Vol. 14(32), pp. 1584-1592, September, 2019
DOI: 10.5897/AJAR2019.14222
Article Number: 6E6E83F61883
ISSN: 1991-637X

http://www.academicjournals.org/AJAR

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African Journal of Agricultural Research

Full Length Research Paper

Factors influencing the level of commercialization among smallholder cassava farmers in Taita-Taveta and Kilifi Counties, Kenya

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Received 1 June, 2019; Accepted 11 July, 2019

Commercialization of farm produce is a decision made at the household level. However, the decision is influenced by different socio-economic and institutional factors which in turn affect the level of commercialization. Therefore, cassava farmers in Taita-Taveta and Kilifi counties participate in the market at different commercialization levels due to their difference in market orientation. The Household Commercialization Index (*HCI*) was used to categorize cassava farmers into four different commercialization levels. This study has been informed by the decision theory which is concerned with the reasoning underlying an agent's choices in the presence of options. Data was collected using semi-structured questionnaires from a sample of 250 smallholder cassava farmers. Descriptive statistics was used to analyze the socio-economic characteristics of respondents and an Ordered Profit model was used to analyze the cassava commercialization levels. The results show that credit access, pest management, seed buying and area under cassava positively influence the level of commercialization while distance to the nearest market negatively influence the level of commercialization. Therefore, policy makers should initiate policies targeting the specified socio-economic factors in order to introduce incentives that will motivate smallholder cassava farmers to participate in cassava marketing at higher categories of commercialization level.

Key words: Cassava, commercialization, farmers, market, Profit.

INTRODUCTION

Cassava is a perishable crop and has a shelf life of approximately three days in its raw form after harvest (George et al., 2016). Cassava is grown in 40 of the 54 countries in Africa and it is very adaptive to the tropical climate and soils. It has the ability to thrive in areas where other crops have failed like in the semi-arid regions and in less fertile soils. In addition, cassava is widely consumed in many African countries and has significantly contributed to solving food insecurity problems in the continent. Nigeria which is the largest

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producer of cassava in the world, consumes 70% of its cassava produce as food (Kehinde and John, 2015). Different farming systems can be used to grow cassava, it has low labour requirements, it can do well in less fertile soils and can withstand drought. In addition, cassava tubers can be processed into different products and it is termed as a famine reserve crop due to its ability to remain in the ground for over two years without spoilage (Infonet, 2018; Koplez; IITA, 2009).

In Kenya, cassava is mainly consumed as snacks or with tea after boiling and its utilization is concentrated in the western and coastal regions. Besides, cassava is dried and milled into flour and used as blends when preparing *ugali* (stiff porridge), porridge and for home baking. On the other hand, cassava leaves are also used by some people as vegetables and feed for livestock (GoK, 2007). Kenya Agricultural Research Institute (KARI, 2006) report, shows that despite introducing value addition technologies to smallholder farmers in Eastern Kenya, to spur entrepreneurial activities and enhance cassava commercialization, none of the farmers was found using the technologies. According to the report, the few farmers who practiced commercial cassava farming, sold raw tubers. Commercialization of cassava is mainly hindered by the bulkiness of cassava tubers which makes it costly to transport to distant markets and processing places. Similarly, cassava tubers require quick utilization or processing after harvesting due to their high perishability nature. However, affordability of the required equipment, skills and technologies for cassava processing may be out of reach for most smallholder farmers. Another major challenge facing commercialization of cassava farming and cassava utilization is limited farmer entrepreneurial orientation. This is because, farmers that have adequate entrepreneurial orientation, take advantage of market intelligence in an attempt to exploit prevailing profitable opportunities.

Farmers are considered to be commercialized when their production decision is aimed at markets and not when they participate in markets due to surplus production (Pingali and Rosegrant, 1995). Therefore, agricultural commercialization involves farming with a sole aim of meeting market demand for either processed or unprocessed agricultural products (Abbott, 1987). Abbott (1987) further argues that, well developed markets facilitate commercialization of subsistence farming and this is key in promoting economic growth as well as poverty reduction. Besides, farmers should sell the largest percentage of what they produce and use the income they get to purchase farm inputs and satisfy other needs in order for this to happen. On the other hand, Reardon and Timmer (2005), argue that economic growth has a counter-relationship with market participation, a perspective which Gebremedhin and Jeleta (2010) maintain in their work that market participation links the output and input agricultural markets and this in turn spurs economic growth. According to Mathenge et al. (2010), market participation of small holder farmers with dismal harvests is low and these farmers are the poorest. Smallholder farmers who practice commercial oriented farming based on Jayne et al. (1995) argument, have improved welfare as a result of declining real food prices due to increased market competitiveness in agricultural markets. Market incentives, marketing information and market returns promote productivity for farmers who highly participate in agricultural markets (Brian and Barret, 2014). Cassava commercialization in Western Africa is high in both scale and composition. According to Phillips et al. (2004), more than 75% of cassava produced in Nigeria is marketed and more than a half of these is processed to *gari* which is sold as a pre-cooked urban convenience food.

