Australian Journal of Science and Technology

ISSN Number (2208-6404)
Volume 7; Issue 1; March 2023

Original Article

Technical efficiency and profitability analysis of cassava (*Manihot* species) production among small-scale farmers in Federal Capital Territory, Nigeria

Olugbenga Omotayo Alabi[1]*, Abubakar Sadeeq Musa[2], Ibrahim Maharazu[3], Samuel Jeremiah Aluwong[4]

[1]Department of Agricultural-Economics, Faculty of Agriculture, University of Abuja, PMB 117 Gwagwalada-Abuja, Federal Capital Territory, Nigeria, [2]Department of Agricultural Extension and Management, Niger State College of Agriculture, Mokwa, Niger State, Nigeria, [3]Department of Agricultural Economics and Extension, Faculty of Agriculture, Kaduna State University, Kaduna, Nigeria, [4]Department of Agricultural-Extension and Management, School of Agricultural, Technology, Nuhu Bamali Polytechnic, Zaria, Samaru Kataf Campus, Kaduna State, Nigeria

ABSTRACT

This study evaluated technical efficiency and profitability analysis of cassava (*Manihot* species) production among small-scale farmers in Federal Capital Territory, Nigeria. Multistage sampling technique was employed. About 100 small scale cassava producers were sampled and selected. Data of primary sources were collected using well-designed and well-structured questionnaire. Data were analyzed using descriptive statistics, farm budgeting technique, financial analysis, stochastic production frontier model, and principal component model. The results show that 78% of small scale cassava producers were between 31 and 50 years of age. The mean age was 45 years; the small scale cassava producers were young, active, energetic, and resourceful. About 88% of small scale cassava producers had formal education and were literate. Averagely, small-scale cassava producers had 1.46 hectares of cassava farms. The household sizes were large with an average of six people per farming household. The gross margin and net farm income of cassava production per hectare was calculated at ₦297, 660 and ₦279, 160, respectively. The gross margin and operating ratios were estimated at 0.66 and 0.51, respectively. The small-scale cassava production was profitable and worthwhile enterprise. The statistical and significant predictors influencing output of small-scale cassava production were farm size ($P < 0.05$), cassava cuttings ($P < 0.01$), and labor input ($P < 0.10$). The statistical and significant socioeconomic predictors influencing technical efficiency of cassava production were age ($P < 0.10$) educational level ($P < 0.05$), and experience in farming ($P < 0.05$). The least and maximum technical efficiency scores of cassava producers were 0.11 and 0.81, respectively. The constraints facing small-scale cassava producers were lack of credit facilities, inadequate extension services, bad road infrastructures, high labor cost, and high cost of farm input. The study recommended that credit facilities should be available and easily accessible at low interest rate to small-scale cassava producers, farm inputs such as improved cassava cuttings, and chemical inputs should be made available to small-scale cassava producers to increase productivity.

Keywords: Nigeria, profitability analysis, small-scale cassava production, technical efficiency

Submitted: 30-01-2023, **Accepted:** 15-02-2023, **Published:** 30-03-2023

INTRODUCTION

Cassava (*Manihot* species) is an economic important crop in the world. It is an important food and cash crop in sub-Saharan Africa especially in Nigeria where it plays a principal role in the food economy.[1] Cassava serves as a major source of carbohydrates and is a major staple food crop for low-income earners and resource poor farmers in the developing economies of sub-Saharan Africa. Cassava has been transformed from being a subsistence crop to an industrial cash crop and is the most promising in terms of growth and new market opportunities.[2] Today, the world market for cassava, and its secondary products is increasingly dynamic, the volume of cassava production together with foreign trade is seen to be

