organizations, or entities responsible for production, distribution, and consumption of vanilla. The market can be local, national, or international, depending on the scale and reach of the vanilla industry in the study regions. For instance, the market for Tanzanian vanilla extends beyond the boundaries of individual farms to involve buyers, processors, distributors, retailers, and consumers. It is influenced by various factors, including supply and demand dynamics, pricing mechanisms, and regulatory frameworks that govern the vanilla trade (Yao, 2023).

Market access is concerned with the ability of individuals, businesses, or products to join and make participation in each market. It involves the conditions, mechanisms, and opportunities that facilitate or hinder the entry of participants into the market (Martín et al., 2022). Market access is not only about physical entry but also encompasses issues such as regulatory compliance, information availability, and the ability to compete on fair terms. With respect to this research, access to market relates to the capability of vanilla farmers to join, connect with, and effectively get participation in markets for their produce. It involves overcoming various barriers and challenges to reach buyers and consumers, ensuring that the products are traded at fair prices and in sustainable quantities. In the context of the study, factors influencing market access may include geographical, economic, social, and institutional elements that either facilitate or hinder the entry of vanilla products into the market. For example, limited transportation infrastructure, lack of market information, and price volatility can act as barriers to effective market access for vanilla farmers.

Several empirical studies have investigated the dynamics of market access in the context of crop farming. In their study, Bezu & Villanger (2019) delved into the determinants for Tanzanian smallholder farmers to participate in crop market, emphasizing factors such as transaction costs, asset endowment, and cooperative engagement. Using Crag's double-hurdle model and addressing potential endogeneity through a control function approach, the researchers realized that distance to destination of markets had a negative impact on cash crop sales. Access to information and communication, on the other hand, positively influenced both food and cash crop marketing. The study emphasized the importance of marketing cooperatives in augmenting participation to market for their members, while noting a potential negative effect on local food market activities within the village.

In a similar vein, Hassan (2015) investigated factors influencing access to market among farmers dealing with spice in Zanzibar. The study encompassed traders and spice farmers' economic characteristics, assessment of marketing channels, and an analysis of spice market potential. Primary data from questionnaires and binary logistic regression were employed, revealing that spice farmers' engagement in spice production was influenced by various economic characteristics. The study identified significant factors affecting market access, including distant markets, access to market information, market organization, and spice price. Another study by Mutayoba and Ngaruko (2015), focused on the participation in market of the tomato smallholder farmers in Morogoro region of Tanzania. Using Heckman selection and outcome equations, the researchers found insignificant differences statistically between nonmarket and

market participants. The study recommended enhanced extension services, particularly in market information dissemination, to improve tomato production and market access. It also suggested the establishment of rural information centers and mobile telephony systems for regular access to market dynamics. Magingxa et al. (2009), explored factors that influence for South African smallholder irrigators to access markets for produce. The study utilized principal component analysis and logit regression, revealing the significance of farmers' skills, physical market access and the nature of access to market. The findings emphasized the crucial role of these factors in determining market access for smallholder irrigators.

Akrong et al. (2021), focused on the factors driving Ghanaians' smallholder farmers in participating in mango markets with high-value potentials. Using a triple hurdle model, the research identified income of households, education, experience in farming, motorized transport owned by households, trust, certification, access to credit and distance to access the road and as influential factors in market participation. Distance to tarmacked roads, income, price, household size and experience in farming were the key determinants of involvement level in markets dealing with exports. In a study conducted by Belete and Nigatu (2023), variables affecting decisions of Teff smallholder farmers to participate in market and Teff sales volume in central Ethiopia were examined. Primary data collected from 355 farmers' households producing Teff were analyzed using descriptive statistics, Tobit and Probit censored models. The study highlighted the impact of outputs, extension contact and membership of farmers in their organizations on decisions of households and levels of market involvement, emphasizing the need to focus on addressing socioeconomic and issues concerned with resources to enhance involvement of smallholder farmers in markets from the studied areas.