The cassava industry in Kenya is most likely to improve in the near future due to the quest by the Kenyan government to realizing the 'Big Four Agenda'. One of the pillars of the 'Big Four Agenda' is to ensure food security for all Kenyans by boosting smallholder farmers' productivity. The ministry of agriculture has drafted a policy that will compel flour millers to blend cassava, millet and sorghum in flour to ensure sufficient production of food as well as promote commercialization of locally produced grains (Farmbizafrica, 2018). In this case, flour millers are expected to provide a ready market for cassava hence boost cassava production in the country. Therefore, this study aims to assess the socio-economic and institutional factors that influence the commercialization of cassava in Kenya.

METHODOLOGY

Theoretical framework

This study is anchored on the decision theory which is concerned with the goal-oriented behavior of human beings in presence of options (Sven, 2005). This implies that, the decision-making process aims at reaching certain goals and since human beings are rational in nature, they tend to maximize their utility when faced with different options. The decision theory is therefore, concerned with the reasoning underlying an agent's choices (where an agent is an entity, usually an individual person, that is capable of deliberation and action) (Steele and Stefansson 2015). According to Brim (1962), the decision process can be subdivided into five steps including identifying the problem, acquiring information, suggesting different solutions, evaluation of the solutions, and selecting the best performance strategy. Therefore, the decision to take a given alternative solution is based on individual preference and choice. Furthermore, making a decision or choosing between options involves trying to get the best outcome according to one's own or given standards. The theory assumes that choices are based on moral philosophy which sets the decision-making value standard (Sven, 2005). In addition, decisions are made under any of the three broad conditions of certainty, risk and uncertainty (Bradley, 2014). Therefore, smallholder farmers may choose either to participate in cassava farming or not. Those who choose to participate in cassava farming, have to decide whether to farm for subsistence or commercial purposes or both and the quantity sold to the market. Producing cassava for commercial purposes depends on land allocation, input use, crop maintenance and

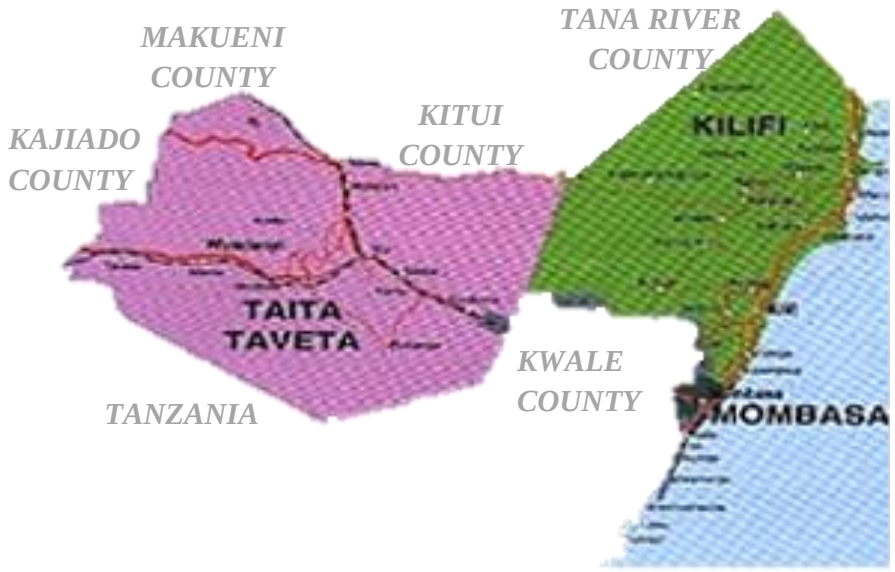

Figure 1. The study area.
Source: Gabriel (2012).

quantity produced. Farmers producing for commercial purposes also decide on the level of commercialization and the channels they use to deliver their product to the market.

Study area

The study was carried out in Taita-Taveta and Kilifi counties located at the coastal parts of Kenya. Taita-Taveta county covers a geographical area of 17,083.9 km^2 of which 62% is within Tsavo East and Tsavo West National Parks. The remaining 38% is occupied by ranches, wildlife sanctuaries, sisal estates, water bodies, hilltop forests and it is also used for residential purposes and other human activities. The county's altitude ranges from 500 to 2,228 m above sea level and has a population of approximately 274,828 persons with a population density ranging between 3 and 800 persons per km^2 (KNBS and SID, 2013). The county has diverse terrain patterns with rainfall ranging between 440 mm per annum in low lands and 1900 mm per annum in the highland areas (Figure 1).

Kilifi county on the other hand, covers a geographical area of 12,245.90 km^2 and it is a home of approximately 1,109,735 people according to the 2009 National Census (KNBS, 2009). The temperatures of the county range between 21°C during the coldest months (June and July) and 32°C during the hottest months (January and February). It has two rainy seasons; April to June (long rains) and October to December (short rains) with annual rainfall ranging between 900 and 1000 mm per annum.