Address for correspondence: Alabi Olugbenga Omotayo, Department of Agricultural-Economics, Faculty of Agriculture, University of Abuja, PMB 117 Gwagwalada-Abuja, Federal Capital Territory, Nigeria. E-mail: omotayoalabi@yahoo.com

growing steadily.[3] Cassava is cultivated for its tuberous roots, from which cassava bread, flour, and tapioca are obtained. Cassava can be processed into many secondary products of value in the industrial market. The secondary products include: pellets, chips, adhesives, flour, alcohol, and starch. This secondary products of cassava are used in the following industries: livestock feed, textile, confectionary, food, wood, soft, and alcohol/ethanol.[4] Nigeria is the world's largest producer of cassava, while Thailand is the largest exporter of cassava starch. It was estimated in 2021 that cassava production was about 63,031, 376 tonnes in Nigeria.[5] In Nigeria, total area used for cassava harvesting in 2021 was estimated at 9,085,736 hectares, the yield was 69,374 hg/ha also in 2021.[5] Cassava is a food security crop and it plays a major role in agriculture and has potentials to reduce poverty among smallholder farming households in sub-Saharan Africa.[6] Cassava production is a major source of income and employment for rural dwellers in Nigeria.[7] Agricultural production in Nigeria is dominated by smallholder farming systems with cassava farms dominated by small-scale farmers who accounted for about 95% of total production.[8] The smallholder cassava farmers belong to the poorest segment of the population and cannot invest much on their cassava farms.[9] Cassava has certain inherent characteristics which make its cultivation attractive to small-scale farmers. Cassava has inherent traits of the ability to thrive on soils where other crops failed, grow on marginal soils, the crop can withstand stress such as pests, diseases, and drought, cassava is available all the year round, very cheap to cultivate, it generates income for small-scale peasant farmers hence provide household food security.[10] Cassava has capacity to produce in poor environments, as they can grow on poor soils and low rainfall. Cassava can be produced with minimum inputs, but it can produce substantially with more fertilizers and better management production.[11] Cassava production is characterized with small-scale traditional farming methods with low level of mechanization, using crude implements and is faced with low productivity. Cassava production is faced with relatively high production cost, low yield, and poor production price.[12] The problem of small scale agriculture in Nigeria is over dependence on traditional technologies which are characterized by inefficiency and poor yield. Small-scale farmers who produce the bulk of cassava are economically inefficient in terms of management of resources. Small scale farmers must be aided by efficient and effective use of available production resources to increase productivity, produce higher profitability, and to reach optimal production above subsistence level. Technical efficiency refers to ability of cassava farmers to get maximum output out of a given set of resource input. Technical efficiency is regarded as an important determinant of productivity growth and international competitiveness in any economy.[2] Measuring efficiency of cassava producers will be of advantages firstly help in the formulations of economic policies that will improve producers' efficiency and output in general. Second, improve technical efficiency helps to increase the levels of income through increased profits and help reduce poverty. Third, technical efficiency will provide guidelines for government on how to improve output of cassava farmers.

Objectives of the Study

This study evaluated technical efficiency and profitability analysis of cassava (*Manihot* species) production among small-scale farmers in Federal Capital Territory, Nigeria. Specifically, the objectives were as follows:

1. Determine the socioeconomic profiles of cassava producers
2. Analyze the profitability of cassava production
3. Evaluate socioeconomic factors influencing technical efficiency of cassava production, and
4. Determine the constraints facing cassava producers in the study area.

METHODOLOGY

This study was conducted in Abuja, Nigeria. It occupies between Latitudes 9° 4′20″ North and Longitudes 7° 29′28″ East. Abuja has population of about 3,464, 000 people in 2021. The area experienced three weather conditions in a year. The weather conditions are: dry season, wet season, and Harmattan period, the Harmattan period is very brief and comes in between the dry and wet seasons. Indigenes of the area are small-scale farmers; they grow crops and also engaged in rearing animals. Crops grown include: cassava, soyabeans, maize, sorghum, millet, beans, rice, yam, and groundnut. Animal kept include: goats, sheeps, rabbit, turkey, and cattle. Multistage sampling technique was used. One hundred cassava producers were selected. Primary data were used. Data were obtained through well-designed and well-structured questionnaire. Data were analyzed using the following tools:

Descriptive Statistics

Data collected from field survey on cassava producers were summarized through the use of mean, frequency distributions, and percentages. Descriptive statistics was used to summarize the socioeconomic characteristics of cassava producers as stated in specific objectives one (i).

