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Determinants of market outlet choices among cattle farmers and implications for fostering participation in rewarding livestock markets in rural Tanzania

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Abstract

Agricultural markets play a crucial role in enhancing smallholder farmers' participation in markets. Nevertheless, there is a scarcity of studies on market outlet choices among smallholder cattle farmers, particularly in Africa where markets are fragmented and weakly integrated. Subsequently, there is a limited understanding of the drivers influencing the choices of market outlets and implications for fostering beef farmers' market participation and socio-economic transformation. This study intends to fill this gap by examining the factors determining market outlet decisions among beef farmers in Monduli and Longido districts, Tanzania. Multistage sampling method was employed to identify beef farmers in the selected rural areas. A semi-structured questionnaire was used to solicit data from 400 smallholder cattle farmers selected through a simple random sampling. Analysis of the collected data involved estimation of descriptive statistics and econometric analysis. The multivariate probit regression showed that, age and extension services positively and significantly influenced market outlet choices ($p < 0.01$). Contrariwise, sex, group membership, distance to the nearest main road, tropical livestock unit (TLU), off-farm income and shock occurrences negatively and significantly influenced market outlet decisions. The findings evince that, agricultural extension services and distance to roads are imperative in influencing smallholder farmers' market outlet choices. The study asserts the need to bridge extension services and rural infrastructure to enhance beef farmers' participation in profitable livestock market outlets.

Keywords Beef farmers, Commercialisation, Livestock markets, Market outlets, Multivariate probit, Rural Tanzania

1 Introduction

Livestock sector is an important source of livelihood for both rural and urban households in developing countries, particularly in Africa. According to the Organisation for Economic Cooperation and Development, and the Food and Agriculture Organisation (OECD/FAO) [1], the indispensable role of the livestock sector globally is vindicated by



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its contribution to the agricultural gross domestic product (GDP) which ranges between 30% and 80% annually. Similarly, the African Union Inter-African Bureau for Animal Resources (AU-IBAR) [2] contended that the continental contribution of the livestock sector to the agricultural value-added product is averaged at 26%. This indicates that livestock plays an essential livelihood function to rural households and economies in sub-Saharan African countries.

In Tanzania, livestock is a significant contributor to household incomes and various non-income benefits. According to the National Bureau of Statistics (NBS) of Tanzania [3] the contribution of the livestock sector to the country's GDP is 7%. Recently, ruminant stock has reached 36.6 million cattle, 25.6 million goats and 9.1 million sheep and thereby making Tanzania the leading country in cattle and goat population within the SADC region [4, 5]. Cattle are among the dominant ruminant species and contributor to meat consumed in the country and beef meat exports.

The World Bank [5] stated that, livestock sales such as sales of beef cattle contributes to over 13% of cash income earned by rural households Tanzania. This reveals that, agricultural markets play a vital function in the economy of farming households and the general well-being of the farmers. Accordingly, literature citation corroborates that agricultural markets are important pillar of agricultural commercialisation and rural development [6, 7]. Considering this, the nexus between the agri-food markets and trade serves as a crucial entry point for promoting socio-economic development among rural households including beef farmers.

The assertion by [8] posited that, a decision on choosing a certain alternative market outlet is one of the most determinant of the net farm income earned. Moreover [9], attested that, agricultural markets especially in developing countries represent sources of revenue for farmers and food prices paid by the consumers. Relatedly, the increasing population growth and urbanisation in developing countries such as Tanzania has major implication on beef demand and market development which signifies an understanding of market outlet choices.

Siankwilimba [10] asseverated that beef industry has potential to promote food security and poverty reduction amid growing human population. The increasing beef demand stemmed from the population growth and rising incomes has implications on marketing and market outlets selection among smallholder beef farmers in rural areas. Irrefutably, little attention has been given by scholars to assess beef farmers' market outlet choices to inform policy decisions on guiding cattle commercialisation and market developments for livestock sector. A number of studies [11–14] examined market outlet choices among agricultural producers in African countries.

The available literature focused on selection of market outlets among crop producers with scanty evidence on livestock keepers particularly beef farmers. A few studies [15, 16] examined profitability and value addition practices by cattle farmers in developing countries. Connectedly, other scholars examined market participation and constraints in cattle marketing, for instance [17–21]. Noticeably, there is an observed rural households' participation in market and cattle sales in African countries [22–24].