Data collection techniques

Data was collected using semi-structured questionnaires which were administered face to face. However, a pilot study and focused group discussion was conducted prior to the survey. The pilot study helped the team to pretest the questionnaire and get familiarized with the area of study. On the other hand, information obtained from the focused group discussion was used to inform study results.

Sampling procedure and sample size

The study employed a three-stage sampling procedure. In the first stage, Kilifi and Taita-Taveta counties were purposively selected because of the strategic location, the increasing production of cassava in the area, the different agroecological zones and the different farming patterns. In the second stage, Kaloleni and Kilifi North sub-counties were purposively selected from Kilifi county while the whole of Taita-Taveta county were targeted due to the dispersed settlement of people in the county. Finally, cassava farming households to be interviewed were sampled using a systematic random sampling method.

The sample size for this study was based on imitation of other similar or related studies. Israel Glenn (1992) and Singh and Masuku (2014) outline four different procedures of determining a sample size. This study reached a sample size of 250 cassava farming households by imitating other related studies that include Florence et al. (2017), Kehinde and John (2015), Martey et al. (2012) and Musah et al. (2014).

Empirical framework

An Ordered Logit model was used to evaluate the factors that influence the level of commercialization among smallholder cassava farmers. Before running an Ordered Logit model, a Household Commercialization Index (HCI) was calculated and used to categorize farmers into four groups indicating their market participation and level of commercialization. These groups include none participants, low level participants, medium level participants and high participants. The HCI ranges from zero to one and it measures how a farmer is market oriented. Different studies including Abera (2009), Florence et al. (2017), Muricho et al. (2015), Musah et al. (2014), Martey et al. (2012), and Omiti et al. (2009) have used the HCI to categorize different farmers into different commercialization levels. The general assumption is that, the closer to one the index is, the greater the farmer is market oriented and therefore a higher market participation. Farmers with

Table 1. Socio-economic and institutional characteristics of respondents by level of participation.

Variable	Commercialization Levels				Pooled Sample n = 250
	Non-Participants n = 71	Low level-Participants n = 50	Medium level-Participants n = 36	High level-Participants n = 93	
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Farmers' Age (Years)	50.80 (14.71)	48.04 (15.02)	46.17 (13.42)	48.31 (14.71)	48.72 (14.59)
Years of School	8.42 (3.89)	5.78 (4.77)	6.46 (4.69)	6.03 (4.44)	6.74 (4.50)
Household size	6.99 (3.39)	6.08 (2.06)	6.40 (2.99)	6.77 (3.03)	6.66 (2.99)
Years of Experience	8.04 (5.39)	10.32 (7.42)	8.89 (6.82)	8.23 (6.57)	8.68 (6.49)
Distance to Market (km)	12.33 (2.96)	7.28 (3.89)	8.26 (3.66)	8.07 (4.01)	9.15 (4.17)
Selling Price (Ksh.)	41.00 (0.00)	42.20 (4.86)	42.00 (4.23)	41.99 (6.60)	41.78 (4.87)
Sex of HoH (% male)	94.37	74.00	82.86	75.27	81.20
Sex of farmer (% male)	67.61	32.00	45.71	43.01	48.00
Extension Services (%Yes)	9.86	54.00	42.86	55.91	40.80
Credit Access (%Yes)	7.04	16.00	22.86	34.41	21.60
off-farm activity (%Yes)	35.21	34.00	40.00	34.41	35.60
Pest Manage (%Yes)	11.27	16.00	20.00	26.88	19.20
Seed buying (%Yes)	15.49	44.00	48.57	63.44	44.00
Main Purpose (% generate/save money)	4.23	16.00	25.71	96.77	44.40

index value zero are said to be non-market participants, farmers with index value between 0.01 and 0.25 are said to be low level market participants, farmers with index value between 0.251 and 0.50 are said to be middle level market participants while farmers with index value above 0.50 are said to be high level market participants.

$$HCI = \frac{Gross\ value\ (Quantity) of\ cassava\ sales}{Gross\ value\ (Quantity) of\ cassava\ all\ produced}$$

$CCL = \beta_0 + \beta_1 age + \beta_2 sex + \beta_3 educ + \beta_4 famlabor + \beta_5 landsize + \beta_6 offfarm + \beta_7 accesscred + \beta_8 distmark + \beta_9 membership + \beta_{10} extension + \beta_{11} markexp + \beta_{12} Cassquantity + \beta_{13} famsize + \beta_{14} SP + \mu i$

where CCL is Cassava Commercialization Level, SP is Selling Price and μi is the error term.

