



Assessing the determinants of agricultural commercialization and challenges confronting cassava farmers in Oyo State, Nigeria

Olutosin Ademola Otekunrin^{1*}, Idris Akanbi Ayinde¹, Rahman Akintayo Sanusi¹, and Oluwaseun Aramide Otekunrin²

¹Federal University of Agriculture Abeokuta (FUNAAB), Nigeria

²University of Ibadan, Ibadan, Nigeria

*Correspondence email: otekunrin.olutosina@pg.funaab.edu.ng

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ABSTRACT

This study assesses the agricultural commercialization levels, determinants, and challenges confronting smallholder cassava farmers in Oyo State, Nigeria. This study was conducted in Oyo State, Nigeria using cross-sectional data from 211 smallholder cassava farmers and employing multi-stage sampling procedures. Descriptive statistics, Crop Commercialization Index (CCI), and Ordered Logit Model (OLM) were used to analyze the data collected. The results revealed that 83.9% of the cassava farmers participated in the commercialization of their cassava roots while the remaining farmers were non-participants. The greatest challenge faced by the cassava farmers in the study area was the incessant attacks by the Fulani herdsmen (destroying growing cassava on the farm) while other challenges included cassava cyclical gluts and poor access road. Moreover, OLM revealed that age, farm size, cassava marketing experience and distance to market had significant influence on commercialization levels of cassava farmers. However, in order to enhance increased commercialization levels of cassava farmers and peaceful coexistence in the study area, policies and intervention programmes that will facilitate rural infrastructure development and proffer lasting solution to the farmers-herders crisis should be given upmost priority.

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INTRODUCTION

In recent time, global food demand continues to escalate with increasing world population especially in the developing economies (FAO, IFAD, 2021; Otekunrin et al., 2019a; Otekunrin et al., 2020; Otekunrin & Otekunrin, 2021a). It is evident that subsistence agriculture practiced by about two-thirds of the farmers in the developing countries needs rapid transformation in order to meet the ever-growing food

demand in the region and in the world at large. Transformation of subsistence agriculture is a crucial pathway that leads to the growth and development of many low and medium income countries especially those that depend mainly on agriculture (Otekunrin et al., 2019a; Pingali and Rosegrant, 1995). Leveraging on the power of comparative advantage, commercialization promotes commerce and productivity that leads to economic growth at the federal level and increases household income that

tends to improve food consumption and nutritional outcomes of both rural and urban households (Carletto et al., 2017; Otekunrin, 2021).

Agricultural commercialization arises when agricultural enterprises depend largely on the market for the sale of produce and for the purchase of production inputs (APRA, 2018). Also, agricultural commercialization implies increased market transactions (that is, market participation) for capturing the gains from specialization (Carletto et al., 2017). Commercialization process comes in different ways. It may be on the output side of production with sales of farm produce or on the input side regarding accumulated use of purchased inputs. The measurement of the degree of commercialization of subsistence agriculture from the output side of production provides avenue to capture the marketing behavior (from pure subsistence to completely commercialized) of individual households (APRA, 2018; Carletto et al., 2017; Otekunrin et al., 2019b; Otekunrin, 2021).

Empirical evidences revealed that smallholder farmers account for about 75% of the population of farmers in Sub-Saharan Africa with similar proportion of land being utilized by them while contributing largely to increased agricultural production in the sub-region (Ayinde et al., 2020; Lowder et al., 2016; Martey et al., 2012; Otekunrin, 2017). In past decades, agricultural commercialization in Africa was usually connected to large scale farming with special focus on cash crops (Martey et al., 2012). Meanwhile, this has changed because popular cash crops are usually cultivated by solely depending on rainfall and unfavorable weather conditions usually lead to dwindling production levels, hence the need for crop diversification (Martey et al., 2012; Obisesan, 2012; Opondo et al., 2017). Consequently, common crops such as cassava and sorghum are being promoted because of their resilience to drought, making them a target for food security strategy in the region (Martey et al., 2012; Obisesan, 2012; Opondo et al., 2017).