Despite the growing tendency of cattle sales in African countries including Tanzania, a dearth of literature on market outlets selection among beef farmers exist. The paucity of empirical evidence on market choices inhibits an understanding to integrate beef farmers in rewarding and well-functioning livestock markets. Consequently, weak integration

in livestock markets impedes the prospects for welfare improvements among the beef farmers at the household and macro-level [25, 26]. This paper builds on this literature gap to elucidate the drivers influencing the choices of market outlets among beef farmers in rural Tanzania amid growing agricultural commercialisation.

2 Materials and methods

2.1 Study area

This research was done in rural areas of the Arusha region, Tanzania. The region is prominent in livestock keeping particularly ranked first in terms of indigenous cattle per capita in the country [27, 28]. Equally, in this region, smallholder pastoral and agro-pastoral farmers dominate, with an increased government interventions to upgrade livestock auction markets and passable road infrastructure. Specifically, the study was conducted in the Longido and Monduli districts where cattle marketing is becoming integral source of income for beef farmers. Selection of these districts was based on their predominance of beef cattle-keeping by smallholder farmers and observed sales of live animals such as beef cattle [29, 30]. In that light, the selected districts represent engrossing study area to expound market choices among beef farmers to inform policy making for promoting socio-economic improvements Fig. 1.

2.2 Sampling procedure and sample size

Multistage sampling procedure was used to obtain the required sample in study areas. This procedure fits well when the sample is to be drawn from a big geographic area such as a country [31]. Moreover, to obtain a representative sample, this study selected villages with different characteristics for meaningful analysis and generalisation of the findings. In the last stage, a simple random sampling method to obtain smallholder beef farmers from each village for data collection.

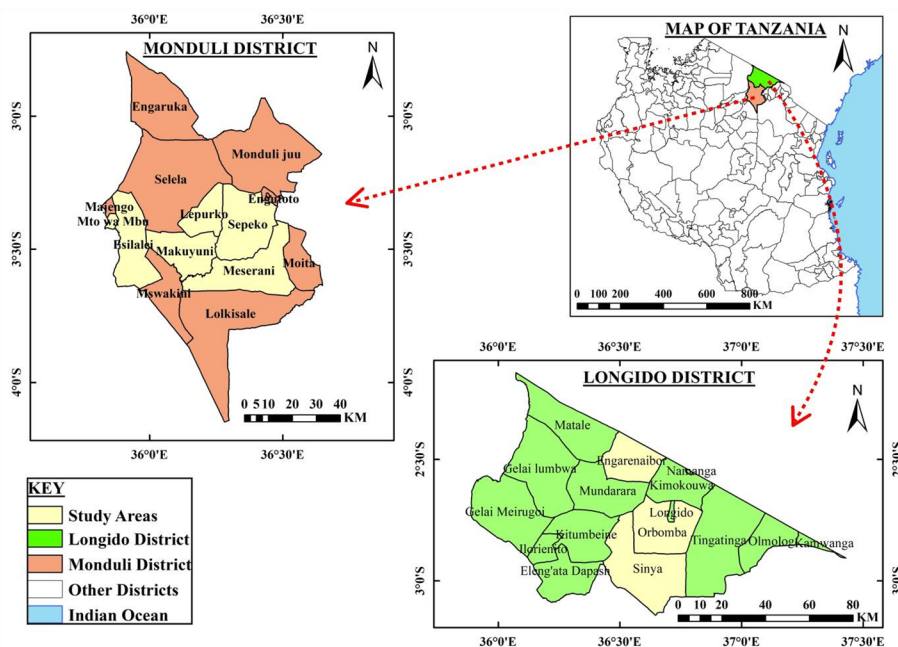


Fig. 1 Study sites in monduli and longido districts

The determination of sample size was guided by a formula put forward by [32]. This formula is suitable in social science research when the population size of the target population is not known. The sample size of farming households as a representative of beef cattle farmers in this study was determined as shown in Eq. (1).

$$n = \frac{z^2 pq}{(e^2)} \quad (1)$$

In Eq. 1, n = sample size, z = is a standard value for a given confidence interval ($\alpha = 0.05$), p = estimated proportion of the population (0.5 for unknown population), $q = 1 - p$ and e = the allowable sampling error which is 0.05. The resulting sample size for this study is shown in Eq. (2).

$$n = \frac{(1.96)^2 (0.5) (0.5)}{(0.05^2)} = 384 \quad (2)$$

The study's sample size obtained from the formula is 384 respondents. However, to account for non-response and missing information, the study utilised data collected from 400 beef farmers in the selected villages. Sample size was distributed proportionally across the study districts, whereby 174 respondents were selected in Longido district and 226 were obtained in Monduli district.