Farm Budgetary Technique

Gross margin and net farm income analysis of cassava production was estimated using the following models:

$$GM = TR - TVC \quad (1)$$

$$GM = \sum_{j=1}^{n} P_i Q_i - \sum_{j=1}^{m} P_j X_j \quad (2)$$

$$NFI = TR - TC \quad (3)$$

$$NFI = \sum_{i=1}^{n} P_i Q_i - \left[\sum_{j=1}^{m} P_j X_j + \sum_{k=1}^{k} GK \right] \quad (4)$$

Where
P_i = Price of Cassava $\left(\frac{N}{Kg}\right)$
Q_i = Quantity of Cassava (Kg),
P_j = Price of Variable Inputs $\left(\frac{N}{Unit}\right)$
X_j = Quantity of Variable Inputs (Units),
TR = Total Revenue obtained from Sales from Cassava (N),
TVC = Total Variable Cost (N),

GK = Cost of all Fixed Inputs (Naira)

NFI = Net Farm Income (Naira)

The farm budgetary technique was used to analyze the profitability of cassava production as stated in specific objective two (ii).

Financial Analysis

According to Alabi *et al*.,[13] gross margin ratio is defined as:

$$\text{Gross margin ratio} = \frac{\text{Gross margin}}{\text{Total tevenue}} \quad (5)$$

According to Olukosi and Erhabor,[14] operating ratio (OR) is defined as:

$$\text{Operating ratio} = \frac{TVC}{GI} \quad (6)$$

Where,
TVC = Total Variable Cost (Naira),
GI = Gross Income (Naira),

The financial analysis was used to analyze the profitability of cassava production as stated in specific objective two (ii).

Stochastic Production Frontier Model

According to Alabi *et al*.,[15] the stochastic production frontier model is stated thus:

$$Y_i = f\left(X_i, \beta_i\right)e^{v_i - u_i} \quad (7)$$

$$l_nY = \beta_0 + \beta_1 l_n X_1 + \beta_2 l_n X_2 + \beta_3 l_n X_3 + \beta_4 l_n X_4 + \beta_5 l_n X_5 + V_i - U_i \quad (8)$$

Where,
Y_i = Output of Cassava (kg)
X_i =Vectors of Factor Inputs
β_i =Vectors of Parameters
V_i = Random Variations in Cassava Output
U_i = Error Term due to Technical Inefficiency
X_1 = Farm Size (ha)
X_2 = Fertilizer-Input in kg
X_3 = Cassava Cuttings in kg
X_4 = Chemical-Input in liter
X_5 = Labor-Input in man-days

$$U_i = \alpha_0 + \alpha_1 Z_1 + \alpha_2 Z_2 + \alpha_3 Z_3 + \alpha_4 Z_4 + \alpha_5 Z_5 + \alpha_6 Z_6 \quad (9)$$

where,
Z_1 = Age in years
Z_2 = Gender (Dummy; 1, male; 0, otherwise)
Z_3 = Educational Level Attained (Likert; 0, non-formal; 1, primary; 2, secondary; 3, tertiary)
Z_4 = Marital Status (Dummy; 1, married; 0, otherwise)
Z_5 = Size of Household (number)
Z_6 = Experience in Farming (years)
α_0 = Constant Term
$\alpha_1 - \alpha_6$ = Parameters to be Estimated
U_i = Error Term due to Technical Inefficiency.