The categorical outcome y_i of the Ordered Profit, is related to the latent variable specified as:

$$y_i^* = x'_i\beta + e_i$$

The latent variable y_i^* is not observable but is only known when it crosses a certain threshold such that:

$$y_i = j \text{ if } \alpha_{j-1} < y_i^* \leq \alpha_j$$

Therefore, the commercialization categories can be observed as follows:

$y_i = 1$ if $\alpha_0 < y_i^* \leq \alpha_1$
$y_i = 2$ if $\alpha_1 < y_i^* \leq \alpha_2$
$y_i = 3$ if $\alpha_2 < y_i^* \leq \alpha_3$
$y_i = \mathrm{J}$ if $\alpha_j < y_i^*$

The functional form (*F*) of the Ordered Profit is the cumulative distribution function (cdf). The probability that observation *i* will select alternative *j* can be presented as:

$$p_{ij} = p\,(y_i = j) = p\left(\alpha_{j-1} < y_i^* \leq \alpha_j\right)$$
$$= F\,(\alpha_1 - x_i'\beta) - F\left(\alpha_{j-1} - x_i'\beta\right)$$

RESULTS AND DISCUSSION

Socio-economic and institutional characteristics of respondents

Farmers respond differently to different environments or situations due to their personality differences. Table 1 shows socio-economic and institutional characteristics of respondents by level of market participation. The average age of the pooled sample was 49 which implies that cassava farming is mostly carried out by middle aged farmers. The average years of schooling were 7 which imply low education level among the respondents. The average household size was 7 which implies a high birth rate in the area which translated to increased demand for food. The average years of experience in farming cassava were 9 while distance to the nearest market was 9.15 km. The selling price per kg of fresh cassava tubers was about 41 Kenya shillings (Ksh) which is slightly below a half US dollar.

Most of the households (81%) were male headed but to the contrary, most farmers (60%) who participated in cassava marketing were female. Only 9% of farmers who received extension services did not participate in cassava marketing. However, provision of extension services to farmers was still low at about 40% which implies that more extension services are required to enhance market participation. Similarly, only few cassava farmers had

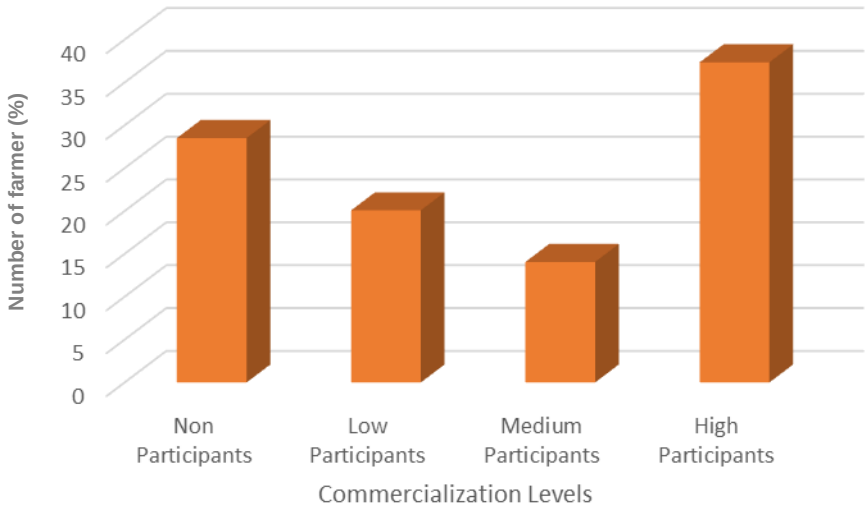

Figure 2. Levels of commercialization among smallholder cassava framers.

access to credit services implying that the farmers are constrained in terms of the magnitude and timely carrying out farm practices like pest management and seed buying.

About 35% of the farmers engage in other income generating activities off the farm. This implies that most cassava farmers do not fully concentrate on farming which leads to low participation in cassava marketing. On the other hand, most of the farmers who participate in cassava marketing at high levels, have income generation/saving as their main purpose of farming cassava. Figure 2 shows the different levels of commercialization among the cassava farmers at the Kenyan coast.

Figure 2 shows that, there are still many farmers (29%) at the Kenyan coast who farm cassava for only subsistence purposes (non-participants). Similarly, a large number (20%) of the farmers still participate at low levels while the rest (51%) are medium and high-level market participants.

Ordered Probit model results for factors that influence the level of commercialization among smallholder cassava farmers

There are different commercialization levels among the different cassava farmers at the Kenyan Coast. Tables 2, 3 and 4 present the results of an Ordered Profit regression model showing the different commercialization levels. The results in the three tables, respectively, give insights on how different factors influence the level of cassava commercialization for pooled data and when the data for Kilifi county and Taita-Taveta county is run independently. The dependent variable (Level of commercialization) is a categorical variable which has been set into four distinct categories comprising: Non-participants (Y = 0), Low (Y = 1), Medium (Y = 2) and High (Y = 3) level participants. The Household Commercialization Index (HCI) was used to categorize smallholder cassava farmers. The index ranges from 0 to 1 and therefore was used to lamb smallholder farmers into the four categories such that: Y=0: =0, Y=1: >0≤0.25, Y=2: >0.25≤0.50, Y=3: >0.50. The marginal effects of variables that have a significant influence as shown in the Tables 2, 3 and 4 have been interpreted in the discussion.