2.3 Data collection and analysis

Trained enumerators collected data using a semi-structured questionnaire with both open and close ended questions programmed and deployed in the Kobocollect tool. Collection of data entailed soliciting information from smallholder beef farmers in the selected areas. Socio-economic, demographic and institutional variables were collected during data collection between September and October 2024. Moreover, information on ownership of productive and non-productive assets as well as available market outlets for cattle was collected. Stata 17 and Ms. Excel were used in data manipulation and econometric analyses. Data analyses entailed computation of descriptive statistics and econometric estimation of the pairwise correlation test and multivariate probit regression.

2.4 Econometric model specification

Different econometric models can be used to analyse market outlet choices. The most commonly models for analysing categorical and unordered outcomes are multinomial logit regression (MNL) and multinomial probit (MNP) regression [33, 34]. As a result, a series of studies, for example [11, 35–37] employed the MNL and MNP models in assessing choices. However, the application of MNL and MNP requires the assumption of *independence of irrelevant alternatives* (IIA) that is mutual exclusiveness of the error terms for each market outlet equation [38]. Accordingly, the IIA assumption states that, an individual's choice between a set of two or more alternatives are unaffected by the presence of other alternatives [39, 40].

Undeniably, literature such as by [41, 42] posit that, choices between alternatives can be affected by the available alternatives. Analogously, growing evidence suggests that market outlet choices are not be mutually exclusive as respondents may simultaneously engage in multiple market outlets. Studies by [15] and [43] assert that smallholder

farmers often sell their cattle through multiple market outlets simultaneously. In such context, error terms for market outlet equations correlate, making the application of the MNL and MNP models unsuitable for analysing market choices [44].

In realisation of this shortcoming, the choices of smallholder beef cattle farmers were required to be jointly estimated. This study essentially used a Multivariate Probit (MVP) model which considers simultaneous participation in the available market outlets [45]. MVP model jointly provides the effects of selected variables on given alternative market outlets using a simulated maximum likelihood (SML) [46]. The SML simultaneously estimate the correlated binary dependent variables, overcoming the methodological challenges associated with standard MLE techniques [46, 47]. The market outlet choice Y_{ij} ($j = 1, 2, 3, 4$) represents four market outlets viz., auction market, farm-gate, traders, and abattoirs opted by the i^{th} beef cattle farmer. Moreover $(X'_{ij}\beta_j)$ and (ϵ_{ij}) represents regressors and an error term respectively. Thus the MVP model can be specified as follows (Eqs. 3 and 4).

$$Y_{ij} = X'_{ij}\beta_j + \epsilon_{ij} \quad (3)$$

Therefore, to identify the market outlets influencing factors, the following MVP reduced equation was generated in (4).

$$Y_{ij} = \begin{cases} 1 & \text{if } Y_{ij}^* > 0 \\ 0 & \text{if otherwise} \end{cases} \quad (4)$$

In Eq. 4; X'_i represent a set of predictor variables determining the choices of market outlet, β_j represents unknown parameters to be generated and ϵ = the residual term. Description of the explanatory variables and priori expectation are presented on Table 1.

3 Results and discussion

3.1 Descriptive statistics

Table 2 provides a summary statistic of socio-economic and institutional variables obtained from the beef farmers sampled in the study. From the findings in Table 2, the average age of household head in the study areas was 43.8 years. With regard to education level, a household head has an average of 4 years of schooling, inferring that majority of the sampled smallholder farmers had primary level of education. The findings show that, the average distance to nearest market among smallholder cattle farmers was

