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TECHNICAL EFFICIENCY OF CASSAVA FARMERS IN EKITI STATE, NIGERIA

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Abstract: This study measured the technical efficiency of cassava farmers in Ekiti State, Nigeria. A multi-stage sampling technique was employed to select 120 respondents for the study. Primary data were collected from the randomly selected respondents through a well-structured and self-administered questionnaire. The results of the study indicated that more than half (52.5%) of the cassava farmers were older than 50 years of age and had household sizes within the range of 6-10 persons. About 51.6 percent of the respondents had more than a primary school education. No difference existed between those with tertiary education and those without formal education in terms of the farm size (4.00 ha) cultivated. The use of combined labour (family and hired labour) was prevalent among the farmers as submitted by 65.8 percent of the cassava farmers. Results from the Stochastic Frontier Production Function (SFPF) model indicated that the cost of cassava stem, depreciation value of tools, cost of fertilizer used and farm size was significantly different from zero and of importance in the production of cassava. Also, the year of formal education, farming experience, marital status and the number of extension visits were the major socio-economic characteristics affecting the technical inefficiency of the cassava farmers. Essentially, the technical efficiency of cassava farmers ranges between 0.334 and 0.972 with a mean value of 0.790. This shows that on average, farmers were able to obtain about 80% of potential output from a given set of inputs. For technical efficiency to be improved in the study area, the year of formal education and farming experience should be considered by policymakers. Also, more extension services should be made available to the farmers.
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Introduction

Agriculture was the backbone of Nigeria's economy before the major shift to oil exploration (Imiti & Odjebor, 2022). Agriculture, between 1960 and 1969, contributed not less than an average of 57% of the GDP and 64.5% of the export earnings (Abubakar & Ibrahim, 2019). However, the contribution of the sector to the nation's economy steadily declined from 1970 to the late 2000s (National Bureau of Statistics, 2016). From 2011 to 2014, the contribution of the sector to Nigeria's economy stood at an average of 23.5% of GDP and 5.1% of export earnings. And in 2016, agriculture made up 24.4% of the GDP and 4.8% of the foreign earnings (PWC, 2016).

Observing this dwindling trend in the impact of agriculture on the nation's economy (Michael, 2017) and the recent global fall in crude oil prices (Solaymani, 2019), resulting in decreasing contributions of crude oil to export earnings, the Federal Government and other stakeholders have begun generating conversations about the major role agriculture has to play in expanding and revamping Nigeria's economy. To make a significant improvement in this sector, the focus must largely be on crop production which accounts for 90% of the total agricultural output (Odetola & Etumnu, 2013). Nigeria is blessed and great agricultural potential with not less than 82.0 million hectares of arable land out of a total land mass of 92.4 million hectares she possesses (Adeoye & Iwegbu, 2020). Of these arable hectares, only 34 million hectares have hitherto been cultivated.

To accomplish the necessary growth desired for agriculture, there are only two ways out: an increase in yield per hectare; and an expansion of land for production (Fugile and Rada, 2013). So far, in Nigeria, land expansion has been the main driver of growth in agriculture. Yield per hectare, receiving low attention, has been generally and persistently small due to meagre and inadequate farming inputs which include seedlings, fertilisers and pesticides (PWC, 2016).

Cassava, which is one of the top 5 agricultural products in Nigeria and also the focus of this study, has persistently witnessed low output despite the growing amount of hectares dedicated to its production (Oluwafemi, Omonona and Adepoju, 2019). The nation's cassava production is reported lower than the global average yield of all producing countries in 2014 (Akinwumiju, Adelodun, and Orimoogunje, 2020). This calls for a reflection of what may be constituting bottlenecks to cassava production in the country. This study, therefore, examined the technical efficiency of cassava farmers in Ekiti State, Nigeria. To unravel this, the study specifically:

i. identified the socio-economic characteristics of the farmers;
ii. examined the technologies available to the farmers in the study area;
iii. estimated the technical efficiency of the cassava farmers; and
iv. examined the factors determining the technical efficiency of cassava farmers.

