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Market Participation Determinants Among Smallholder Carrot Farmers in Songoro Ward, Meru District Council

Authors

Elimeleck Parmena Akyoo[1]; Hassanal Issaya[2]

Main author email: eparmena@gmail.com

(1.2) Tanzania Institute of Accountancy, Tanzania.

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Abstract

The purpose of this study was to assess the socio-economic determinants of market participation by smallholder carrot farmers. Carrot farming represents one of the most valuable vegetables in Songoro Ward. However, smallholder farmers are constrained by many factors from effectively participating in market activities to generate enough income to improve their livelihoods. The study adopted a cross-sectional research design and an exploratory sequential mixed-methods approach, whereby qualitative data were first collected from 5 FGDs and 6 KIIs and analysed, followed by quantitative data collection and analysis. A sample of 285 smallholder carrot farmers was selected using simple random sampling techniques. The qualitative data were analysed using thematic content analysis with constant comparison, while quantitative data were entered into IBM-Statistical Package for Social Sciences (SPSS) and analysed using descriptive and inferential statistics using a binary logistic regression model. The study found that age, sex, land size, household head's carrot farming experience, and access to market information statistically significantly influenced household market participation at the $p<0.005$ significance level. The study concludes that the implications of these factors are that market participation is rarely equal. Socio-economic factors create barriers that lead to economic exclusion, gender inequality in market access and unequal market information access. It is therefore recommended that local government authorities in Meru District Council and other policymakers consider these factors when supporting farmers' participation in carrot markets to ensure the long-term success of market participation in Meru District Council.

Keywords: Market participation, marketing information, Meru District, smallholder carrot farmers, socio-economic factors.

INTRODUCTION

Carrot farming is among the most valuable vegetable crops worldwide (Yigezu et al., 2025). Globally, it plays a significant role in the vegetable market and public health due to its economic and dietary importance (Simon, 2020). There is increasing demand worldwide due to growing awareness of carrot health benefits, the use of their bioactive byproducts in food and pharmaceutical applications, and the diversification of diets and culinary versatility (Yigezu, 2025). Its powder is a rich source of polyphenols, which play a role in gastrointestinal and colonic health (Mall & Pate, 2024).

In Tanzania, carrot farming has emerged as one of the most highly valued and lucrative economic activities in agribusiness (Sewando et al., 2022). The crop is mostly grown in the cooler highland areas of the region (Sewando et al., 2022). In Tanzania, Carrot Farming is predominantly adopted by most small-scale farmers due to high yields even in small plots, minimal attention requirements, a shorter maturity period, and ease of management compared to maize and coffee (Emana et al., 2015; Dube, 2020). In the country, the crop is also cultivated in Arumeru, Bukoba, Mbeya rural, Kilombero, Njombe, Lushoto, Moshi rural and Iringa (Sewando et al., 2022).

Despite the sector being a potential source of food and income-generating activities for households across the country, smallholder farmers in Meru District, particularly in Songoro Ward, are constrained by limited access to lucrative markets. Despite the increasing contribution of carrot farming in Tanzania, existing research has mainly focused on profitability, implications for food security, agronomic practices, and other crop constraints, leaving aside market participation (Woldetsadik et al., 2018; Mekonnen & Kibret, 2021; Abesha et al., 2022). Therefore, this study aims to address this by (1) identifying the smallholder farmers' socio-economic characteristics, and (2) identifying smallholder determinants for carrot market participation.

LITERATURE REVIEW

Theoretical Review

The study was guided by transaction cost theory, hinged on the fundamental work of Coase, who drew a distinction between the firm and the market (Coase, 1937 & Coase,, as cited in Otekunrin et al., 2019). Transaction cost theory posits that the costs of searching, negotiating, and enforcing contracts determine market participation, often forcing actors to choose between using the market and internalising activities within a firm to minimise expenses. High, fixed, and proportional transaction costs (e.g., transportation, fees, and information gaps) directly hinder participation in distant or competitive markets (Adenegan, 2013).