Table 1 Predictor variables used in the multivariate probit model

Variables	Description and measurement	E(sign)
Age	Age of the household head in years (Continuous)	+/-
Sex	Sex of the household head (Binary; 1 = Female, 0 = Male)	+/-
Schooling	Years of schooling of the household head (Continuous)	+
Dependency ratio	Ratio of non-working family members (Continuous)	+/-
Market information	Accessed market information (Binary; 1 = Yes, 0 = No)	+
Non-farm income	Earning non-farm income (Binary; 1 = Yes, 0 = No)	+/-
Farmers group	Membership in farmers group (Binary; 1 = Yes, 0 = No)	+/-
TLU	Number of TLU owned by household (Continuous)	+
Distance market	Distance to nearest market (in kilometers)	-
Distance road	Distance to nearest main road (in kilometers)	-
Extension service	Received extension service last year (Binary; 1 = Yes, 0 = No)	+
Shock occurrence	Experienced negative shock (drought and diseases) last year (Binary; 1 = Yes, 0 = No)	+/-

Table 2 Summary statistics of regressors used multivariate probit

Variable(s)	Mean	Min	Max
Age of the household head in years	43.8	20	85
Sex of the household head (= 1 if female)	0.21	0	1
Years of schooling of the household head	4.79	0	19
Number of dependency ratio at the household	1.10	0	9
Accessed market information (= 1 if yes)	0.48	0	1
Earning non-farm income (= 1 if yes)	0.54	0	1
Membership in farmers group (= 1 if yes)	0.2	0	1
Number of TLU owned by household	20.13	0.3	187
Distance to nearest market in kilometers	6.43	0.3	70
Distance to nearest main road in kilometers	4.05	0.1	30
Received extension service last year (= 1 if yes)	0.48	0	1
Experienced negative shock last year (= 1 if yes)	0.77	0	1

Table 3 Pairwise correlation coefficient for the market outlets decisions

Market outlet	Auction market	Farmgate	Cattle trader	Butcherries & abattoirs
Auction market	1.000			
Farmgate	0.157***	1.000		
Cattle trader	0.152***	0.269***	1.000	
Butcherries and abattoirs	0.082	0.190***	0.296***	1.000

***reflects 1% a statistically significant level

5.98 km. With respect to the distance to the main road, the results show that, the average distance to the nearest main road among smallholder cattle farmers was 4.05 km. Additionally, results show that, about 21% of the farmers in study areas were female headed households. The results further revealed that, 48% of the smallholder cattle farmers had accessed extension service in the last calendar year.

3.2 Pairwise correlation analysis of the dependent variables

Results show that smallholder cattle farmers in the study areas participate in the four market outlets viz., auction, farm-gate, traders and abattoirs. Pairwise correlation was estimated to check interdependence among the market outlets chosen by smallholder cattle farmers. Results on Table 3 shows that pairwise correlation coefficients between the residuals of the market outlets were significant at 1% level. For instance, the results on Table 3 revealed a positive and significant correlation between the residuals of the auction market and farm-gate, and auction market and cattle traders. Under *ceteris paribus*, this suggests that an increase in selection of auction markets associates with an increase in selection of farm-gate and cattle traders.

Similarly, the results showed a positive and significant correlation between the residuals of the farm-gate and cattle traders. Also, the findings revealed a positive and significant correlation between a farm gate and butcherries and abattoirs. This demonstrates that, market outlet equations correlate, implying the interdependence of the dependent outcomes for the binary probit models [48]. Participation in multiple market outlets indicate a risk diversification strategy particularly price fluctuations and dictations associated with monopsonic buyers. Goyal [49] argued that, participation in multiple markets improve access to market information, understanding of the market dynamics and income opportunities for farmers.