The existing literature on market access among smallholder farmers, including in Tanzanian contexts, provides valuable insights into various factors influencing crop marketing. However, a notable research gap exists regarding the specific challenges faced by vanilla farmers in Tanzania, especially in the Kagera region. While previous studies address broader crop market dynamics, the unique characteristics of vanilla production and the distinctive socio-economic landscapes of Kagera demand more targeted investigation. Existing studies have generally focused on major staple crops like maize, rice, and coffee, often overlooking high-value cash crops such as vanilla. For instance, Mbunduki (2024) and Kangile al. (2021) examined challenges facing coffee producers in Tanzania but did not extend these findings to specialty crops like vanilla. Similarly, Ndiege and Kazungu (2020) explored the impact of transportation infrastructure on coffee farmers' market access without addressing the unique requirements of vanilla cultivation and marketing. Additionally, the role of marketing cooperatives in facilitating access to market for vanilla farmers has been inadequately addressed. While cooperatives are acknowledged to play a critical role in improving market access for various crops, the extent to which they influence vanilla market access in the Kagera region remains unclear. This gap in the literature is significant, given that cooperatives could potentially mitigate some of the logistical and financial barriers vanilla farmers face. Technological interventions and their impact on vanilla market access also remain underexplored. The study by Mwita (2024) focused on how training impacts growth of SACCOS in Tanzania but the focus neglected to consider how such training could be extended to boost access to market by vanilla farmers. Furthermore, regional nuances, such as the socio-economic and cultural factors unique to Kagera, are often glossed over in broader studies. For example, Nyangango et al. (2023) discussed the general challenges of access to agricultural marketing information for grapes smallholder farmers in Tanzania but did not incline towards challenges related to market access among vanilla framers in Kagera region.

3. Methodology

Descriptive research design in form of a cross-sectional study was adopted in this study since researchers experienced shortage of financial resource and time against other designs. This design was applied using surveys whereas collection of data was made once a time and data obtained were judged sufficient for statistical analysis (Kothari, 2009). The research was carried out in Kagera region of Tanzania. Kagera region was selected due to its significant presence of vanilla farming and the observed shift from traditional crops like coffee to vanilla in recent years as well as the favorable vanilla agro-climatic conditions, diversity in vanilla types, also its alignment with the national agricultural landscape compared to other regions in Tanzania. Yao (2023) presented that Kagera region is the pioneer and foremost producer of vanilla in Tanzania.

The study' population was covered by vanilla farmers in Kagera region and the cooperative societies that were known to contain several about vanilla produces. The population of vanilla farmers in Kagera region was not well

established leading to be termed as unknown population. Yao (2023) while undertaking the research in Kagera region established that the number of vanilla farmers was greater than 6,000. Given this assumption of unknown population, Cochran formula (1977) (Equation 1) was adopted in computation of a sample size since it the formula is suitable for determining sample sizes when the population of the study is unknown (Mashenene, 2016). Therefore, 385 vanilla farmers constituted the study's sample size for the research.

$$n = \frac{Z^2}{e^2} * pq \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

Whereby:
n = sample size
Z = critical value of anticipated level of confidence equal to 1.96 at 95% level of confidence.
p = proportion for the largest population equal to 50%.
q = 1-p = 50%.
e = degree of accuracy equal to 0.05.

Hence, $n = \frac{1.96^2}{0.05^2} * 0.5 * 0.5$ = 384.16 ≈ 385.

A multi-stage technique for sampling was employed to ensure a representative and manageable sample of vanilla farmers in the Kagera region was selected. Multi-stage sampling is advantageous in studies involving large and diverse populations, as it allows researchers to break down the population into smaller, more manageable sub-groups. Purposive sampling was used to purposefully select agricultural extension officers, local government officers, vanilla trading/marketing agents and leaders of farmers groups for qualitative interview. The multistage sampling techniques started purposefully by selecting Kagera region as the only region with bumper vanilla production and the oldest in vanilla farming since 1980s when vanilla was introduced from Uganda (Yao, 2023). The districts involved in vanilla farming in Kagera region are Bukoba urban, Bukoba rural, Karagwe, Muleba and Misenyi (Yao, 2023). From these districts, Bukoba rural with 1,400 registered vanilla farmers being the highest number of all districts in Kagera region was purposefully selected. Bukoba district has 29 wards that are involved in vanilla production but the top five wards in vanilla production with number of farmers in brackets are Kasharu (386), Igo (238), Kishogo (176), Nyakibimbili (142) and Kyamulaile (120). Out of the top five vanilla producing wards, Kasharu ward with 386 vanilla farmers and Igo with 238 vanilla farmers were purposefully selected based on the wards being the top two wards in vanilla production marked with the highest number of vanilla farmers constituting 44.6% of all farmers in Bukoba rural district. Thereafter, proportionate stratified sampling technique was adopted as shown in Table 1 whereas 237 vanilla farmers from Kasharu ward and 148 vanilla farmers from Igo ward were nominated, resulting into a total of 385 vanilla farmers which formed the study's sample size. The selection of final farmers to participate in the study was performed using simple random sampling from Kasharu and Igo wards.