Pooled data results in Table 2 show that, years of schooling, credit access, off-farm activities, farmers' age, extension services and selling price have insignificant influence on the level of commercialization. However, the results in Tables 2 and 4 show that an increase in the household size has a significant but negative influence on the level of commercialization. Hence, as the household size increases, smallholder cassava farmers are more likely to participate in lower categories of commercialization levels. This result is similar to that of Florence et al. (2017) who found out that, in Kilifi county households with larger number of people were likely to participate at lower categories of commercialization level because larger households exerted pressure on the limited resources available in the homestead including farm produce. Similarly, Agwu et al. (2013) found out that, an increase in the household size reduces the probability of farmers' orientation towards market commercialization due to its effect on increased domestic consumption needs. The pooled data results in Table 2 show that, an increase in the household size by one person at the coast leads to 1.2% more likely not to participate in cassava marketing, 0.1% less likely to be in the low commercialization level, 0.2% less likely to be in the medium commercialization level and 0.9% less likely

Table 2. Ordered Probit model results for factors that influence the level of commercialization among smallholder cassava farmers at the Kenyan Coast.

Commercialization level	Pooled Data		Marginal effects at different levels			
	Coef.	Std. Err.	Y=0	Y=1	Y=2	Y=3
Years of schooling	-0.023	0.020	0.004	-0.001	0.000	-0.004
Credit access	0.341	0.232	-0.066	0.008	0.005	0.053
Off-farm activity	0.036	0.184	-0.007	0.001	0.001	0.006
Farmer's Age	-0.004	0.006	0.001	0.000	0.000	-0.001
Household size	-0.061*	0.033	0.012*	-0.001*	-0.002*	-0.009*
Pest Manage	0.693***	0.226	-0.134***	0.017***	0.010***	0.107***
Seed buying	0.525***	0.199	-0.102***	0.013***	0.008***	0.081***
Extension services	0.204	0.191	-0.040	0.005	0.003	0.032
Cassava Area	1.469***	0.537	-0.285***	0.036***	0.022***	0.226***
Selling Price	0.013	0.019	-0.003	0.000	0.000	0.002
Log Distance to Mkt	-0.319**	0.138	0.062**	-0.008**	-0.005**	-0.049**
Main Purpose	2.105***	0.220	-0.408***	0.052***	0.031***	0.325***
/cut1	-0.394	0.948				
/cut2	0.622	0.945				
/cut3	1.487	0.953				

Number of obs = 250; Log likelihood = -198.806; LR chi^2 (12) = 261.64; Pseudo R^2 = 0.397; Prob > chi^2 =0.000.

Table 3. Ordered Probit model results for factors that influence the level of commercialization among smallholder cassava farmers in Kilifi County.

Commercialization level	Kilifi County		Marginal effects at different levels			
	Coef.	Std. Err.	Y=0	Y=1	Y=2	Y=3
Years of schooling	0.001	0.029	0.000	0.000	0.000	0.000
Credit access	0.584*	0.326	-0.084*	-0.006*	-0.003*	0.093*
Off-farm activity	-0.462	0.301	0.067	0.004	0.002	-0.073
Farmer's Age	-0.004	0.008	0.001	0.000	0.000	-0.001
Household size	-0.026	0.042	0.004	0.000	0.000	-0.004
Pest Manage	0.822**	0.379	-0.119**	-0.008**	-0.004**	0.131**
Seed buying	0.232	0.329	-0.034	-0.002	-0.001	0.037
Extension services	-0.122	0.288	0.018	0.001	0.001	-0.019
Cassava Area	1.054	0.663	-0.153	-0.010	-0.005	0.168
Selling Price	0.013	0.026	-0.002	0.000	0.000	0.002
Log Distance to Mkt	-0.344**	0.176	0.050**	0.003**	0.002**	-0.055**
Main Purpose	2.585***	0.347	-0.374***	-0.024***	-0.013***	0.411***
/cut1	-0.542	1.258				
/cut2	0.569	1.248				
/cut3	1.626	1.264				

Number of obs= 122; LR chi^2 (12) =124.94; Prob > chi^2= 0.000; Log likelihood = -124.94; Pseudo R^2 = 0.413.

to be in the high commercialization level. On the other hand, results from Taita-Taveta county in Table 4 show that, an increase in the household size by one person leads to 2.9 percent more likely not to participate in cassava marketing, 0.6% less likely to be in the low commercialization level, 0.4% less likely to be in the medium commercialization level and 1.9% less likely to be in the high commercialization level.

The results in Tables 2, 3 and 4 show a positive significant influence of pest management on the level of commercialization. Cassava farming households who practice pest management are more likely to be in higher categories of commercialization levels. This is because, farmers who practice pest management incur higher production costs and therefore, are likely to gain higher marginal product due to controlled loss of produce from

Table 4. Ordered Profit model results for factors that influence the level of commercialization among smallholder cassava farmers in Taita-Taveta County.