Table 4 Determinants of choice of market outlets among beef cattle farmers

Variable(s)	Auction	Farmgate	Traders	Butcheries & abattoirs
Age of household head	0.015*** (0.006)	0.026** (0.010)	0.008 (0.007)	0.006 (0.012)
Female headed household	-0.796*** (0.183)	-3.384 (2.907)	-0.472 (0.330)	0.175 (0.360)
Schooling (in years)	0.014 (0.017)	0.046 (0.031)	0.048** (0.022)	0.091*** (0.027)
Dependency ratio	-0.109* (0.061)	-0.414** (0.166)	0.064 (0.082)	-0.113 (0.116)
Group membership	-0.336* (0.198)	0.039 (0.306)	0.176 (0.225)	-0.431 (0.355)
Received extension service	0.412*** (0.140)	0.760*** (0.262)	0.805*** (0.805)	0.737** (0.308)
Distance to nearest livestock market (km)	0.021 (0.014)	-0.026 (0.027)	-0.002 (0.019)	0.043*** (0.016)
Distance to the nearest main road (km)	-0.051*** (0.020)	0.037 (0.028)	0.027 (0.026)	-0.058 (0.040)
Earned off-farm income	-0.391*** (0.147)	0.091 (0.268)	0.760*** (0.235)	0.235 (0.319)
Accessed market information	0.010 (0.141)	0.180 (0.226)	0.375* (0.213)	0.611* (0.354)
TLU	0.007* (0.004)	-0.010 (0.006)	-0.001 (0.004)	-0.002 (0.005)
Experience negative shocks	-0.573*** (0.182)	-0.400 (0.267)	0.262 (0.238)	-0.920*** (0.353)
_cons	0.922** (0.429)	0.554 (2.818)	-3.074*** (0.697)	-3.343*** (0.988)

***, ** and * denote a statistical significance at 1%, 5% and 10% respectively for the marginal effects values. Values in parenthesis indicate the robust standard errors

3.3 Determinants of the market outlet choices among smallholder beef farmers

The MVP model was used to fit the determinants of market outlet choices among the beef farmers. Table 4 indicates that MVP estimated using the simulated maximum likelihood approach fitted well the variables used. The results in Table 4 shows that, Wald test (Wald chi2 (48) = 231.88; Prob > chi2 = 0.0000) implying that, coefficients in binary probit equation being jointly equal to zero [50]. Moreover, the likelihood ratio test of $\rho_{21} = \rho_{31} = \rho_{41} = \rho_{32} = \rho_{42} = \rho_{43} = 0$, with a chi2 (6) = 20.176 Prob > chi2 = 0.0026, signifying that predictor variables in the model jointly explain the probability of success [51]. This explains that, multivariate probit model fitted well the dependent and predictors variable used. The SML estimation of the MVP revealed that, choice for each market outlet was determined by several predictors at different level of statistical significance.

Age of the beef farmer (household head) has a positive and significant influence on both auction market and farm-gate market outlet choice at 1% and 5% level respectively. This indicates that, an increase in a year of age of the farmer, increases statistically and significantly the likelihood of opting auction market and farm-gate market. This may suggest that, as farmer's age increases at the first place, the likelihood of choosing the assumed high rewarding market (auction market) increases. However, as the age of farmers continue to increase, smallholder cattle farmers were found to utilise farm-gate market due to accumulated experience and networking with buyers in rural areas [52]. Abate [53] and [54] indicate that, as age of the farmer increases, the probability of choosing profitable outlet increases. Moreover, Arumugam [11] and [55] attest that, older farmers are more likely to choose nearby market such as farm-gate.

Sex of the household head was found to be negative and significantly influenced decision for auction market at 1% as shown on Table 4. This indicates that, female headed household are less likely to choose auction market when selling cattle in the study areas. This could be possibly due to the fact that auction market entails long time of waiting, bidding and negotiating with livestock buyers. Additionally, trekking of animals from

household locality to auction market may disfavour women in utilising auction markets. Dlamini [56] argued that women often own few livestock such as cattle, this could imply that female headed households choose to sell to the alternative markets apart from the auction market. The findings are similar to seminar work by [57] who posited that gender of household head influenced choices of market choices differently.

Likewise, membership in farmer's group among smallholder cattle farmers was negative, and significantly in choosing auction market (Table 4). Evidently, empirical evidence asserts that, farmers' group are critical source of information and networking and subsequently lower the transaction costs. However, group composition may affect choices of members differently. In that regard, such composition and sharing of experiences for instance on time spent in trekking to the market and failure to auction cattle in some days could discourage utilisation of auction outlets. The findings are similar to results by [12] who found that, membership in farmer's group may constrain utilisation of certain market outlets among the members.

Additionally, access to extension visits (services) among smallholder cattle farmers significantly influenced the selection of auction market, farm-gate, traders and butcheries and abattoirs. Maulu [58] argued that accessing extension services among farmers enhances technical and marketing capabilities. Specifically, access to extension services was positive and statistically significant at 1%. In the same manner, access to extension services was positive and statistically significant in choosing butcheries and abattoirs at 5%. This indicates that, having access to extension agents increases access to relevant information, value addition and grading, and awareness of the available market outlets [11, 59]. In that regard, smallholder farmers choose the market outlet that maximize their needs.