Cost Saving Formula

The cost saving formula for average technical efficient (ATE) cassava producers and most technical inefficient or least technical efficient (MTI) cassava producers is stated as:

$$\text{Cost Savings} = \left[\left[1 - \frac{\text{ATES or MTIS}}{\text{MaxTES}}\right] \times 100\right] \quad (10)$$

Where,
ATES = Average Technical Efficiency Score (Units)
MTIS = Most Technical Inefficiency Score (Units)
MaxTES = Maximum Technical Efficiency Score (Units)

This will be used specifically to achieve objective three (iii) which is to evaluate socioeconomic factors influencing technical efficiency of cassava production.

Principal Component Analysis

The constraints facing cassava producers and militating against cassava production were subjected to principal component analysis. This was used to achieve specific objective four (iv).

RESULTS AND DISCUSSION

Socioeconomic Profiles or Characteristics of Small-scale Cassava Producers

The socioeconomic profiles or characteristics of small-scale cassava producers under consideration were as follows: marital status, age, level of education, household size, farming experience, extension contact, memberships of cooperatives, and farm size [Table 1]. About 58% of small-scale cassava producers were married, 17% were single, while 25% were

Table 1: Socioeconomic profiles of small-scale cassava producers

Variables	Frequency (%)
Marital status	
Single	17 (17.00)
Divorced	25 (25.00)
Married	58 (58.00)
Age (years)	
31–40	27 (27.00)
41–50	51 (51.00)
51–60	22 (22.00)
Mean	45.00
Level of education	
Non-formal	22 (22.00)
Tertiary	9 (9.00)
Secondary	49 (49.00)
Primary	20 (20.00)
Household size (units)	
1–5	37 (37.00)
6–10	58 (58.00)
11–15	5 (5.00)
Mean	6.00
Farming experience (years)	
1–5	44 (44.00)
6–10	37 (37.00)
11–15	12 (12.00)
16–20	7 (7.00)
Mean	7.10
Extension contact	
Yes	54 (54.00)
No	46 (46.00)
Memberships of cooperative	
Yes	57 (57.00)
No	43 (43.00)
Farm size (hectares)	
<1.0	36 (36.00)
−2.0	40 (40.00)
2.1–3.0	19 (19.00)
3.1–4.0	5 (5.00)
Mean	1.46
Total	100 (100.00)

Source: Field survey (2021)

divorced.[12] Oyibo reported that the need to provide for the family upkeep explains why farming is dominated by married households.[16] Adesehinwa stated that marital status is an important socio-economic factor to farmers because it determines the status of family responsibilities. Furthermore, 78% of cassava producers were <50 years of age. This mean age of small-scale cassava producers was 45 years. This suggests that the small-scale cassava producers were young, agile, active, energetic, and resourceful. They will be able to adopt innovations, new ideas, research findings, and new farming technologies that can increase productivity and efficiency among cassava producers. About 78% of small-scale cassava producers had formal education and were literate. The various levels of formal education of cassava producers include primary education (20%), secondary (49%), and tertiary education (09%). In addition, about 22% of cassava producers had non-formal education. According to Alabi and Safugha[17] who reported that education increase cassava producers' understanding and knowledge of new farm technologies, and it is an important and significant factor that facilitates adoption of improved farm technologies among cassava producers. Furthermore,[6] reiterated that education of cassava producers will reduce technical inefficiency, as educated cassava producers would find it easier to read and understand information about cassava production technologies and farm practices.[10] Akerele reported that education of smallholder farmers is of great importance in decision making, education can improve farmers' ability to read and understand activities of cassava production and ways to maximize gains. Through education the quality of labor is improved and there is increased propensity to adopt new farm techniques. The household sizes of small-scale cassava producers were large. Averagely, there are six people per cassava farming household. About 37% of small-scale cassava producers had <5 people per farming household. Furthermore, 58% of cassava producers had between six and ten people per household. Edet-George and Enimu,[19] household size is the major determinants of labor availability especially in smallholder, small-scale farm production given the relative high cost of hired labor. Majority (81%) of small-scale cassava producers had between 1 and 10 years farming experience; also, 12% of small-scale cassava producers had between 6 and 10 years' experience in farming. Farming experience is used a measure of management ability, the more experienced the cassava farmers is the more his ability to make farm decisions. According to Alabi and Safugha,[17] farmers with long years of experience in cassava production would be more acquaints with the constraints and this would increase cassava farmers' level of acceptance of research findings, new ideas, and innovations of overcoming the problems. About 54% of cassava producers had contact with extension officers, while 46% of cassava producers had no contact with extension officers. The interaction with extension officers affects positively the use of better production technologies by cassava producers. Furthermore, 57% of cassava farmers belong to members of cooperative organization. In addition, 43% of cassava producers do not belong to any cooperative organization. Memberships of cooperatives afford the cassava producers the opportunity to access credit in group, bulk purchase farm inputs, and jointly sold farm produce in bulk. The mean farm size was 1.46 hectares. About 76% of farmers had <2 hectares of cassava farm land. This connotes that farmers are smallholder cassava producers, with relatively small farm holdings and thereby were small-scale farmers.