Table 1: Estimation of sample size

Wards	Farmers	Proportionated farmers	Selected farmers
KASHARU	386	386/624 ×385	238
IGO	238	238/624 ×385	147
Total	**624**		**385**

The survey using a questionnaire and interview was adopted in gathering primary data for the research. Questionnaires were used in collecting quantitative data while interviews were used in collecting qualitative data. The consideration to use several data collection approaches and methods aimed at complementing one another and to obtain adequate and detailed data for the research. The questionnaire designed adopted Yao (2023) and some modifications were made to suit the current study. The questions that captured data were formulated in a Likert scale with 5 points denoting 1 for strongly disagree and 5 for strongly agree. The administration of the questionnaires took a form of face to face from 6th May to 20th June 2024, on average it took 30 minutes to fill in the questionnaire. For accurate and proper capturing of data, the questionnaire was translated into Kiswahili and researchers were also involved in face-to-face questionnaire administration. The questionnaire was pre-tested to a small sample in Bukoba urban district in order to get opportunity for revising it to a better version that covers important aspects in the study. The questionnaire response rate was 100% as all 385 administered questionnaires were received back and were useful. For qualitative data, interview guide with guiding questions was formulated in reference to that used by Yao (2023), some modifications were made to make interview guide suit the study requirements.

The interview sessions were conducted with the same data collection period from 6th May to 20th June 2024. Interview sessions went on for an average time of 45 minutes and the responses were recorded in notebooks and in mobile phones as electronic devices after consent was provided by interviewees. The interview sessions were carried out in Kiswahili language, the Tanzania national language which is well spoken by natives from rural Bukoba district.

The analysis of qualitative data that were gathered through interview was carried out using content analysis as its steps were adopted from Nicmanis (2024). These steps covered seven steps serially presented as (i) interpretation of research question, perspective and necessity, (ii) data collection and familiarization, (iii) coding, (iv) revision of codes, (v) development of analytical structure, (vi) reporting the analytical structure, (vii) interpretation of findings. Since the first and second steps were covered under development of tools for collecting data and stages for collecting data, then, in the current research content analysis commenced from the third step and went on serially throughout the remaining steps of the seven steps. Coding step as the first step in qualitative data analysis considering that steps number i & ii were excluded as described earlier, it involved assigning labels to data collected whereas dataset was carefully read between lines, identifying relevant text to the research question and introducing this into a code that was further described by corresponding information (Nicmanis, 2024). Coding as an active process continued to be improved as the process proceeded whereas more codes were generated since coding was subjectively defined process. Revision of codes was the next step to coding which involved splitting up of codes into many smaller codes or combining codes with fewer closely related meanings. It was in this stage where condensation of codes into fewer clearly demarcated codes took place (Nicmanis, 2024). After codes were successfully developed and revised as explained in the prior step, the next step was development of analytical structure that involved configuring codes into categories and subcategories. This step necessitated researchers to fully understand the dataset for easy structuring them (Nicmanis, 2024). Reporting the analytical structure step came next to development of analytical structure whereas this step formed the major part of qualitative findings. It was important to note that, in this step all parts of the analytical structure were reported in the form of graphs, tables or figures that covered presentation of codes, subcategories and categories (Nicmanis, 2024). Finally, the last step involved interpreting findings, the cope of interpreting findings was wide based on perspective of methodology and epistemology whereas the quality of interpretation of findings was enhanced by engaging literature that highlighted fundamental supporting or contradicting focal areas in relation to findings and theoretical context (Nicmanis, 2024).