Moreover, education level in years positively and significantly influenced selection of traders, and butcheries and abattoirs at 5% and 1% level respectively. This indicate that, a year increase in level of education of the household head will increase the probability of using traders, and butcheries and abattoirs. Accordingly, increase in level of education associate with, the smallholder farmers' ability to collect and evaluate alternatives and make judicious market choices [54]. Ngarava [43] argued that, participation in formal market outlets associate with costs, time value and price fluctuations, thereby discouraging educated farmers. In that connection, risks (e.g., price instabilities) and cost consciousness by educated farmers may result into selection of convenience outlets such as farmgate and traders.

Accessing (receiving) market related information positively and significantly influenced traders, and butcheries and abattoirs at 10% level. Smallholder farmers' access to the relevant information such as selling prices, demand conditions and availability of buyers and traders improves market outlet choices through comparison of prices [13, 60]. Additionally, information on the available market outlets enhances farmers' rational ability to evaluate the costs and returns from participating in the livestock markets (for instance auction market in urban centres). The implication is that, with increased access to market information, farmers will prefer to sell to the less cost outlets [14]. Similar results with statistically significant relation between access to market information and choosing the low costs market outlets were put forward by [61, 62].

The results on Table 4 also revealed that, distance to the main road in kilometre negatively and significantly influenced choosing auction market at 1% level. This means that,

with an increase in kilometre of distance to the main road, the probability of choosing the auction market is reduced. This indicates that, the farther the smallholder cattle farmer to the main road, the higher the costs of trekking and transporting the cattle. Abafita [63] showed that, a distance to roads (e.g., all weather roads) upsurges the costs of farmers' participation in distant markets such as urban and peri-urban markets. Consistently [64], posited that, distance to the all-weather roads constrain decisions to utilise high rewarding and competitive market outlets in urban and town centres.

Distance to the nearest livestock market was positive, and significantly influence butcheries and abattoir outlet choice among smallholder farmers at 1% level. This shows that, smallholder cattle farmers who are located away from the auction market had a high chance of choosing butcheries and abattoirs outlet. Similarly [65], argued that, distance to the nearest agricultural market influences farmers choice in selecting the nearby market outlets. Accordingly, distance to nearest market indicates a trekking distances and transport costs especially in rural Tanzania where physical livestock market are largely absent, thereby an increased transaction costs among the smallholder cattle farmers. Siankwilimba [10] contented that, physical market infrastructure enhances participation cattle farmers in formal market outlets. The results are attested by [64] and [66] who argued that distance to market has implication on transaction costs and therefore farmers opt alternative within rural areas.

Dependency ratio was negative and significantly influenced the auction and farm-gate market outlets at 10 and 5% level. This implies that, an increase in dependency ratio in the smallholder farmer household reduces the probability of selecting the auction and farm-gate market. The negative relationship between the auction market outlet choice and dependency ratio could be due to burden of taking care for the inactive members such as children and the elderly particularly in rural Tanzania. Literature suggests that, dependency ratio intensifies the financial burden on households including smallholder farmers henceforward, subjecting them to a lower commercialisation level [63, 67].

The results posit that, earning off-farm income among smallholder cattle farmers was negative and statistically significant in influencing selection of auction market at 5% level. Contrarily, earning of off-farm income was found to positive and statistically significant in influencing selection of traders at 5% level of significance. This specifies a negative link between earning off-farm income among household head and choosing auction market. Likely reason could be that, smallholder cattle farmers who are earning income from the off-farm activities are less likely to choose the auction market. This can be due to time taken for trekking cattle to and from the market in case of failure to meet desired buyers [43]. Similarly, off farm activities engagement have negative effect on market outlet which requires time in trading and are associated with high transaction costs [68]. As a result, smallholder farmers opt less time-consuming outlets such as selling direct to buyers at the farm-gate. This is reflected by the positive association between the earning off-farm income and choosing the traders outlet by the smallholder farmers as shown in Table 4.