Previous empirical studies revealed that commercialization is affected by some determinants such as population and demographic changes, technology, infrastructure, and market (Jaleta et al., 2009). Muricho (2015) posited that health domain is another important factor to be assessed. Moreover, other studies indicated some of the factors affecting agricultural commercialization such as amount of output, access to market information, transaction

costs, as well as household characteristics like gender, age, farm size and family size (Hailua et al., 2015; Zhou et al., 2013).

Cassava (*Manihot esculenta* Crantz) is mostly regarded as 21st century staple crop for most smallholder farmers globally and especially in Africa. It is recognized as the most widely cultivated root crop and equally as food security crop in the tropical region. Cassava can survive in areas with uncertain rainfall pattern where other crops may not be successfully cultivated, and that is why cassava is commonly referred to as "drought-tolerant crop" (Otekunrin & Sawicka, 2019). According to Food and Agriculture Organization (FAO), global cassava production stands at 303.6 million tonnes with leading countries like Nigeria, Democratic Republic of Congo (Congo, DR), Thailand and Ghana rank 1st, 2nd, 3rd, and 4th respectively (Table 1). The cassava production in Africa, the largest cassava growing region, reach 192 million tonnes. Whereas, Nigeria retained the top spot as the highest producer of the crop in Africa and globally with about 59 million tonnes and 19.50% share of world total production in 2019 (FAO, 2021; Otekunrin, 2021).

Table 1. Main Countries Producing Cassava in 2019

Global Rank	Country	Production Tonnes
1	Nigeria	59,193,708
2	DR Congo	40,050,112
3	Thailand	31,079,966
4	Ghana	22,447,635
5	Brazil	17,497,115
6	Indonesia	14,586,693
7	Cambodia	13,737,921
8	Viet Nam	10,105,224
9	Angola	9,000,432
10	Tanzania	8,184,093
	Rest of the world	77,685,915
	World Total	303,568,814

Source: Authors' compilation using FAO (2021)

Cassava in Nigeria is regarded as the most important crop by production and second most important by consumption (Otekunrin & Sawicka, 2019; SAHEL, 2016). Majority (90%) of the fresh cassava roots are consumed locally as food and about 10% is used for industrial purposes. Nigeria is yet to tap the enormous trade potential of the crop because less than 1% of cassava produced in the country enters the international market (Otekunrin & Sawicka, 2019).

Considering the myriad of problems confronting crop farmers in Nigeria, empirical studies have documented the spate of wanton destruction of crops on farmers' farmland by Fulani herdsmen's cattle. This has become a common phenomenon in the Northern (north-east, north-west and north-central) part of Nigeria (Bello, 2013; Ikhuoso et al., 2020; Salihu, 2018). In recent time, apart from already identified problems such as lack of credit, inadequate farm inputs, inadequate market information and lack of rural infrastructure, crop farmers in the South-west Nigeria now experience similar attacks by the Fulani herdsmen (Obaniyi et al., 2020). While in search for pasture and water for their cattle, herders directed their cattle to crop farmers' farm and the cattle were made to feed on the growing crops and in the process, destroying the crops (such as cassava). This act usually ignites conflict between the affected farmers and the Fulani herdsmen in the community. The menace of Fulani herders' attack on crop farmers' farmland largely poses a threat to increased commercialization and food security in the affected geo-political zones and the country at large. This study, therefore, contributes to the existing body of knowledge by analyzing factors affecting agricultural commercialization and the challenges confronting smallholder cassava farmers in South-West Nigeria.

RESEARCH METHOD

Nigeria is unarguably the most populous country in Africa and the seventh most populous nation in the world. The population of Nigeria was estimated to be 211,814,947 persons (per 14 August 2021) representing 2.64% of total world population (Worldometer 2021). Nigeria is made up of six geopolitical zones in which South-West is one of them. It is located in Western region of Africa with total land mass of 923,768 square kilometer, as a multi-ethnic country with Hausa, Igbo and Yoruba being its three predominant ethnic groups and national languages. The six states in Nigeria's South-West region are Lagos, Ekiti, Ogun, Ondo, Osun and Oyo. The region lies between latitude 9° 4.9199' N and longitude 8° 4.9199' E. It is largely a Yoruba speaking region with diverse dialects within and across the states in the zone. There are two distinct seasons in the zone i.e. rainy and the dry seasons. Agriculture remains the most common means of livelihood of about 70% of the rural population (Lawal and Samuel, 2010;

Otekunrin & Otekunrin, 2021b). The main cash crops mostly grown in the zone include cocoa, citrus and timber, while the food crops are cassava, yam, maize, cowpea, melon, and millet. Livestock production include pigs, rabbits, sheep, goats, poultry and snails (Lawal and Samuel 2010; Otekunrin & Otekunrin, 2021b).