An analytical tool, the Statistical Package for Social Sciences (SPSS) was made in use of analyzing quantitative data. Descriptive statistics were executed, whereas percentage, frequencies, mean scores and standard deviations were computed. In the course of quantitative data analysis, a logit model was adopted whereas independent variables which were captured in various units were entered in the logit model in form of index scores that emanated from the analysis of data collected using the 5 points Likert scale questions. Further, the dependent variable in a logit model was estimated as a dummy variable where vanilla farmers accessed market (accessed market= 1) and zero if otherwise (not accessed=0).

The logit model was specified as:

$$\log(odds) = logit\ (P) = ln\left(\frac{P}{1-P}\right) \quad \text{.....(2)}$$

Where $P = \frac{exp(\beta_0+\beta_1X_1+\beta_2X_2+\beta_3X_3+\cdots)}{1+exp(\beta_0+\beta_1X_1+\beta_2X_2+\beta_3X_3+\cdots)}$

Thus $Y = \beta_1X_1 + \beta_2X_2 + \beta_3X_3+\cdots$

Where: ln = natural logarithm, logexp, where exp or e=2.71828, p = the probability that Y for cases = 1, p (Y=1), 1-p = the probability that Y for cases = 0, 1 – p(Y=1), p/(1-p) = the odds, ln[p/1-p] = the log odds or logit.
Reliability for this study was achieved by performing Cronbach's alpha (α) test which was computed for every variable in the predictor. Mashenene (2016) presented that the coefficients for the Cronbach's α ranging between 0 and 1 with larger coefficients approaching to 1 depict having high internal reliability. The coefficient α is interpreted as high reliability if the coefficient is usually ≥ 0.90, depicting excellent reliability, those ranging from 0.80 to 0.89 are defined as good. Further, those ranging from 0.70 to 0.79 are defined as tolerable whereas those ranging from 0.60 to 0.70 are doubtful, from 0.50 to 0.60 are declared poor and those having values below 0.50 are termed as undesirable. In the current study, the coefficients of α had values 0.70 being defined as suitable, depicting high validity and reliability for the instrument used in measurement.

4. Results and Discussion

4.1 Sample Characteristics

4.1.1 Sex

Table 2 presents that 199 (51.7%) of respondents were males while186 (48.3%) were females, suggesting that vanilla farming is accessible to both men and women, reflecting a potential inclusivity in this agricultural sector. The near-equal gender participation in vanilla farming in Kagera could be leveraged to promote gender equity in agricultural development programs. However, targeted interventions may be necessary to ensure that female farmers have equal access to resources, training, and market opportunities to fully benefit from vanilla farming. These findings align with Hassan (2015) who noted the involvement of both genders in spice farming in Zanzibar, emphasizing that gender does not significantly limit participation in agricultural activities. However, Gneiting and Sonenshine (2018) highlighted that women often encounter numerous challenges in accessing markets due to cultural norms and resource constraints, which could imply that despite the balanced participation, females may still encounter more barriers to market access than their counterparts' males.

Table 2: Sample characteristics (n = 385)

Variable	Frequency	Percent
Sex		
Female	186	48.3
Male	199	51.7
Total	**385**	**100.0**
Age		

18–27	34	8.8
28–37	187	48.6
38–47	99	25.7
48+ and above	65	16.9
Total	**385**	**100.0**
Education level		
No formal Education	23	6.0
Primary	156	40.5
Secondary	185	48.1
Certificate	8	2.1
Diploma	12	3.1
Bachelor degree	1	0.3
Total	**385**	**100.0**

4.1.2 Age

Table 2 shows that the majority of respondents are aged 28-37 years (48.6%), 38-47 years (25.7%), 48+ years (16.9%), and 18-27 years (8.8%). The predominance of younger to middle-aged farmers suggests a dynamic and adaptable workforce. This age distribution aligns with studies by Bezu and Villanger (2019), who found that younger Tanzanian farmers are more inclined to engage in cash crop farming due to their openness to new agricultural practices and technologies. Similarly, Akrong et al. (2021) observed that younger farmers in Ghana are more likely to enter high-value markets, motivated by their enthusiasm for innovation and willingness to take risks.