Commercialization level	Taita-Taveta County		Marginal effects at different levels			
	Coef.	Std. Err.	Y=0	Y=1	Y=2	Y=3
Years of schooling	-0.067**	0.033	0.014**	-0.003**	-0.002**	-0.009**
Credit access	0.320	0.378	-0.068	0.014	0.010	0.044
Off-farm activity	0.283	0.254	-0.060	0.012	0.009	0.039
Farmer's Age	-0.008	0.011	0.002	0.000	0.000	-0.001
Household size	-0.137**	0.063	0.029**	-0.006**	-0.004**	-0.019**
Pest Manage	0.604**	0.295	-0.128**	0.026**	0.019**	0.083**
Seed buying	0.807*	0.438	-0.172*	0.035*	0.025*	0.111*
Extension services	0.426	0.277	-0.091	0.019	0.013	0.059
Cassava Area	2.917**	1.288	-0.620**	0.127**	0.091**	0.402**
Selling Price	-0.005	0.033	0.001	0.000	0.000	-0.001
Log Distance to Mkt	-0.744**	0.337	0.158**	-0.032**	-0.023**	-0.102**
Main Purpose	1.797***	0.330	-0.382***	0.078***	0.056***	0.247***
/cut1	-2.881	1.870				
/cut2	-1.806	1.864				
/cut3	-1.065	1.873				

Number of obs= 128; LR chi^2 (12) =129.14; Prob > chi^2= 0.000; Log likelihood = -101.718; Pseudo R^2 = 0.388. ***, **, and * are significant levels at 1, 05 and 10%, respectively.
Source: Survey Data (2018).

pest. Consequently, they are more likely to participate in higher categories of commercialization levels to cover the extra costs and to dispose off the excess produce. The results in Table 2 show that, farmers who practice pest management are 13.4% less likely not to participate in cassava marketing, 1.7% more likely to participate in the low commercialization level, 1% more likely to participate in the medium commercialization level and 10.7 more likely to participate in the high commercialization level. Similarly, smallholder cassava farmers in Taita-Taveta county and at the Kenyan Coast, who frequently buy clean seed for planting are more likely to participate in cassava marketing at higher levels of commercialization. Results in Tables 2 and 4 show that, farmers who participate in the seed market are 8.1 and 11.1% more likely to participate in cassava marketing at high commercialization level, respectively. The result on pest management and seed buying is in line with focused group discussion findings where farmers who engaged in these two practices said their cassava productivity was high. The results also concur with Sarka (2017), who found a positive relationship between use of farm inputs and market participation in his study on Factors Affecting Farmers' Market Participation Decision and Amount of Cassava Supplied to the Market in Wolaita Zone, Ethiopia.

Area under cassava is a proxy for the quantity of cassava produced. As the area increases, the quantity produced is more likely to increase proportionately and consequently, the quantity available for marketing (Florence et al., 2017). According to the results in Tables 2 and 4, the area under cassava has a positive and significant influence on the level of commercialization. As the area under cassava increases, smallholder farmers are more likely to be in the higher categories of commercialization levels. The results in Tables 2 and 4 show that, an increase in the area under cassava by 1 acre, increases the probability of being in the high commercialization level by 22.6 and 40.2%, respectively.

Results in Tables 2, 3 and 4 indicate that distance to the market has a negative and significant influence on the level of commercialization. The results show that, as distance to the market increases, smallholder cassava farmers are more likely to be in the lower categories of commercialization levels. According to the results in Table 2, 3 and 4, an increase in the distance to market reduces the probability of participating at high commercialization level by 4.9, 5.5 and 10.2%, respectively. This is because, an increase in distance to the market increases transport and production costs and therefore reducing gains from cassava farming hence discoursing cassava marketing. This result corresponds with that of Florence et al. (2017), Muhammad-Lawal et al. (2014), Agwu et al. (2013) and Martey et al. (2012) who found a negative relationship between distance to the market and commercialization, whereby Florence et al. (2017) concluded that it was due to increase in transport and transaction costs.

When farmers make a decision to plant any crop on the farm, there is always a main purpose behind it like income generation or otherwise. Results in Tables 2, 3 and 4 show that, when the main purpose of growing

cassava is to generate income, smallholder farmers are more likely to be in the higher categories of commercialization levels. Hence, an increase in the proportion of farmers who plant cassava for income purposes, increases the probability of being in the high commercialization level by 32.5, 41.1 and 24.7%, respectively.

Results in Table 3 show that an increase in credit access has positive and significant influence on being in the higher categories of commercialization level. According to the results, increasing the proportion of farmers who access credit by 1%, increases the probability of being in the high commercialization level by 9.3%. This is because, access to credit enables farmers to perform farming activities in good time as well as acting as an incentive to work hard and participate in marketing for repaying the credit awarded. According to Agwu et al. (2013), credit enhances farmers' skills and knowledge through enabling them to acquire modern technology including farm inputs and machinery thus increasing their productivity which in turn induces market orientation hence market participation at higher commercialization level categories.