Methodology

The study focused on farmers who cultivate cassava in Ekiti- State. A multi-stage sampling technique was employed to select the respondents for the study. In the first stage, 4 Local Government Areas were randomly selected. The second stage involved the random selection of 3 local communities from each Local Government Area communities. The final stage involved the random selection of 10 farmers from each of the 12 local communities, to make a total of 120 respondents. It is quite important to emphasize that personal administration and collection of relevant information were undertaken so that important and genuine information was collected. In this case too, oral interview, personal observation and estimates were applied and notes were taken on comments and other contextual events.

Descriptive statistical tools such as frequency counts, percentages, tables and mean were used to describe the socio-economic characteristics of the cassava farmers, the technologies available to the farmers and the factors militating against the production of cassava in the study area. While Stochastic production frontier was employed to estimate the technical efficiency and the determinants of the technical efficiency of the cassava farmers.

For this study, the model was assumed to be of the Cobb Douglas form following Battese and Coeli (1995).

Model Specification

The implicit form is given as

$Y = F(X1 \ldots \ldots \ldots .. Xn, Ui)$

$Where\ Y = value\ of\ cassava\ output\ (₦)$

$Ui = error\ term$

$Xi - Xn = variables$

$The\ above\ will\ be\ utilized\ explicitly\ as$

$$InY1 = \beta0 + \beta1InX1 + \beta2InX2 + \beta3InX3 + \beta4InX4 + \beta5InX5 + \beta6InX6$$

$Where\ Y1 = value\ of\ cassava\ output\ (₦)$

$X1 = value\ of\ cassava\ stem\ used\ (₦)$

$X2 = labour\ used\ (Man - days)$

$X3 = Herbicides\ and\ pesticide\ used\ (₦)$

$X4 = Farm\ size (Hectares)$

$X5 = Fertilizer\ used\ (₦)$

$X6 = Farm\ tools\ used\ (₦)$

$\beta1 - \beta6 = Parameters\ to\ be\ estimated$

$Also\ inefficiency\ model\ (Ui) is\ shown\ as$

$$Ui = \delta0 + \delta1Z1 + \delta2Z2 + \delta3Z3 + \delta4Z4 + \delta5Z5 + \delta6Z6$$

$Where,$

$ui = technical\ efficiency\ of\ the\ ith\ farmers$

$\delta's = Unknown\ scalar\ parameters\ to\ be\ estimated$

$Z1 = Marital\ status$

$Z2 = Age (years)$

$Z3 = Farming\ experience\ (years)$

$Z4 = Extension\ visit\ (numbers)$

$Z5 = Educational\ status\ (years)$

$Z6 = Household\ size$

Results and discussion

The results in Table 1 show the distribution of cassava farmers by their socioeconomic characteristics. The results revealed that 91.7 percent of the cassava farmers were married, and 52.5 percent of the respondents fell into the age group of 51 and above with mean age of 53 years. This implies that farmers were still in their active years and this is expected to enhance better productivity. More than half (54.2%) of the respondents had household sizes between 6 and 10 members with a mean family size of 6 persons. The educational background of the cassava farmers shows that the majority (84.2%) of the farmers were literate, while only 15.8 percent were illiterate. This indicates that the farmers in the study area were more enlightened and know how to source land and this is expected to enhance higher productivity. Most (55.8%) of the farmers had a farming experience of more than 10 years with mean farming years of experience of 15 years. About 80 percent of the cassava farmers practised mixed cropping while only 20 percent practised sole cropping. The table further revealed that 62.5 percent owned land through inheritance. This was expected to reduce the cost of production as less was spent on land acquisition. The mean farm size was 4.8 hectares, and 51.7% of the farmers had access to more than 4.0 hectares of land. 35.8 percent of the farmers planted a mixture of local and improved varieties of cassava on their farmlands, while 30.8 percent of the farmers planted improved varieties and 33.3 percent still stuck to the cultivation of the local variety even though the yield from this variety was not as high as the yields from the improved varieties. Not less than 47.5 percent of the farmers got their planting materials from the Agricultural Development Programme (ADPs) Zones. This was because the ADP Zones are sited close to the rural farmers in their various localities, which has enhanced the extension agents' contacts with a high percentage of the local farmers as they held meetings with them fortnightly. Meanwhile, none of the farmers obtained their planting materials from the research station; this was a result of the exceeding great gap existing between local farmers and the research station in terms of new findings.