4.1.3 Education

Table 2 shows the majority of respondents have primary (40.5%) and secondary education (48.1%), while a smaller portion has tertiary education, with certificates (2.1%), diplomas (3.1%), and a bachelor's degree (0.3%). Additionally, 6.0% of respondents have no formal education. The high percentage of farmers with primary and secondary education is consistent with the findings of Mutayoba and Ngaruko (2015), who observed similar educational distributions among Tanzanian farmers in high-value crop markets. Education is crucial for market participation, as it provides farmers with the skills to understand market dynamics and adopt new technologies. Blumberg, Cooper and Schindler (2014) highlighted that educated farmers had better chance to access and interpret market information, improving their bargaining power and market outcomes.

4.2 Determinants for Market Access for Vanilla Produce

4.2.1 Cooperative Engagement

Results in Table 3 show that the cooperative engagements were also deemed important (mean = 3.79), inferring that cooperatives always play a crucial role in enhancing market access by providing collective marketing opportunities and negotiation power. These findings are supported by Ferris et al. (2014) which showed that farmer cooperatives can enhance market access by improving collective bargaining and marketing. Strengthening farmer cooperatives and encouraging cooperative engagements could improve market access by consolidating resources and enhancing bargaining power. By collectively marketing their produce and accessing shared resources and market information, farmers within cooperatives could overcome individual constraints and access larger and more lucrative markets (Magingxa et al., 2009).

Table 3: Determinants of market access for vanilla produce (n = 385)

Determinants	Mean	Standard Deviation
Cooperative engagements	3.79	0.80
Transportation infrastructure	3.88	0.87
Credit facility	3.77	0.91
Geographic factors	3.91	0.87
Training participation	3.62	0.76
Social networks	3.46	0.85
Technological adoption	3.44	0.89
Overall mean	**3.70**	

4.2.2 Transportation Infrastructure

Results in Table 3 indicate that transportation infrastructure also received a high mean score of 3.88, reflecting its crucial role in market access. Improved transportation infrastructure, such as roads and transport services, reduces travel time and costs, directly affecting farmers' ability to reach markets. This is consistent with findings by Belete & Nigatu (2023) which informed that better roads and transport services could significantly enhance farmers' market access and economic outcomes; improved transportation infrastructure reduces transaction costs and facilitates the movement of goods from production areas to markets, thereby enhancing farmers' access to distant markets.

4.2.3 Credit Facility

Results in Table 3 indicates that the credit facility availability with (mean = 3.77) is considered an important factor in market access for vanilla farmers in Kagera. Access to credit enables farmers to invest in essential inputs, such as fertilizers, equipment, which can enhance yield and potentially increase market access. However, the moderate mean score suggests that while credit is valuable, its impact on market access may not be as immediate or pronounced. To optimize the benefits of credit, it is essential to ensure that credit facilities are accessible and tailored to the specific needs of farmers. Providing financial education and designing credit products that align with farmers' cash flow and investment cycles can help improve their ability to leverage credit effectively for better market access. Thereby enhancing their productivity and market participation (Tadelis & Williamson, 2012).

4.2.4 Geographical Factors

Results in Table 3 indicate that the geographic factors were deemed crucial for market access (mean = 3.91), indicating that respondents perceive these factors as critically important. Geographic factors often include aspects like proximity to markets and rural isolation, which can substantially impact farmers' ability to sell their products. These findings align with those of Hassan (2015) which highlighted that geographic isolation can significantly hinder farmers' ability to access markets due to increased transportation costs and reduced market integration. Enhancing geographic accessibility, such as by improving rural roads and reducing isolation, should be a priority for policymakers and development agencies to facilitate better market access and integration for farmers.

4.2.5 Training Participation

Results in Table 3 show that the training participation with the (mean = 3.62) was considered somewhat less influential since the mean score was below the overall mean score of 3.70. Though the mean of 3.62 was below the overall mean score of 3.70 but still it was at the high side of the agreement level, suggesting that it was a determinant to be considered for further analysis. This is consistent with Martín et al. (2022) who suggested that while training and credit facilities are vital for productivity, their effects on market access are often more complex and context dependent. While training and credit facilities are important, a greater emphasis on improving infrastructure and market information might yield more immediate benefits for market access. Ensuring that these support services complement infrastructural improvements can create a more comprehensive approach. Training programs equipped farmers with knowledge and skills related to market dynamics, value addition, and quality standards, thereby empowering them to navigate market challenges and seize opportunities (Martín et al., 2022).