Profitability Analysis of Small-scale Cassava Production Per Hectare

The costs, returns, and profitability of small-scale cassava production per hectare are presented in Table 2. The various costs incurred and revenue obtained of small-scale cassava production was based on prevailing market price as at the time of the survey. The total variable cost (TVC) was calculated at 152 340 Naira per hectare and this accounted for 89.17% of total cost of cassava production per hectare. The TVC consists of cassava cuttings (02.93%), fertilizer input (16.68%), insecticides (05.97%), herbicides (04.98%), and labor cost (58.60%). The fixed cost was calculated at 18,500 Naira per hectare, and this accounted for 10.83% of total cost of cassava production per hectare. The total cost, gross margin, and net farm income per hectare basis were estimated at ₦ 170 840, ₦ 297 660, and ₦ 279 160, respectively. This shows that cassava production in the study area was profitable and worthwhile. The gross margin ratio was 0.66, this signifies that for every one Naira invested in cassava production 66 kobo covered taxes, profits, interest, expenses, and depreciation. According to Alabi and Safugha,[17] the operating ratio was used to measure financial position and operating efficiency of cassava enterprise per hectare. It is worthwhile and preferable to have low values of operating ratio for cassava enterprise. The operating ratio was calculated at 0.51, this connotes that 51% of returns from cassava products was used to cover cost incurred in sales of cassava products and other operating expenses.

Table 2: Profitability analysis of small-scale cassava production per hectare

Items	Amount (Naira)	Percentage of total cost
Total revenue/gross income	450,000	
Variable cost		
Cassava cuttings	5000	2.93
Fertilizer input	28,500	16.68
Insecticides	10,200	5.97
Herbicides	8500	4.98
Labor cost		
Land clearing and preparation	20,500	11.99
Planting	12,100	7.08
Weeding	15,400	9.01
Fertilizer application	8340	4.88
Chemical application	6100	3.57
Harvesting	16,700	9.78
Transportation	18,500	10.83
Loading and offloading	2500	1.46
Total labor cost	100,140	58.60
Total variable cost	152,340	89.17
Fixed cost		
Estimated depreciation value on tools (hoes, machetes)	1700	0.99
Rent on land	16,800	9.83
Total fixed cost	18,500	10.83
Total cost	170,840	100.00
Gross margin	297,660	
GMR	0.66	
NFI	279,160	
OR	0.51	

Source: Field survey (2021). OR: Operating ratio, NFI: Net farm income, GMR: Gross margin ratio