Data Collection and Sampling Procedure

We employed multi-stage sampling procedure for the cross-sectional study. In the first stage, Oyo State was purposively sampled as it is regarded as one of the six cassava producing states in the South-West region. The second stage involved random selection of five Local Government Areas (LGAs) known for the production of cassava in the state: Egbeda, Ona-Ara, Ido, Afijio, and Oyo East. In stage 3, 13 villages were selected from the five LGAs. Stage 4 involved random selection of 17 cassava farming households resulting in a total of 221 farming households as respondents. The data were gathered through structured, interviewer-administered questionnaire including the household socioeconomic characteristics, food consumption and expenditure pattern, and other salient household information. After data cleaning, 10 results of the questionnaires were discarded due to incomplete information resulting in 211 cassava farm households as respondents with 95.5% total responses from the survey.

Crop commercialization Index (CCI)

The cassava commercialization levels of the farmers was estimated using Crop commercialization Index (CCI) by Carletto et al., (2017), Otekunrin et al., (2019b), and Strasberg et al., (1999), expressed as:

$$CCI_i = \frac{\text{Gross value of crop sale}_{hhi, \text{ year } j}}{\text{Gross value of all crop production}_{hhi, \text{ year } j}} \times 100 \quad (1)$$

Where hhi is the i^{th} household in year j . With this method of estimation, commercialization levels can be represented by a scale from absolute subsistence farmer ($CCI = 0$) to perfectly commercialized one ($CCI = 100$) (Carletto et al., 2017). This method allows for more than just the usual dichotomy of sellers and non-sellers, or between staple and cash crop producers (Carletto et al., 2017; Otekunrin et al., 2019b; Otekunrin & Otekunrin, 2021b). It also gives information about how much of the harvested households decide to offer for sale in the market. The

crop sold ratio is the ratio of gross value of crop sold and gross value of all crop production (Shively & Sununtnasuk, 2015).

Cassava farmers were categorized based on their cassava commercialization levels. Farmers that did not participate (non-sellers) in the sale of the cassava roots were categorized as zero commercialization level (CCI 1 = 0%) while those that participated actively (sellers) are grouped into 3 (three) categories: Low commercialization level (CCI 2 = 1-49%), Medium-High commercialization level (CCI 3 = 50-75%) and Very High commercialization level (CCI 4 = >75%) level (Otekunrin & Otekunrin, 2021b; Otekunrin et al., 2021).

Ordered Logit Model

This model was used to determine factors influencing commercialization levels of smallholder cassava farmers in Oyo State. This analysis is adopted when the dependent variable has more than two categories and the values of each category have an ordered sequential structure where a value is indeed "higher" than the previous one (Torres-Reyna, 2014).

The logit coefficients are in log-odds unit and they are not read as OLS coefficients as such in interpreting. We need to estimate predicted probabilities of $Y=1$ or the marginal effects which measure changes in the probability of commercialization outcome with respect to change in explanatory variables. The likelihood of falling in any of the levels is estimated using natural log of the cumulative distribution (Booroah, 2002; Obayelu, 2012). A positive marginal effect estimate for a category indicates that an increase in that variable will increase the probability of being in that category while a negative estimate implies a decrease in probability of being in that category.

In the ordered logit model, there is an observed ordinal variable Y which is a function of another variable y^* that is not measured. The latent variable y^* has various threshold points.