4.2.6 Social Networks

Results in Table 3 show that social networks were rated low with a mean of 3.46 which was below the overall mean score of 3.70 as average weighted scores. Despite this determinant having lower mean score, the factor still has a role in market access. Social networks can facilitate information exchange and market opportunities. These findings are comparable with the research by (Magingxa et al., 2009) which suggested that social networks significantly influence market access by improving information flow and operational efficiency. Investing in building and maintaining social networks can provide additional benefits and opportunities for market access. Social networks provided farmers with access to market information, credit, and support networks, facilitating market transactions and reducing market uncertainties (Bezu & Villanger, 2019).

4.2.7 Technological Adoption

Results in Table 3 reveal that technological adoption was perceived as having the lowest influence on vanilla farmers' market access in Kagera, with a mean score of 3.44, though in a broad spectrum still such a determinant is useful in supporting vanilla farmers to access market. This suggests investment in technology is required to enable vanilla farmers to access the market. Consequently, while promoting technological adoption could enhance market access, it should be complemented by addressing other critical factors such as infrastructure and market conditions to achieve more substantial improvements. These findings aligned with the literature emphasizing the importance of technology in improving agricultural productivity and market access (Ahmad et al., 2020). Technological innovations such as mobile phone applications, precision agriculture and value-added processing enhanced farmers' efficiency, product quality, and market competitiveness are timely required to support vanilla farmers.

4.3. Binary Logistic Regression Results

4.3.1 Cooperative Engagement

The findings (Table 4) show that the coefficient for cooperative engagements is 1.203, with a highly significant p-value of 0.001. This designates that each unit rise in cooperative engagement leads to a 120.3% rise in market access. Additionally, the odds ratio of 3.34 shows that farmers involved in cooperatives are 3.34 times more likely to have better market access. These results highlight the crucial role of cooperatives in enhancing market access through collective bargaining, resource sharing, and information dissemination. These finding show alignment with those of Belete and Nigatu (2023) which presented that cooperative membership significantly improves market participation among smallholder farmers, and Ferris et al. (2014), who noted that cooperatives enhance market linkages and access

to extension services. Promoting cooperative engagements among vanilla farmers could therefore significantly boost their market access, leading to improved income and livelihoods.

Table 4: Binary logistic regression results (n=385)

Determinants	B	S.E.	Sig.	Exp (B)
Cooperative engagements	1.203	0.532	0.001	3.34
Transportation infrastructure	0.987	0.436	0.001	2.678
Credit facility	0.752	0.333	0.001	2.122
Geographic factors	0.251	0.111	0.046	1.285
Training participation	0.164	0.073	0.145	1.178
Social networks	0.09	0.04	0.293	1.094
Technological adoption	0.032	0.014	0.527	1.032

4.3.2 Transport Infrastructure

Regarding transportation infrastructure (Table 4) which had a coefficient of 0.987 with a significant p-value of 0.001 and odds ratio of 2.678. This suggests that improvements in transportation infrastructure nearly triple the likelihood of better market access for vanilla farmers. These findings are cemented with Akrong et al. (2021) who reported that poor roads and transport facilities hinder farmers' access to high-value markets. Improving transportation infrastructure is therefore crucial. Investing in road networks and transportation services can reduce post-harvest losses and ensure timely delivery of produce, thereby increasing profitability and sustainability for vanilla farming in the region.

4.3.3 Credit Facility

The coefficient for credit facility availability (Table 4) is 0.752, with a significant p-value of 0.001 and an odds ratio of 2.122. This indicates that access to credit more than doubles the likelihood of improved market access for farmers. This finding is consistent with Mutayoba and Ngaruko (2015) which highlighted access to credit facilities as a key determinant for market participation among high-value crop farmers in Tanzania. To improve market access for vanilla farmers, it is crucial to ensure they have access to affordable credit. Financial institutions and policymakers should develop and promote credit schemes tailored to the needs of smallholder farmers. As one Key Informant emphasized, "Farmers need loans that will greatly help them grow their businesses, including expanding their markets and increasing profits …" (Key Informant, June 2024).