Factors Influencing Output of Small-scale Cassava Production in the Study Area

Table 3 presented the results of the maximum likelihood estimates of the stochastic frontier model for factors influencing output of small-scale cassava production in the study area. The predictors under consideration in the model include: farm size, fertilizer input, cassava cuttings, chemical input, and labor input. The statistical and significant predictors included in the stochastic frontier model were: farm size ($P < 0.05$), cassava cuttings ($P < 0.01$), and labor input ($P < 0.10$). All the predictors included in the stochastic production frontier model had positive coefficients. The coefficient of farm size (0.214) was statistically significant at ($P < 0.05$). A 1% increase in hectares of farm size used in cassava production will lead to 21.4% increase in output of small-scale cassava production. All the regression coefficients in the technical efficiency component of the stochastic frontier production model were the elasticities of production, the summation of elasticities of production gave the return to scale. The return to scale was estimated at 1.069, this connotes increasing return to scale, and this implies that any additional inputs included in the stochastic production frontier model will lead to more than proportionate increase in output of small-scale cassava production in the study area. The diagnostic statistics show that the coefficient of sigma square σ^2 was 1.7011 and it is statistically significant and different from zero at ($P < 0.01$). This connotes good fit and the correctness of the specified distributed assumption of the composed error term. The variance ratio (gamma value) of 0.7721 was statistically significant and different from zero at ($P < 0.01$), this implies that 77.21% of variations in output of small-scale cassava producers were attributed to technical inefficiency during the production. The log likelihood function of −327.12 implies that inefficiency exists in the data set.

Table 3: Maximum likelihood results of the stochastic frontier production model

Variables	Parameters	Coefficient	SE	t
Constant	β_0	2.630*	1.206	2.18
Farm size	β_1	0.214**	0.079	2.71
Fertilizer-input	β_2	0.172	0.142	1.21
Cassava cuttings	β_3	0.232***	0.064	3.61
Chemical-input	β_4	0.231	0.228	1.01
Labor input	β_5	0.220*	0.099	2.21
RTS		1.069		
Inefficiency component				
Constant	α_0	0.321*	0.141	2.27
Age	α_1	−0.171*	0.069	−2.46
Gender	α_2	−0.104	0.095	−1.09
Educational level	α_3	−0.238**	0.088	−2.70
Marital status	α_4	−0.201	0.197	−1.02
Size of household	α_5	−0.131	0.116	−1.13
Experience in farming	α_6	−0.234**	0.089	−2.61
Diagnostic statistics				
Total variance	σ_2	1.7011***		
Variance ratio	Γ	0.7721		
Log-likelihood		−327.12		
Likelihood ratio test		328.31		

*Significant at ($P < 0.10$), **Significant at ($P < 0.05$), ***Significant at ($P < 0.01$). Source: Data analysis (2021). SE: Standard error, RTS: Return to scale

Socioeconomic Factors Influencing Technical Efficiency of Small-scale Cassava Production

Table 3 also presented the results of the maximum likelihood estimates of the stochastic frontier model for socioeconomic factors influencing technical efficiency of small-scale cassava production in the study area. In the technical inefficiency component, the socioeconomic factors included in the stochastic frontier production model under consideration were as follows: age gender, educational level, marital status, size of households, and experience in farming. The statistical and significant socioeconomics factors influencing technical efficiency include: age ($P < 0.10$), educational level ($P < 0.05$), and experience in farming ($P < 0.05$). All the socioeconomic factors in the technical inefficiency component had negative coefficients that this signifies decrease in technical inefficiency. The coefficient of educational level (−0.238) was statistical significant at ($P < 0.05$). As small-scale cassava producers acquired an additional education that this will lead to 23.8% decrease in technical inefficiency of cassava production.

Technical Efficiency Scores of Small-scale Cassava Producers in the Study Area

Table 4 shows the summary statistics of technical efficiency scores of small-scale cassava producers. Majority (64%) of cassava producers were between 21 and 60% efficiency levels, this implies that most farmers were average technically efficient. The mean technical efficiency was 40.18% leaving a gap of 59.82% for improvement. In addition, the least technical efficiency score was 11.0%, while the best performing small-scale cassava farm had the maximum technical efficiency of 81.0%. If the average cassava producers were to achieve the level of technical efficiency like most of its efficient counterparts, then the average small-scale cassava producers could make 50.39% cost savings calculated as $\left[\left[1-\frac{40.18}{81.00}\right]\times 100\right]$. The calculated value for the most