The theory posited that smallholder farmers would not be encouraged to participate actively in the market if transaction costs were not kept at the barest minimum. According to the New Institutional Economics perspective, institutions develop arrangements to reduce transaction costs, which may adapt and evolve as the nature and sources of transaction costs change (Adenegan, 2013). Transaction costs may be referred to as 'hidden costs', which may be observable and/or non-observable costs linked with the exchange of goods and services (Barret, 2008). In this study, transaction costs are assumed to affect smallholder carrot farmers' decision to participate in the market. When the cost of participating in the market increases, it reduces the chances of smallholder carrot farmers to sell their carrots to a lucrative market (Sewando et al., 2022)

Empirical Review

Recent studies have investigated the challenges and opportunities, breeding, Determinants of profitability, determinants of commercialisation, post-harvest losses, cost-benefit analysis, and market supply determinants (Simon, 2021; Sewando, 2022; Djoufack et al., 2024; Paparella et al., 2024). Studies have also assessed the production efficiency and market performance of carrots, as well as price dynamics (Osmani & Hossain, 2015).

However, only a few studies directly assessed smallholder carrot farmers' market participation, particularly employing empirical approaches that consider institutional factors, demographic and socio-economic characteristics, market factors and technological factors (Kyaw et al., 2018; Rugebe et al., 2019; Dube,2020; Hlatshwayo et al., 2021). Also, a few empirical studies have examined the determinants of smallholder farmers' market participation. Most previous studies focused on staple and other

vegetable crops, leaving unexplored the determinants of smallholder carrot farmers' market participation. This study is important for the overall understanding of market participation and for policy-making at different levels and for different stakeholders. The study results may deepen our understanding and support policymakers in advancing policy interventions that advance sustainability in market participation, particularly in the carrot sector. Also, this study serves as a framework for other developing countries that are developing carrot-growing. It will add to the body of knowledge specifically on the theory of transaction cost and seeks to build a framework for the determinants of farmers' market participation decisions. Therefore, it is important to gather empirical evidence from diverse backgrounds. Such information is useful for policymakers, researchers, and development partners, especially those working to help carrot farmer's access market information. This paper provides empirical evidence on the socio-economic factors influencing smallholder carrot farmers' market participation in Meru District Council.

METHODOLOGY

The study was conducted in Meru District Council due to an increasing number of smallholder farmers engaging in carrot production (Sewando et al., 2022). A cross-sectional research design was adopted to collect data at a single point in time (Cvetković et al., 2021). According to Labaree (2009), the design also allows the collection of multiple variables from a representative sample with varied characteristics. A mixed exploratory sequential approach was used, in which qualitative data were first collected and analysed, followed by the collection and analysis of quantitative data to corroborate findings. According to Creswell (2014), the mixed-methods approach combines qualitative and quantitative methods to provide a complete comprehension of a research problem.

Qualitative data were collected by the use of Focus Group Discussions (FGDs) and Key Informants Interviews (KIIs). 5 FGDs with participants ranging from six to eight were conducted in Urisho, Sura, Ushili and Songoro Villages, involving participants who were knowledgeable in carrot production and aware of the marketing channel of carrots. Six KIIs were purposively selected based on their knowledge of carrot production and market participation. The KIIs include Ward Executive Officers (WEOs), Four Village Executive Officers (VEOs), and Meru District Council Agricultural, Irrigation and Cooperative Officer (DAICO). Saturation was assessed by determining the point at which no new information, themes, or insights were emerging from additional in-depth interviews. It was achieved by monitoring code frequency (a few new codes), reaching code-book stability (no new codes), and finding thematic repetition across participants.

The household survey was employed to gather quantitative data on the respondents' socio-economic characteristics, carrot production and marketing activities, and the factors affecting their participation in carrot markets. A multistage sampling technique was employed to identify and select the study area. The Arusha region was purposively selected from a list of carrot-producing regions in Tanzania in the first stage. In the second stage, Meru District Council was chosen randomly from a list of carrot-producing districts, while in the third stage, Songoro ward was purposively selected due to its rank in terms of carrot production in the district (Sewando et al., 2022).In the last stage, 285 smallholder carrot farmers were selected from the 1000 population of smallholder carrot farmers in the Villages of Sura, Ushili, Urisho and Songoro. Proportionate sampling techniques were used to obtain a sample for the four villages using a simplified formula by (Yamane, 1973, as cited in Koomson, 2025).Specifying the research design, all methods of data collection, sampling procedure, sample sizes and data analysis procedure.