4.3.4 Geographical Factors

Geographic factors (Table 4) have a coefficient of 0.251, a significant p-value of 0.046, and odds ratio of 1.285, indicating that geographical location has a moderate influence on market access. This finding aligns with Magingxa et al. (2009), who emphasized the importance of geographic proximity to markets for smallholder irrigators in South Africa. Similarly, in Kagera, geographic factors such as distance to markets significantly affect farmers' ability to access markets. To address these challenges, efforts to enhance market access should consider geographic barriers. Initiatives like establishing local collection points or improving local market infrastructure could help mitigate the negative effects of geographic remoteness, improving market access for farmers.

4.3.5 Training Participation

Training participation (Table 4) has a coefficient of 0.164 and a p-value of 0.145, indicating that it is not statistically significant in this analysis. While the coefficient is positive, its impact on market access is not as pronounced in this study. Despite the lack of significance, Blumberg et al. (2014) argue that training and capacity-building are crucial for enhancing farmers' market knowledge and practices. The discrepancy suggests that while training is beneficial, its direct effect on market access might be limited without complementary support factors. The result implies that training alone may not be sufficient to significantly enhance access to market. Integrating training with other support services, such as market information systems and financial services, could lead to more substantial improvements in market access.

4.3.6 Social Networks

Social networks (Table 4) have a coefficient of 0.09 with a p-value of 0.293, indicating no significant impact on market access. The odds ratio of 1.094 suggest a minimal effect. Gneiting and Sonenshine (2018) found that social networks can aid market access by providing information and support. However, the insignificant result in Kagera suggests that social networks alone may not significantly influence market access without the support of formal structures like cooperatives. To enhance their effectiveness, strengthening formal networks and integrating them with informal social networks could improve market access for vanilla farmers.

4.3.7 Technological Adoption

Technological adoption has a coefficient of 0.032 and a p-value of 0.527, indicating it is not statistically significant in impacting market access. The odds ratio of 1.032 suggest a minimal effect. Ahmad et al. (2020) highlighted the importance of technological adoption for enhancing agricultural productivity and market access. However, the lack of significance in Kagera suggests that technology adoption might not be widespread or effectively implemented enough to influence market access significantly.

5. Conclusion and Recommendations

The study concludes that cooperative engagements, transportation infrastructure, credit facility availability and geographical factors are critical determinants of market access for vanilla farmers in the Kagera region. The findings align with the existing research, reinforcing the importance of these factors in improving market access for smallholder farmers. The study suggests that policymakers, agricultural extension services, and development agencies should focus on enhancing cooperative support, investing in transportation infrastructure and providing better access to credit. Addressing these areas can reduce barriers to market access, improve farmers' livelihoods and support sustainable agricultural practices. Recommendations include prioritizing infrastructure development, strengthening cooperative networks and designing tailored financial products to better support vanilla farmers. Further, investigating the impact of climate change on sustainability of vanilla production in the Kagera region is recommended for future research. This study could explore how changing weather patterns, temperature fluctuations, and extreme weather events affect vanilla crop yields and quality. Another significant area for future research is the role of technology in enhancing market access for vanilla farmers. This study may consider examining the adoption of digital tools, mobile applications and block chain technology in improving market transparency, traceability, and direct market linkages. Assessing the effectiveness of technological interventions in connecting farmers to buyers and streamlining the supply chain can provide valuable insights for modernizing agriculture.

Authors‘ Contribution

The first author was a student undertaking Master Degree of Business Administration in Marketing Management at the College of Business Education (CBE) Dodoma Campus. This author developed research proposal, collected data, analyzed data, drafted the manuscript and incorporated comments provided by reviewers. The second author supervised the first author during research work, participated in writing of the manuscript and guided the firtst author on how to write the manuscript and incorporate reviewers‘ comments. The second author also submitted the manuscript to the journal as the corresponding author.

Acknowledgements

The authors are glad to the anonymous journal’s reviewers for their enormously beneficial recommendations to advance the quality of the article. Usual disclaimers apply.

Declaration of Conflicting Interests
The authors stated no likely conflicts of interest regarding the research, authorship and/or publication of this article.
Funding
The authors did not have any financial funding for the research, authorship and/or publication of this article.

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