Table 4: Summary statistics of technical efficiency scores

Efficiency score	Frequency (%)
0.00–0.20	24 (24.00)
0.21–0.40	21 (21.00)
0.41–0.60	43 (43.00)
0.61–0.80	6 (6.00)
0.81–1.00	6 (6.00)
Mean	0.4018
SD	0.2227
Minimum	0.11
Maximum	0.81

Source: Field survey (2021). SD: Standard deviation

Table 5: Principal component model of constraints encountered small-scale cassava producers

Constraints	Eigen-value	Difference	Proportion	Cumulative
Lack of credit facilities	1.821	0.201	0.1731	0.1731
Inadequate extension services	1.709	0.306	0.1628	0.3359
Bad road infrastructures	1.589	0.219	0.1527	0.4886
High labor cost	1.422	0.209	0.1508	0.6396
High cost of farm input	1.389	0.392	0.1452	0.7848
Bartlett test of sphericity				
χ^2	793.01***			
KMO	0.7107			
Rho	1.00000			

***Significant at 1% probability level. Source: Computed from data analysis (2021)

technically inefficient small-scale cassava producers reveal a cost savings of 86.42% calculated as $\left[\left[1-\frac{11.0}{81.0}\right]\times 100\right]$.

Constraints Facing Small-scale Cassava Producers in the Study Area

The constraints facing small-scale cassava producers were subjected to principal component analysis [Table 5]. The constraints facing small-scale cassava producers retained by the model include: lack of credit facilities (Eigen-value = 1.821), inadequate extension services (Eigen-value = 1. 709), bad road infrastructures (Eigen-value = 1. 589), high labor cost (Eigen-value = 1. 422), and high cost of farm input (Eigen-value = 1. 389). The lack of credit facilities faced by cassava producers was ranked 1st among the constraints, and this explained 17.31% of all constraints retained by the model. Inadequate extension service was ranked 2nd, and this explained 16.28% of all constrained retained by the principal component model. Bad road infrastructure was ranked 3rd, and this explained 15.27% of all constraints retained by the principal component model. All the constraints retained by the model with Eigen-values greater than one explained 78.48% of all constraints included in the model. The Chi-square value of 793.01 was statistically significant at ($P < 0.01$).

CONCLUSION AND RECOMMENDATIONS

This study has established that small-scale cassava production is profitable and worthwhile enterprise in the study area. The small-scale cassava producers were young, active, energetic, and resourceful. The household sizes were large and they had formal education and were literate. The TVC accounted for 89.17% of the total cost of small-scale cassava production per hectare. The gross margin and net farm income of small-scale cassava production per hectare were ₦ 297, 660 and ₦ 279,160, respectively. Farm size, cassava cuttings, and labor input were the statistical and significant factors influencing output of small-scale cassava production in the study area. Age, educational level, and experience in cassava farming were the statistical and significant predictors influencing technical efficiency of cassava production in the study area. The least and maximum technical efficiency scores of small-scale cassava producers were 0.11 and 0.80, respectively. The constraints facing small-scale cassava producers were as follows: lack of credit facilities, inadequate extension services, bad road infrastructures, high labor costs, and high cost of farm inputs. Based on the findings, the following recommendations were made:

i. Farm inputs like improved cassava cuttings, chemical inputs should be made available for small-scale cassava producers to increase productivity
ii. Extension officers be made employed and made available to disseminate research findings, innovations, and new ideas to small-scale cassava producers
iii. Feeder roads should be constructed for easy evacuation of cassava products from producing areas to nearby markets
iv. Credit facilities at low interest rate should be made available and easily accessible to small-scale cassava producers.