In this study, the model specification followed Hussayn et al. (2020), Ogutu et al. (2020), and Oluwatayo and Rachoene (2017).

$$y_i^* = x_i' \beta + \varepsilon_i(2)$$

where y_i^* is the latent variable of the commercialization levels of cassava farmer i , x_i' is a vector of regressors explaining farmer i , β is a vector of parameters to be estimated and ε_i is a random error term which follows a standard normal distribution.

Choice rule:

$$y_i = \begin{cases} 1 & \text{if } y_i^* \leq \mu_1 \text{ (Zero level (0\%))} \\ 2 & \text{if } \mu_1 \leq y_i^* \leq \mu_2 \text{ (Low level (1 - 49\%))} \\ 3 & \text{if } \mu_2 \leq y_i^* \leq \mu_3 \text{ (Medium - High level (50 - 75\%))} \\ 4 & \text{if } y_i^* > \mu_3 \text{ (Very High level (> 75\%))} \end{cases} \quad (3)$$

in which μ_1 to μ_3 are threshold values for the commercialization levels.

Hence, the dependent variable is the commercialisation levels and it is categorized into four outcomes as mentioned above. As the ordered classes increase, β is interpreted as: positive (+) signs suggest higher commercialisation level as the value of the variables increase, while negative (-) signs indicate the opposite (Adeyemo et al., 2019). These interplays would be compared to the scales linking several thresholds, μ_i , so as to establish the appropriate commercialisation level for a particular farmer.

The explanatory variables include the following: X_1 is age, X_2 is gender, X_3 is marital status, X_4 is household size, X_5 is year of schooling, X_6 is farm size, X_7 is farm experience, X_8 is farm income, X_9 is nonfarm income, X_{10} is member of association, X_{11} is transport cost, X_{12} is food expenditure, X_{13} is cassava marketing experience, X_{14} is access to credit, X_{15} is access to extension, X_{16} is access to healthcare services, X_{17} is distance to market.

RESULT AND DISCUSSION

Characteristics of Respondents

The socioeconomic description of cassava farming households is presented in Table 2. The results show that the mean age of cassava farmers was estimated to be 50 years, indicating that the cassava farmers are in their advanced age. About 85% of the household heads were men, revealing that cassava production is male dominated. The mean household size in the study area was 6 persons while farmers' mean year spent in school was 6.84 years.

Table 2 also reveals that the mean size of the farmland used for cassava production in the last cropping season was 1.51 hectare. Furthermore, the mean farm income and non-farm income of cassava farmers were N102,682.46 and N47,052.13 respectively. The distribution of cassava farmers by their experience in farming activities (Table 3) indicated a mean cassava farming experience of 15.23 years.

Table 2. Cassava Farmers' Socioeconomic Characteristics

Variable	Description	Mean	Std. Dev	Minimum	Maximum
AGE	Age of farmers (years)	50.18	11.72	27.00	89.00
GEND	Gender of farmers (1 male, 0 female)	0.85	0.36	0.00	1.00
MARSTAT	Marital status of farmers (1 married, 0 otherwise)	0.89	0.32	0.00	1.00
HHSIZE	Number of Household members	6.42	3.18	1.00	20.00
EDUSTAT	Number of years spent in school	6.84	4.93	0.00	16.00
FARMSIZ	Size of the farm used for cassava production (hectare)	1.51	1.05	0.20	4.86
FARMEXP	Cassava Farming experience of the farmers (years)	15.23	10.87	1.00	50.00
FARMINC	Farm income of the farmers (Naira)	102,682.46	74,199.14	0.00	500,000.00
NFARMINC	Non-farm income of the farmers (Naira)	47,052.13	79,839.14	0.00	900,000.00
CASSMRTEXP	Cassava marketing experience of the farmers (years)	11.23	9.68	0.00	45.00
ASSMEMSHP	Member of farmers' association (1 if yes, 0 otherwise)	0.16	0.36	0.00	1.00
TRANSPCOST	Cost of transportation (Naira)	3,668.72	1,419.88	1,000.00	10,000.00
EXTENSION	Access to extension services (if yes 1, 0 otherwise)	0.22	0.41	0.00	1.00
CREDIT	Access to credit facilities (if yes 1, 0 otherwise)	0.05	0.21	0.00	1.00
FOODEXP	Farmers' household Food expenditure (Naira)	21,535.55	11,180.02	2,000.00	60,000.00
DISTANCE	Distance from farm to closest market (Km)	8.54	4.58	1.00	30.00
CASSOUTPUT	Total value of cassava output last cropping season (Kg)	7,814.41	9,342.30	0.00	60,000.00
PRICECASS	Market Price of cassava (Naira)	27,405.21	18,563.61	5,000.00	70,000.00
HEALTH	Access to healthcare services (1 if yes, 0 otherwise)	0.42	0.49	0.00	1.00