Livestock holding in TLU was positively and significantly influenced smallholder cattle farmers' decision in opting auction market at 10% level. Meaning that, probability of smallholder cattle farmer to select auction market will increase with an increment in a unit of a TLU. A positive and significant connection between TLU and a possibility of choosing auction market could due to an increased diversification of livestock

holdings which provides a number of livestock for selling in auction markets. Evidently, an increased in TLU resulted into commercialisation and utilisation of better market outlets such as auction [15, 23]. Getahun [13] ascertained that, size of livestock holdings owned by farmers influence market outlets differently.

4 Conclusion and policy recommendations

4.1 Conclusion

This study aims to examine the drivers influencing the choices of market outlet among beef farmers in rural areas of Tanzania. Smallholder beef cattle farmers participate in multiple market outlets to diversify risks and capitalise on market outlets that generates the best returns. Participation of smallholder beef farmers in different market outlets demonstrates the existence of rural trade and exchange among smallholder farmers, livestock traders and consumers. Subsequently, this validates targeted interventions by the government and non-government organisations to create an enabling environment by bridging support infrastructure to foster beef cattle commercialisation.

Multivariate probit model evidences that, age, education level, access to market information and TLU positively and significantly influenced choices of market outlets among the beef farmers. Differentially, distance to the nearest road, sex, earning off-farm income and shock occurrence negatively and significantly influenced choice of market outlets among smallholder beef farmers. Therefore, the socio-economic and institutional factors represent the centre of policy entry to promote beef farmers' participation in profitable livestock market outlets for enhanced socio-economic development at the farmers' and macro-economy level.

4.2 Policy recommendations

To foster participation in rewarding livestock market outlets, interventions on infrastructure, capacity building, gender sensitive approaches and risk mitigation are essential. Specifically, the government should ease the enabling environment by improving rural connectivity through the construction of all weather roads including through public-private partnerships arrangements. Likewise, it is recommended that; the government and non-government organisations should provide capacity building by enhancing access to extension services to widely reach out beef farmers. Extension services on cattle value addition and grading, digital marketing and market information can improve farmers ability to participate in profitable livestock markets. Connectedly, mobile phone-based applications and farmers' groups can be used to disseminate market information and demand conditions to help farmers make judicious decisions.

There is also a need to initiate gender-inclusive approaches to enhance women headed households' benefits from cattle market participation and outlet choices. This can be done introducing convenience procedures for selling beef cattle and other live animals in livestock auction markets. Lastly, the negative relationship between shock occurrences and market outlet decisions, necessitates proactive shock mitigation strategies (e.g., index-based livestock insurance) and coping strategies. Eventually, shock mitigation strategies can enhance viability of beef cattle industry and resilience among smallholder farmers in rural areas.

5 Limitation of the study and areas for further studies

5.1 Limitation of the study

The study examined smallholder cattle farmer's market outlet choices using the cross-sectional survey data collected between September 2024 and October 2024. Cross-sectional data may not sufficiently provide dynamics in farmers' market outlet decision compared to longitudinal data. Moreover, spatial variation in demand and supply of beef cattle, and individual and context specific differences across the study areas may differ from other localities and thereby limit generalization.

5.2 Areas for further studies

This study inadequately utilised qualitative information to fully explain the market outlet choices among beef farmers in the study areas. This partially limits an understanding of the possible socio-cultural specific factors and practices that may influence market outlet decision among the cattle farmers. Therefore, further studies on market outlet choices among cattle farmers should incorporate mixed method approaches to systematically provide the qualitative insights, and thereby help to explain the underlying reasons for contradicting findings and results from the beef cattle farmers.

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Author contributions

N.I.S conceptualised the topic, methodology and manuscript drafting. M.M and H.K.B supervised writing of the draft paper, conceptualised the methodology and edited the paper. All authors approved the final version for its submission for publication.

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Data availability

Data used in this research available from the corresponding author upon request.

Declarations

Ethics approval and consent to participate

Ethical approval was granted by the Tanzania Commission for Science and Technology (COSTECH) research ethics committee (Permit No. CST00000653-2024-2024-00791). The COSTECH has its own national ethics committee which approves all types of research conducted in Tanzania including those not involving human participants such as surveys. Therefore, methodology and research questionnaire in this study was approved by the COSTECH ethics committee.

Consent for publication

Not applicable.

Informed consent

Participation of respondents in this study was entirely voluntary as farmers were briefed on the purpose of the study and asked to agree to participate prior to data collection. In that light, informed consent was obtained from the respondents prior to data collection.

Competing interests

The authors declare no competing interests.

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