Table 4 shows that years of schooling have a negative and significant influence on the level of commercialization. Adenegan (2013), found a similar result in his study on Smallholder Cassava Commercialization in Nigeria. Florence et al. (2017) also found a similar result for Kilifi county but a contrary result for Siaya county and argued that as farmers in Siaya county advanced in formal education, they got endowed with different skills in production, processing, management and information access which are critical in making farming decisions, an argument supported by Obisesan (2018). However, due to low literacy levels at the Kenyan coast, the few people who advance in formal education are easily absorbed in office work and get off-farm income more lucrative than farm income (Muhammad-Lawal et al., 2014). According to Table 3, an increase in the years of schooling in Kilifi County by 1 year, increases the probability of being a non-market participant by 1.4%, reduces the probability of being in the low commercialization level by 0.3%, reduces the probability of being in the medium commercialization level by 0.2% and reduces the probability of being in the high commercialization level by 0.9%. Years of schooling have a negative effect on the level of commercialization because, as people at the coast get more learned, they shift from farming to office work and therefore allocating more of their time to off-farm activities.

CONCLUSION AND POLICY RECOMMENDATIONS

This article integrates science which is academic knowledge to economic application in solving human needs in the society. Analyzing the socio-economic and institutional factors that influence the level of commercialization of different cassava farmers is important in informing targeted policies. Farmers are considered to be commercialized when their production decision is market oriented and not when they participate in markets due to surplus production. The results show that farmers with ease of accessing credit are more likely to be highly commercialized. Therefore, policy interventions should target reducing the cost of obtaining credit services. Ease of credit access would also enable farmers to manage pests on their farmers, buy quality planting materials and increase the area under cassava farming. Pest management, frequent purchase of quality cassava-cuttings and larger areas under cassava farming increase the likelihood of farmers' participation at higher categories of commercialization level. On the other hand, longer distances to the nearest market place, reduces the probability of farmers' participation in higher categories of commercialization level. Therefore, policy interventions should target to improve infrastructure in remote areas to act as incentives for traders to go for the cassava products in the farms. This will make cassava farmers to become more market oriented and therefore more likely to participate at higher commercialization levels.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

REFERENCES

Abbott C (1987). Agricultural marketing for the developing world. Cambridge University Press, UK.

Abera G (2009). Commercialization of Smallholder Farming: Determinants and Welfare Outcomes A Cross-sectional study in Enderta District, Tigrai.

Adenegan KO, Olorunsomo SO, Nwauwa LOE (2013). Determinants of Market Orientation Among Smallholders Cassava Farmers in Nigeria. Global Journal of Management and Business Research Finance 13(6).

Agwu NM, Anyanwu CI, Mendie EI (2013). Socio-Economic Determinants of Commercialization Among Smallholder Farmers in Abia State, Nigeria. Journal of African Association of Agricultural Economists No. 309-2016-5233. 4th ICAAAE September 22-25, 2013 https://ageconsearch.umn.edu/record/161518/

Bradley R (2014). Decision Theory: A Formal Philosophical Introduction. London School of Economics and Political Science; http://personal.lse.ac.uk/bradleyr/pdf/Handbook%20%20Decision%20theory%20 (revised).pdf

Brian D, Barrett CB (2014). Agricultural Factor Markets in Sub-Saharan Africa: An Updated View with Formal Tests for Market Failure. Policy Research Working Paper (No. 7117). World Bank Group, Washington, DC, World Bank.

Brim OG (1962). Personality and decision processes: Studies in the social psychology of thinking. (Vol. 2). Stanford University Press.

Farmbizafrica (2018). Government's Maize Flour Blending Policy to Reduce Shortage and Promote Sorghum, Millet and Cassava Farming; http://farmbizafrica.com/advertise/10-profit-boosters/1970-government-s-maize-flour-blending-policy (accessed 20th / 02/2019)

Florence A, Peter D, Maximilian W (2017). Characterization of the Levels of Cassava Commercialization Among Smallholder Farmers in Kenya: A multinomial regression approach. African Journal of Agricultural Research 12(41):3024-3036.

Gabriel L (2012). An Introduction to the County Governments of Kenya; https://gabriellubale.com/an-introduction-to-the-county-governments-of-kenya/ (accessed, 2018)

Gebremedhin B, Jeleta M (2010). Commercialization of Smallholders: Is Market Participation Enough? 2010 Conference, Cape Town, South Africa, September 19-23, African Association of Agricultural Economists (AAAE), Agricultural Economists Association of South Africa (AEASA)

George OA, Solomon S, Elizabeth W, Joshua O (2016). Post-Harvest Practices, Constraints and Opportunities Along Cassava Value Chain in Kenya. http://dx.doi.org/10.12944/ CRNFSJ.4.2.05 Current Research in Nutrition and Food Science 4(2):114-126.

GoK (2007). National Policy on Cassava Industry: Policy Reforms to Improve Production, Research, Marketing and Regulation in Cassava Industry. Government Printer, Nairobi.