Meanwhile, Table 2 also shows that the mean cassava marketing experience of farmers was 11.23 years and this reflects that cassava farmers have considerably long years of cassava marketing experience above 10 years. Proximity to closest market centers enhances increased income, employment opportunities and easy access to farm inputs especially for smallholder farmers. On the average, cassava farmers are 8.54 km far away from the closest market centers as channels for the sale of their harvested cassava roots.

The Levels of Agricultural Commercialization

The agricultural commercialization levels of cassava farmers are presented in Table 3. The results were computed through crop commercialization index (CCI) of each cassava farmers as specified above. The results indicate that about 16% of the farmers did not participate in sale of their cassava produce (non-sellers) in the last cropping season and such farmers are categorized as zero commercialization level (CCI 1). About 21% of the cassava farmers sold between 1-49% of their cassava produce and are categorized as low commercialization level (CCI 2) while the highest% of farmers (33.65%) sold above 75% of their cassava roots in the last cropping season, belonging to the category of very-high commercialization level (CCI 4).

Table 3. Smallholder Cassava Farmers' Commercialization Levels

Crop Commercialization Index (CCI) Level	Frequency	Proportion %
0.00-1.00% Zero Level (CCI 1)	34	16.11
1.00-49.99% Low Level (CCI 2)	45	21.33
50.00-75.99% Medium-High Level (CCI 3)	61	28.91
76.00-100.00% Very-High Level (CCI 4)	71	33.65
Total	211	100.00
Mean CCI (%)	53.64	
Minimum CCI (%)	7.62	
Maximum CCI (%)	95.45	

Challenges of Cassava Farmers

Cassava farmers in the study area identified some challenges confronting the production and marketing of cassava produce (Table 4). Cassava farmers pointed out 11 (eleven) leading problems encountered in the production and marketing of cassava roots. About 15% of them identified high cost of agrochemical (pesticides) while about 19% lamented the poor and deplorable condition of the roads that affected the marketability of the farm produce, leading to the reduced income.

The destruction of the growing cassava by the rodents such as grass cutters was also identified by about 37% of the farmers while about 45% mentioned the lack of funds especially in the aspects of farm business expansion and procurement of farm inputs.

Furthermore, about 24% of cassava farmers reported continued cassava cyclical gluts as it affected their cassava marketing in the last cropping season. From all the problems encountered by the cassava farmers in the study area in the last cropping season, the top ranked challenge of the farmers was the invasion of the Fulani herdsmen on their farm, consuming and destroying their growing cassava plants. About 77% (162 out of 211) of cassava farmers lamented the destruction done by the cattle of these herders in the study area which has led to loss of livelihood by the cassava farming households and serious threat to food security in Oyo State and Nigeria. The top 5 challenges confronting cassava farmers and affecting their production and commercialization of cassava produce in the study area are Fulani herdsmen attack, lack of funds, rodents invading the cassava farms, cassava gluts, and poor access road.