REFERENCES

1. Makinde YO, Balogun OL, Bello AT, Afodu OJ. Technical efficiency among cassava farmers in ikenne local government area of Ogun State, Nigeria. Ethiopian J Environ Stud Manage 2015;8:342-50.
2. Ogunniyi LT, Ajetomobi JO, Fabiyi YL. Technical Efficiency of cassava-based cropping in Oyo State of Nigeria. Agris Online Econ Inform 2013;5:51-9.
3. CBN Central Bank of Nigeria. Welcome address presented by central bank governor. In: Emefiele GI. editor. (CON) At the Meeting with State Governors of Cassava Producing States and Signing of the Memorandum of Understanding between Nigeria Cassava Growers Association and Large Scale Cassava Processors. Abuja: CBN; 2019.
4. Knipscheer H, Ezedinma C, Kormawa P, Asumugha G, Makinde K, Okechukwu R, *et al*. Opportunity in the Industrial

Cassava Market in Nigeria. Nigeria: International Institute for Tropical Agriculture (IITA); 2007.
5. Food and Agriculture Organization. Data Base. Rome, Italy: Food and Agriculture Organization; 2021.
6. Osun T, Ogundijo SD, Bolarinwa KO. Technical efficiency analysis of cassava production in Nigeria: Implication for increased productivity and competitiveness. Res J Agric Environ Manage 2014;3:569-76.
7. Itam KO, Ajah EA, Ofem UI, Abam OE. Technical efficiency analysis of smallscale cassava farmers in cross River State, Nigeria: A stochastic production frontier approach. Appl Econ Finance 2015;2:10-8.
8. Olujenyo FO. The determinants of agricultural production and profitability in Akoko Land, Ondo State, Nigeria. J Soc Sci 2008;4:37-41.
9. Asogwa BC, Umeh JC, Ater PI. Technical Efficiency Analysis of Nigerian Cassava Farmers: A Guide for Food Security Policy. In: Paper Presentation at the International Association of Agricultural Economists Conference, Gold Coast, Australia; 2006.
10. Akerele EO, Odujukan DM, Yangomodou OD, Olugbemi MT, Solana OI, Ilori AR, *et al*. Productivity and technical efficiency of cassava production in Ogun State, Nigeria. IOSR J Agric Vet Sci 2019;12:33-40.
11. Gbigbi TM. Technical efficiency and profitability of cassava production in Delta State: A stochastic frontier production function analysis. J Tekirdag Agric Faculty 2021;18:21-31.
12. Oyibo A, Oyibo MN, Iyegbuniwe HO, Uchegbu FU. Technical efficiency of cassava smallholder farmers in Oshimili South Local government Area, Delta State, Nigeria. Int J Innov Agric Biol Res 2021;9:11-9.
13. Alabi OO, Oladele AO, Oladele NO. Economic market decisions among marginal maize farmers in Abuja, Nigeria: Applications of double hurdle model and factor analysis. Russian J Agric Soc Econ Sci 2020;8:114-25.
14. Olukosi JO, Erhabor PO. Introduction to Farm Management Economics: Principles and Applications. Zaria, Kaduna: Agitab Publishers Limited; 2015. p. 77-83.
15. Alabi OO, Oladele AO, Maharazu I. Economies of scale and technical efficiency of smallholder pepper (*Capsicum* species) production in Abuja, Nigeria. J Agric Sci 2022;67:63-82.
16. Adesehinwa AO, Okunola JO, Adewumi MK. Socio-economic characteristics of ruminant livestock farmers and their production constraints in South-Western Nigeria. Livestock Res Rural Dev 2004;16:1-11.
17. Alabi OO, Safugha GF. Determinants of output of cassava (*Manihot* species) production in Abuja, Nigeria. Am Int J Agric Stud 2022;6:20-5.
18. Olukosi JO, Erhabor PO. Introduction to Farm Management Economics: Principles and Applications. Zaria Nigeria: Ndahi Press; 2005. 114.
19. Edet-George O, Enimu S. Analysis of factors affecting technical efficiency of cassava producers in Delta State, Nigeria. Direct Res J Agric Food Sci 2020;8:6-11.