Infonet-biovision (2018). Plant health-Crops Fruits and Vegetables-Cassava. https://www.infonet - biovision.org/PlantHealth/Crops/Cassava (accessed 18th/3/2019)

Israel G (1992). Determining sample size: Sampling the Evidence of Extension Program Impact. Program Evaluation and Organizational Development, Institute of Food and Agricultural Sciences, University of Florida. PEOD-5.

Jayne TS, Mukumbu M, Duncan J, Lundberg M, Aldridge SJ, Howard JK, Nakaponda B, Ferris J, Keita F, Sananankoua AK (1995). Trends in real food prices in six Sub-Sahara African countries, Policy synthesis Number 2 East Lansing: Michigan State University.

Kehinde YO, John OO (2015). Production and Marketing Performance of Farmers Participating in Cassava Initiative across Agricultural Zones in Nigeria, Department of Agricultural Extension and Rural Development, University of Ibadan, Nigeria. Journal of Economics and Sustainable Development 6(6).

Kenya Agricultural Research Institute (KARI) (2006). Variety, Characteristics and Production Guidelines of Traditional Food Crops. KARI Katumani Research Centre.

Kenya National Bureau of Statistics (KNBS) (2009). National Census; https://www.knbs.or.ke/county-statistics/

KNBS and SID (2013). Exploring Kenya's Inequality. Pulling Apart or Pooling Together? http://inequalities.sidint.net/kenya/wp-content/uploads/sites/3/2013/10/SID%20Abridged%20Small%20Version%20Final%20Download%20Report.pdf

Koplez; IITA (2009). Transforming African Agriculture; Unraveling Cassava's Problems; http://r4dreview.iita.org/index.php/page/22/?orderby=views (accessed 20th Aug 2018)

Martey E, Al-Hassan RM, Kuwornu JKM (2012). Commercialization of Smallholder Agriculture in Ghana: A Tobit regression analysis. African Journal of Agricultural Research 7(14):2131-2141.

Mathenge M, Place F, Olwande J, Mitheofer D (2010). Market Participation among poor rural Households in Kenya. Study report. World Agroforestry Center, Tegemeo Institute of agricultural Policy and Development, Egerton University and World Agroforestry Center

Muhammad-Lawal A, Amolegbe K, Oloyede W, Lawal O (2014). Assessment of Commercialization of Food Crops Among Farming Households in Southwestern, Nigeria. Ethiopian Journal of Environmental Studies and Management 7(5):520.

Muricho GS, Damiano M, Fredrick S (2015). Determinants of agricultural commercialization and its impacts on welfare among smallholder farmers in Kenya. University of Nairobi. http://erepository.uonbi.ac.ke/bitstream/handle/11295/95235/Muricho%20Geoffrey%20Simiyu%20PhD%20Thesis%202015.pdf?sequence=1

Musah A, Yaw B, Seini W (2014). Market participation of smallholder maize farmers in the upper west region of Ghana. African Journal of Agricultural Research 9(31):2427-2435.

Obisesan A (2018). Market Participation and Food Security of Cassava Farmers in Rural South West Nigeria. Journal of Agribusiness and Rural Development 47(1):57-64.

Omiti M, Nyanamba D, Mccullough E (2009). Factors Influencing the Intensity of Market Participation by Smallholder Farmers: A Case Study of Rural and Peri-urban areas of Kenya. African Journal of Agricultural and Resource Economics 3(1).

Phillips TP, Taylor DS, Sanni L, Akoroda MO (2004). A Cassava Industrial Revolution in Nigeria: The Potential for a New Industrial Crop (Rome: International Fund for Agricultural Development and Food and Agriculture Organization). P. 49. https://hdl.handle.net/10568/96463

Pingali PL, Rosegrant MW (1995). Agricultural commercialization and diversification Process and Policies. Food Policy 20(3):171-185. https://www.sciencedirect.com/science/article/abs/pii/0306919295000124

Reardon T, Timmer CP (2005). Transformation of Markets for Agricultural Output in Developing Countries Since 1950: How Has Thinking Changed? Handbook of Agricultural Economics. Amsterdam, the Netherlands.

Sarka S (2017). Factor Affecting Farmers' Market Participation Decision and Amount of Cassava Supplied to the Market in Wolaita Zone, Snnpr, Ethiopia. Journal of Economics and Sustainable Development 8(7).

Singh A, Masuku M (2014). Sampling Techniques and Determination of Sample Size in Applied Statistics Research; International Journal of Economics, Commerce and Management. United Kingdom; http://ijecm.co.uk/wp-content/uploads/2014/11/21131.pdf

Steele K, Stefansson O (2015). Decision Theory. The Stanford Encyclopedia of Philosophy Archive; https://plato.stanford.edu/archives/win2015/entries/decision-theory/

Sven OH (2005). Decision theory. Department of Philosophy and the History of Technology, Royal Institute of Technology (KTH), Stockholm https://people.kth.se/~soh/decisiontheory.pdf