Proportion= Cluster Sample (Location) x Desired Sample Size)

Total population

For this study, this becomes:

Table 1: Proportionate Sampling by Using the Formula

Sura =	284 x 285	= 81respondents
	1000	
Ushili =	234 x 285	= 67 respondents
	1000	
Urisho =	215 x 285	= 61 respondents
	1000	
Songoro=	266x 285	= 76 respondents
	1000	

Qualitative data were transcribed, categorised, coded, and grouped into themes based on the study objective, and analysed through thematic content analysis, using a constant-comparison technique. Socio-economic determinants of smallholder carrot farmers' market participation were analysed using a binary logistic regression model, as the dependent variable was dichotomous (0 = non-participation; 1 = participation). The variables entered in the binary logistic regression model were based on a theoretical review and an empirical literature review. The binary logistic model selected was specified as follows:

Logit (pi) = log (pi/1-pi) = b0 + b1x1 + b2x2 + … + b12x12 + (Agresti & Finlay, 2009).

Where:
Logit (pi) = ln (odds (event), that is, the natural log of the odds of an event occurring.

pi= prob (event), that is, the probability that respondents will participate in the carrot market.

1-pi= prob (nonevent), that is, the probability that the respondent will not participate in the carrot market.
b0= constant of the equation,

b1 to b10 = coefficients of the independent (predictor, response) variables,

k= number of independent variables,

x1 to x10= independent variables entered in the model.

Table 2: Measurement of Variable Entered in Binary Logistic Regression Model

Variable Definition	Unit of Measurement	Assumed Influence
X_1 = Age of the carrot farmers	Years	+
X_2 = Sex of carrot farmer	1 if male headed household, 0 if otherwise)	+
X_3 =Education of carrot farmer	Years of schooling (measured in years)	+
X_4 = Land Size allocated for carrot	Land size (measured in acres)	+
X_5 = Household size	Number of active people in the household	+
X_6= Market information access	1=access and 0 =no access	+
X_7 =Carrot farming experience	Number of years in carrot farming	+
X_8 = Access to extension services	Frequency of visit by extension officer),	+
X_9 = Total carrot produced	Total carrot produced in kg	+
X_{10} =Matital status	1 if married 0 if otherwise	+

Ethical consideration was considered throughout the study as participants were informed of the purpose of the study, and consent was sought from them. The data and information obtained were purposely used for the study. Confidentiality was observed among the key informants as the verbatim and quotes were anonymised. The participants' right to withdraw was reserved.

FINDINGS AND DISCUSSION

Socio-economic Characteristics of Respondents

The findings on household socio-economic characteristics in Table 1 depict that the mean age was 42 years. This suggests that most of the carrot farmers were young. The results suggest that carrot marketing is an intensive activity that requires people of an active age. As observed by Paparella et al. (2024), the level of market participation in carrot farming tends to increase with the optimum age group and starts to drop with an increase in Age. The Mean years of schooling were 7.2 years. The results suggest that most carrot farmers were likely to adopt new carrot varieties which fetch a higher price in the market. These results correspond to the previous studies as reported by Sewando et al. (2022), who found that education had a great contribution to market access by farmers.

Table 3: Household's Socio-Economic Characteristics (n=285

Variable	Standard Deviation of the Means and Means
Age	42 (15.4)
Education	7.2 (2.4)
Household Size	5 (2.3)
Land Size	3.8 (3.7)
Frequency of extension officer visit	2.7(1.5)
Experience in carrot-farming	9.6 (7.8)
Total carrot produced in (bags)	15 (4.9)

*The number in brackets are standard deviations of the means and the number out of brackets are the means.

The mean household size was 5 household members. This implies that market participating households had enough family members to supply labour to enable them to transport carrots to the market. Similar results were reported by Jebesa (2019) and Masere & Worth (2022), who reported that a higher number of active family members was one of the predictors for market participation by smallholder farmers.

The mean land size was 3.8 ha. This suggests that smallholder farmers have enough land and hence they are likely to adopt new innovations introduced by extension officers, hence increasing their carrot production to sell in the market. The mean frequency of extension visits was 2.7 visits. These findings suggest that smallholder carrot farmers had at least one contact with extension officers. Studies by Haile et al. (2022), Ndlovu et al. and Pararella et al. (2024) reported that households with more frequent contact with extension officers had more chances of participating in the market due to access to market information channeled by extension officers.

The mean years in carrot farmingwas 9.6 years. Experience in carrot farming is very important to smallholder farmers as this implies that they have a wealth of experience in testing different marketing information brought by the extension officer. Previous studies by Andaregie et al. (2021), Haile et al. (2022) and Kalauba et al. (2022) reported that most of the farmers who adopted innovation were those who had long experience in farming of the respective crop.