Socioeconomic characteristics of the respondents

Variables	Frequency	Percentage	Mean
Marital Status			
Single	10	8.3	
Married	110	91.7	
Class of Age (Years)			
20-30	4	3.3	
31-40	23	19.2	53 years
41-50	30	25.0	
> 51	63	52.5	
Class of Family Size			
5 or less	53	44.1	
6-10	65	54.2	6 persons
11 or more	2	1.7	
Level of Education			
No formal education	19	15.8	
Primary level	39	32.6	
Secondary level	55	45.8	
Tertiary level	7	5.8	
Farming Experience			
10 or less	53	44.2	
11-20	34	28.3	15 years
21-30	27	22.5	
31or more	6	5.0	
Cropping Pattern			
Mixed cropping	96	80.0	
Sole cropping	24	20.0	
Source of Land			
Leased	13	10.8	
Rent	15	12.5	
Inheritance	75	62.5	
Outright purchase	15	12.2	
Gift	2	1.7	
Farm Size(Ha)			
0.1-1.0	26	21.7	
1.1-2.0	14	11.7	
2.1-3.0	9	7.5	4.8 Hectares
3.1-4.0	9	7.5	
4.1 or more	62	51.7	
Variety planted			
Local Variety	40	33.3	
Improved Variety	37	30.8	
Both	43	35.8	

Source of planting materials		
Research Stations	0	0
ADP	57	47.5
Local Markets	25	20.8
Others(previously cultivated	5	4.2
Farmlands, friends		
and relatives)	33	27.5

Source: Field survey, 2019

Table 2 shows that the majority (91.7%) of the farmers used the traditional method, while 7.5 percent combined the use of the tractor and other simple tools for their farming operations. The findings revealed that simple tools such as cutlass, hoe, etc. were predominantly used by the farmers. This could be a result of the high cost of mechanized farming in the area, it could also be related to a lack of awareness about the advantage of mechanized farming. About 65.8percent of the farmers in the study area made use of both hired and family labour as manpower for their tedious works such as ridging, weeding and sometimes harvesting for farmers who cultivated large areas of land, 14.2 percent made use of family labour only as the use of family labour solely is subjected to household size and farm size, but only 20.0 percent of the farmers hired labour for all their farming activities. Regarding herbicides and pesticide usage, 81.7 percent of the farmers did not use herbicides and pesticides while only 81.7 percent used them. This implies that farmers in the study area predominantly practised traditional methods. More so, the results revealed that the majority (83.0%) of the farmers did not use fertilizer.

Table 2: Technology Available to the Farmers

Variables	Frequency	Percentages
Farming Methods Used		
Traditional Methods	110	91.7
Mechanical Methods	1	0.8
Both	9	7.5
Type of Labour Used		
Family Labour	17	14.2
Hired Labour	24	20.0
Both	79	65.8
Herbicide and Pesticide Usage		
Non Usage	98	81.7
Usage	22	18.3
Fertilizer Usage		
No Fertilizer Use	100	83.3
Fertilizer Use	20	16.7