Table 4. Challenges Facing Smallholder Cassava Farmers

Problems encountered	Frequency	Proportion %	Rank
High cost of agrochemicals (mostly pesticides)	31	14.69	8
Rodents invading cassava farms (mostly grass cutters)	78	36.97	3
Cassava gluts	51	24.17	4
Fulani herds cattle invading cassava farms	162	76.77	1
Lack of funds	95	45.02	2
Climate change (mostly leading to heavy rainfall)	35	16.59	7
Pilferage (theft of cassava roots on the farm)	10	4.74	11
Lack of government support (credit facilities)	39	18.48	6
Poor access road (deplorable condition of the road)	40	18.96	5
Weed infestation	12	5.69	10
High cost of transportation	21	9.95	9

Determinants of commercialization levels

The factors influencing commercialization levels of cassava farmers are presented in Table 5. This analysis was carried out to assess the determinants of commercialization levels among smallholder cassava farmers. The cassava commercialization categories were ordered and the commercialization level was significant ($p < 0.001$) (Table 5). Likewise, the threshold value showing the commercialization levels; μ_1, μ_2 , and μ_3 , (cut1, cut2 and cut3) indicate that a value

of the latent variable with -0.5871 or less represented zero commercialization, between -0.5871 and -0.0767 was low commercialization, between -0.0767 and 2.2026 represented medium-high commercialization, while a value ≥ 2.2026 was very high commercialization. The dependent variable is the commercialization levels (determined from crop share ratio) categorized into four outcomes (1=zero level, 2=low level, 3=medium-high level and 4=very-high level).

The marginal effects give explanations on how the regressors move the probability of cassava farmers' commercialization among the identified categories. The estimated results indicate that age of cassava farmers was significant at 5% level of probability, and had a negative association with the probability of being highly commercialized. The results of the marginal effects show that a unit increase in age would result in 0.0082 decrease in the likelihood of attaining very high commercialization level (CCI 4). The cassava farmers with higher farm size had a higher likelihood of attaining very high commercialization level. The coefficient of the farm size was found to be positive and significant at 5%. A unit increase in farm size was anticipated to result in 0.1065 increase in the likelihood of attaining very high commercialization level (CCI 4) but a unit increase in farm size decreased the likelihood of the farmers belonging to zero, low and medium-high commercialization levels by 4.27%, 1.97% and 4.1% respectively.

Moreover, as the distance from farm to market decreased by a kilometer, the likelihood of the cassava farmers belonging to low commercialization level (CCI 2) increased by 0.41% while as the distance from farm to market increased by a kilometer, the likelihood of farmers engaging in very high level of commercialization (CCI 4) increased by 2.22%. With reference to very high commercialization level (CCI 4), when cassava marketing experience went up by one year, the likelihood of farmers attaining very high commercialization level increased by 3.1% assuming other factors are held constant. Moreover, as access to healthcare services increased by one unit, the probability of farmers increasing their cassava market participation went up by 0.1137, 0.0484 and 0.0839 from zero, low and medium-high commercialization levels respectively.