Table 4: Demographic Characteristics of Respondents (n=285)

Characteristics		Frequency	Percent (%)
Sex	Male	150	75
	Female	50	25
Access to market information	Access	126	63
	No access	74	25
Marital status	Married	144	72
	Single, Window, Separate	56	28

The results indicate that (75%) of head of the heads of the household were male. This implies that most farmers who had access to the market were male, as in most cases, cash crops like carrots are male crops. Most of the respondents were members of the carrot farming association. The reasons for this are that most innovations brought by extension officers are channelled to farmers through their association. Similar results were reported in a previous study by Rugube et al., (2019) & Kaluba et al., (2022).

The results further indicate that (63%) of smallholder carrot farmers had access to market information. This implies that the majority of the carrot farming community had access to market information, which is crucial in making decisions on where to sell their carrot. These findings are consistent with previous studies reported by Andaregie et al., (2021) & Sennuga (2023). On the other hand, most of the carrot farmers (72%) were married, while only a few (289%) were single, widows, and separated.

Determinants of Smallholder Carrot Farmers Market Participation

The study employed a binary logistic regression model to assess the determinants of smallholder carrot farmers' market participation, as indicated in Table 5. The binary logistic regression model indicates that five variables out of the ten variables entered in the model were significant predictors of market participation by smallholder carrot farmers ($p < 0.05$). Age was the highest predictor among these ten variables ($p = 0.000$).

In addition to that, the results in Table 5 show that the Hosmer and Lemeshow Test had a Chi-Square statistic of 6.018 ($p = 0.562$). This suggests that the overall model effectively predicted the outcomes, as the Hosmer and Lemeshow test's Chi-square value was not statistically significant, as proposed by Field (2013). The Negelkerke pseudo R2 statistic, which represents the adjusted Cox and Snell Pseudo R2, was computed at 0.365. This implies that approximately (36.5%) of the variability in smallholder carrot farmers' market participation could be accounted for by the ten independent variables entered into the binary logistic model.

Moreover, the overall model exhibited good predictive power, as evidenced by the significant Omnibus Chi-Square statistic ($p = 0.000$). The Wald Statistic value for household age was among the variables entered into the model, registering a value of 16.386 and a significant statistical association at $p \leq 0.005$. Market information followed as the second most influential variable, with a Wald statistic of 12.744 and a significant statistical relationship at $p \leq 0.001$. These findings suggest that market information increases the likelihood of smallholder carrot farmers participating in the market.

Table 5: Socio-economic Determinants of Smallholder Carrot Farmers Market Participation (n=285)

Variables	Coefficient (B)	S.E.	Wald	Sig.	Exp(B)
Age of the household head	0.086*	0.015	16.386	0.000	2.074
Household head sex	0.228*	0.230	3.656	0.011	2.231
Household head years of schooling	-0.005	0.050	0.006	0.741	0.896
Total Carrot produced	-0.239	0.242	0.658	0.341	0.637
Household Land size	1.354**	0.481	7.782	0.003	0.339
Household Marital status	0.326	0.312	0.201	0.583	0.798
Household access to extension services	0.253	0.182	2.764	0.103	1.525
Household market information access	0.031**	0.019	12.744	0.002 0.038	1.431
Experience in carrot farming	0.003**	0.004	5.959	0.0012	1.789
Household size	0.403	0.103	4.383	0.038	0.871

Omnibus Tests of Model Coefficients (Chi-square = 145.412; sig. = 0.000); Cox & Snell R Square = 0.365 Hosmer and Lemeshow Test (Chi-square= 6.018) sig. = 0.562); Nagelkerke R Square = 0.457; * and ** indicate levels of significance at (1%), and (5%) respectively

The results indicate that the age of the household head emerged as the most influential predictor affecting the likelihood of smallholder carrot farmers to participate in the market. This finding held statistical significance at p = 0.000, with an Exp (B) value of 2.074. The Wald statistic of 16.386 implies the significant contribution of the age of smallholder carrot farmers in predicting their market participation. The odds ratio indicates that, when the age of the household head of smallholder carrot farmers increases by one year, the odds ratio becomes 2.074. This suggests that older smallholder carrot farmers are 2.074 times more likely to participate in the market. This result implies that adult smallholder carrot farmers have a higher propensity to participate in the market, likely due to their accumulated experience in carrot farming. Experienced smallholder carrot farmers are more inclined to participate in the market as they possess a deeper understanding of carrot market channels. These findings are similar to the previous findings as reported by Kyaw et al. (2018); Dube (2020); Mchopa et al. (2020); Masere and Worth

(2022), and Sennuga (2023), who noted a strong relationship between the age of farmers and their participation in the market of their produce. However, the results are inconsistent with the previous results as reported by Rugube et al. (2019) and Hlatshwayo et al. (2021), who noted a negative statistically significant relationship between age and market participation.

The results in Table 5 showed that the sex of household heads was statistically significant (p = 0.011), indicating that sex is a significant predictor of household market participation. Specifically, the findings reveal that household heads' sex was 2.231 times more likely to participate in the carrot market. This suggests that male household heads are more likely to participate in the carrot market as compared to female household heads. The same results have been reported in other studies, such as those by Andaregie et al., (2021), Haile et al., (2022), Hlatswayo et al., (2022), and Kaluba et al., (2022).

In addition to that, the results indicate that with every one-hectare increase in land size, the odds ratio also increases by 1.354. This implies that households with larger land holdings are 1.354 times more likely to participate in the carrot market. This also implies that the level of market participation increases as the land allocated for carrot production increases.

These results were supported by the results from the Focus Group Discussions (FGDs), which indicate that…

> Top of Form"…Most of the farmers who get access to carrot buyers are those with many hectares as they produce many bags of carrot which attract buyers within the District, Arusharegion and other regions like Kilimanjaro, Dodoma and even Dar es Salaam, ……." (FGD in Sura Village, 24th November2024).

The Key Informant Interviews (KIIs) conducted in Ushili and Urisho villages echoed the importance of land size as a contributing factor for pumper carrot harvest, which attracts buyers from various parts of Tanzania, including Dar es Salaam. These are consistent with findings in the study as reported by Osmani and Hossain (2015); Jebesa (2019); Haile et al. (2022), and Kaluba et al. (2022), which highlighted the influences of both the decision to participate in the markets and the proportion of output sold by smallholder farmers.

The Household head's carrot farming experiences also emerged as a statistically significant positive effect on the likelihood of smallholder carrot farmers' participation in the market. The odds ratio of 1.789 suggests that households with more experience in carrot farming were 1.789 times more likely to participate in the carrot market. This can be attributed to the higher experience in participating in selling carrots for a number of years. These results are consistent with previous findings as reported by Kaluba et al. (2022), who reported that farmers' experience in production is positively and statistically significant in predicting the market participation of smallholder farmers. The results are further inconsistent with the previous study reported by Rugube et al. (2019), who found a negative statistically significant effect of smallholder farmers' experience on market participation.

Furthermore, access to market information had a statistically significant and positive influence on smallholder carrot farmers' participation in the markets. The results indicated that when household market information increased by one unit, the odds ratio became 1.431, implying that households with more members were 1.431 times more likely to participate in the markets. This suggests that households with information about markets were more inclined to participate in the markets because they had more information about the price of carrots in different parts of the region and outside the region.

During FGDs, it was reported that most carrot farmers who have options to sell their carrots in different parts of the region are those with information about the market.

> "… Most of those carrot farmers who have been bringing carrot buyers coming from outside the district council are those with market information about the price of carrot in different part of the Country……"

(FGDs inSongoro Village, 30th November, 2024).

The results align with the observations made by Seyoum et al. (2011); Kubwimana (2020), and Ndlovu et al. (2021 who noted that farmers who participate in markets were those who had access to market information.

CONCLUSION AND RECOMMENDATIONS

Conclusion: The study revealed that smallholder market participation is significantly influenced by farmers' socio-economic characteristics and market factors. The implication of these factors is that market participation is rarely equal. Socio-economic factors create barriers that lead to economic exclusion, gender inequality in market access and unequal market information access. Addressing these factors requires targeted intervention, such as age- and gender-specific strategies and supporting land access for marginalised groups.

Recommendations: Thus, the paper recommends that farmers should work together with agricultural extension workers to ensure they have access to carrot market information. The other stakeholders should invest efforts in increasing carrot farming acreage, especially for women and youth, to increase the land size used for carrot production. More experienced carrot farmers' land should be used as a demonstration plot to enhance women's and youth participation in carrot production. Lastly, local government authorities in Meru District Council and other policymakers should consider these factors when supporting farmers to participate in carrot markets to ensure the long-term success of market participation in Meru District Council.

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