Table 5. Determinants of Agricultural Commercialization

Variable (X)	Estimated β values	Marginal effects of zero level	Marginal Effect of low level	Marginal Effect of medium-high level	Marginal Effect of very-high Level
Age	-0.0361** (0.0169)	0.0033** (0.0016)	0.0015* (0.0008)	0.0034* (0.0019)	-0.0082** (0.0039)
+Gender	0.3059 (0.4802)	-0.0305 (0.0523)	-0.0135 (0.0225)	-0.0233 (0.0278)	0.0673 (0.1007)
+Marital Status	-0.1859 (0.5089)	0.0161 (0.0414)	0.0076 (0.0205)	0.0196 (0.0590)	-0.0432 (0.1204)
Household Size	0.0064 (0.0548)	-0.0006 (0.0050)	-0.0003 (0.0023)	-0.0006 (0.0052)	0.0016 (0.0125)
Year of schooling	0.0390 (0.0616)	-0.0036 (0.0056)	-0.0017 (0.0027)	-0.0037 (0.0059)	0.0089 (0.0141)
Farm Size	0.4672** (0.2215)	-0.0427** (0.0210)	-0.0197** (0.0010)	-0.0441* (0.0258)	0.1065** (0.0512)
Farm Experience	-0.0664* (0.0402)	0.0061 (0.0038)	0.0028 (0.0020)	0.0063* (0.0038)	-0.0151* (0.0089)
Farm Income	5.41e-07 (2.38e-06)	-4.94e-08 (0.0000)	-2.28e-08 (0.0000)	-5.10e-08 (0.0000)	1.23e-07 (0.0000)
Nonfarm Income	1.69e-07 (2.31e-06)	-1.55e-08 (0.0000)	-7.13e-09 (0.0000)	-1.60e-08 (0.0000)	3.85e-08 (0.0000)
+Member of Association	1.2462** (0.62325)	-0.0829*** (0.0307)	-0.0418** (0.0196)	-0.1748* (0.1057)	0.2995** (0.1462)
Transport Cost	0.0002* (0.0001)	-0.00002* (0.0000)	-9.23e-06* (0.0000)	-0.00002 (0.0000)	0.00005* (0.0000)
Food Expenditure	0.00002 (0.00002)	-1.95e-06 (0.0000)	-8.99e-07 (0.0000)	-2.01e-06 (0.0000)	4.86e-06 (0.0000)
Cassava marketing Experience	0.1371*** (0.0470)	-0.0125*** (0.0048)	-0.0058** (0.0027)	-0.0129** (0.0052)	0.0312*** (0.0103)
+Access to credit	-0.1042 (0.7653)	0.0099 (0.0755)	0.0045 (0.0336)	-2.01e-06 (0.0000)	-0.0234 (0.1692)
+Access to Extension	-0.4646 (0.5302)	0.0472 (0.0595)	0.0205 (0.0263)	0.0334 (0.0276)	-0.1012 (0.1091)
+Access to healthcare services	-1.1316** (0.4795)	0.1137** (0.0503)	0.0484** (0.0241)	0.0839* (0.0440)	-0.2461** (0.1017)
Distance from farm to Market	0.0965** (0.0405)	-0.0088** (0.0037)	-0.0041** (0.0020)	-0.0091* (0.0049)	0.0220** (0.0093)
/cut1	-0.5871 (0.9453)				
/cut2	-0.0767 (0.9350)				
/cut3	2.2026 (0.9380)				

***, ** and * denote significance at 1%, 5% and 10% level.

+ is dummy variable from 0 to 1

Figures in parentheses are robust standard errors.

Number of observation=211, Log Pseudo likelihood=-206.70376, Wald chi2 (17)=58.09, Probability >chi2=0.0000, Pseudo R2=0.1778

Research Implication

The description of socioeconomic characteristics as shown in Table 2 indicates that cassava farmers are in their advanced age and this result is similar to findings of Adepoju et al. (2019) and Adeyemo et al. (2019). The majority (85%) of the household heads were men reflecting the fact that cassava production is male dominated. This result agrees with Adepoju et al. (2019), Awoyemi et al. (2015), and Otekunrin (2011) that cassava production, utilization and marketing are

male dominated in South West Nigeria. The mean household size of 6 persons reveals that farmers have relatively large family members which could possibly be available as family labour against short fall of hired labour. This result corroborates the findings of Adepoju et al. (2019) and Kolapo et al. (2020) that a relatively large household size enhances the availability of family labour which reduces constraint on labour demand in cassava production, processing, and marketing (Effiong 2005; Zhou et al. 2013). The

lower education attainment among cassava farmers indicates that higher formal education attainment may not be a necessary condition for smallholder households' decision to increase investment in the cassava value chain, rather hands-on (on-farm) experience may be more crucial (Adepoju et al. 2019; Awotide et al. 2012; Huffman 2001). The less than 2.00 ha mean farm size reveals that most of the cassava farmers in the study area are smallholder farmers cultivating less than 5.00-hectare farmland. These findings are in line with works of Ikuemonisan et al. (2020); Otekunrin & Otekunrin (2021b); Otekunrin & Sawicka (2019); Rapsomanikis (2015); and Sebatta et al. (2014). The results (Table 3) also reveal that cassava farmers were found to be far from the closest market centres, indicating that the farther the farmers are to the market, the lower the possibility of the farmers' market participation, which may result in reduced household income (Otekunrin et al., 2019b; Renkkow et al., 2004).

Based on the level of agricultural commercialization of cassava farmers (Table 3), it is shown that the mean crop commercialization index was 53.64% while maximum CCI was 95.45%. The results are similar to that of Hussayn et al. (2020) and Kolapo et al. (2020) who reported higher level of market participation by cassava farmers and processors in South-West Nigeria.

The challenges faced by cassava farmers in rural Oyo state are as shown in Table 4, indicating that lack of high cost of agrochemicals, deplorable road condition, destruction of growing cassava by rodents, lack of funds and continued cassava cyclical gluts are among the important challenges for the smallholder cassava farmers in the study area. Furthermore, studies have reported that availability of rural infrastructure such as good road networks play a vital role in increasing commercialization (Key et al., 2000; Okoye et al., 2016; Otekunrin & Sawicka 2019; Renkkow et al., 2004). Other studies have also identified continuous cassava cyclical gluts as one of the production and marketing challenges of cassava in Nigeria (Ezedinma et al., 2007; FGN, 2011; Otekunrin & Sawicka 2019). Empirical evidences have shown that this situation is common in the northern part of Nigeria but the southern states have also started experiencing this menace by the Fulani herdsmen (Bello, 2013; Ikhuoso et al., 2020; Kazzah, 2018; Salihu, 2018). This finding is supported by Obaniyi et al. (2020) who

identified damages done to crop farmers in Osun State by the Fulani herdsmen attacks.

The factors influencing the cassava commercialization of smallholder farmers in rural Oyo state as indicated in Table 5 reveal that the younger the farmer, the higher the productivity and the probability of increasing commercialization level while the older the farmer, the lower the probability of participating in the marketing of farm produce. The findings agree with previous studies that the older the farmers become, the less likely they participate in the market and the more unlikely they increase their commercialization level (Matey et al., 2012; Olwande & Mathenge 2011; Okoye et al., 2016). But, this finding is contrary to the one by Enete & Igboke (2009) who reported that older farmers are more likely to increase the extent of cassava sales. The distance from farm to market indicates that farmers may not participate in very high level of commercialization if they are at far distance to available market centers, usually because of higher transaction costs that will be incurred by the farmers. This is corroborated by the findings of Agwu (2012), Gebremedhin and Jaleta (2010), Omiti et al. (2009), and Opondo et al. (2017) who found that distance to market centers inhibits market access by the farmers. However, it is a common knowledge that, it is only when farmers have more farming experience that such experience can be translated to better marketing experience (through sales of the cassava roots in the output market). This is expected because farmers with increased marketing experience tend to have good bargain power (for prices of farm produce) at the market than those with little or no experience. This is in line with Okoye et al. (2016) who posited that increased cassava farming experience of farmers has significant influence on the likelihood of farmers participating in markets and attaining increased commercialization level than selling at the farm gate in Central Madagascar. It is also revealed in Table 5 that access to healthcare services promotes agricultural commercialization in the study area.

CONCLUSION AND SUGGESTION

Transformation of subsistence agriculture to commercial status is an important pathway that leads to the growth and development of many low and medium income countries especially those that depend mainly on agriculture. It is equally important to identify the challenges confronting smallholder crop farmers in

their quest to increasing market penetration especially with respect to marketing of output produce. In this study, we investigated the socioeconomic factors influencing agricultural commercialization of cassava farmers in Oyo State, Southwestern Nigeria. CCI was used to classify cassava farming households into levels while ordered logit regression model was employed to analyze the determinants of agricultural commercialization of cassava farmers in the study area. The CCI was computed for each farmer while we explored challenges confronting smallholder cassava farmers in the study area. The study found that about 84% of cassava farmers participated in the marketing of their cassava produce with mean CCI of 53.64%. Also, the study revealed that the number one problem confronting cassava farmers was the menace of Fulani herdsmen attack, limiting the possibility of increased commercialization and threatening food security of the farmers in the study area. The ordered logit regression analysis indicated that age, farm size, cassava marketing experience, distance to market and access to healthcare services were among the significant determinants of agricultural commercialization of cassava farmers in the study area. Therefore, the provision of rural infrastructure (such as good road network) will promote easier transportation of the farm produce (such as cassava) to the market centers. Additionally, stakeholders should intervene in formulating policies that will bring lasting peace between crop farmers and Fulani herdsmen in order to promote food security and peaceful co-existence in the farming communities.

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