Source: Field survey, 2019

Technical Efficiency Analysis

The estimates of the Stochastic Frontier Production Function (SFPF) for cassava farms are shown in Table 3; from the table, the sigma-square (δ^2) of 0.215 was significantly different from zero at 1% level of significance. This indicates a good fit of the model and the correctness of the specified distribution assumption of the composite error term (U_i) as shown by a gamma (γ) value of 0.296 which was significant at 1% level of significance. This implies that about 29 percent variation in the value of cassava output was due mainly to the difference in their technical efficiencies or technical inefficiencies, while the remaining 71 percent can be attributed to random errors. The table indicates the Maximum Likelihood Estimates (MLE) for each of the variables that contribute to the efficiency and inefficiency of the households and how efficient or otherwise the farmers are in the use of these variables. According to Table 3, the estimated coefficients of the cost of planting material and the depreciated value of tools were significant at 5 percent while that of fertilizer and farm size were significant at a 1 percent level of significance. This shows that these four inputs were significantly different from zero and of importance in the production of cassava in the study area.

To improve the efficiency of production, there is a need to examine the factors that cause inefficiency. Explanations are provided for the relative efficiency levels among farmers through the estimated coefficient of the inefficiency model.

From Table 3, it can be deduced that years of farming experience was significant at a 5 percent level of significance, marital status and times of extension visit significant at 1 percent, while that of years of formal education was significant at 10 percent . This indicates that these four variables were the major socio-economic factors that affect the technical inefficiency of cassava farmers in the study area. Other variables such as age and household size were not significantly different from zero at 1 percent, 5 percent or 10 percent levels of significance. The estimated coefficient for household size was positively related to technical inefficiency. This implies that as household size increases (decreases), technical inefficiency increases (decreases) and this leads to a reduction (increase) in technical efficiency. This conforms with the findings of Muhammed-Lawal *et al*. (2009). This may happen when most of the farming household members are very young and their effects in terms of labour provision have not been felt in cassava production.

Table 3: Maximum –likelihood estimates of the stochastic Cobb- Douglas production frontier for Ekiti-state cassava farmers

Functions	Parameters	Coefficient	t-value
Production function			
Constant	β_0	12.927*	0.450
Planting material used(₦)	β_1	-0.032**	0.145
Labour used (man/ days)	β_2-	0.004	0.119
Fertilizer used (₦)	β_3	0.032*	0.012
Herbicide and pesticide(₦)	β_4	-0.027***	0.014
Farm size(Hectares)	β_5	0.881*	0.06
Depreciation value of tools	β_6	-0.131**	0.052
Inefficiency model			
Constant	δ_0	0.050	1.356
Extension visit (numbers)	δ_1	-1.602*	0.267
Age(years)	δ_2	0.259	0.346
Years of formal education	δ_3	-0.185***	0.106
Farming experience (years)	δ_4	-0.539**	0.221
Marital status	δ_5	0.772*	0.258
Household size	δ_6	-0.125	0.209
Variance parameters			
Sigma-squared	δ^2	0.215*	0.028
Gamma	γ	0.296*	0.089
Log-likelihood function	L(H)	-65.595	

SOURCE: *Computed from Field Survey Data, 2019*

*** t-values significant at 10%
** t-values significant at 5%
* t-values significant at 1%

Cassava farmer's technical efficiency index

In Table 4 the frequency distribution of technical efficiency indexes shows high technical efficiency variations among the respondents. It can be observed in Table 4, that 7.5 percent has technical indexes between 0.91and1.00. The technical efficiencies (TE) of the cassava farmers range between 0.334 and 0.972 with a mean of 0.790. The number of cassava producers in the study area considered to be technically efficient was about 56.7percent

The mean value of 0.790 indicates that if the technical efficiency of input usage is increased by 0.210 (1-0.790), the farmers will be operating on the production frontier. This shows that on average, farmers were able to obtain about 80 percent of potential output from a given mix of inputs used in the production process. These findings also reveal the presence of technical inefficiencies whose elimination could lead to the improvement of the technical efficiency of cassava producers in Ekiti-State.

Table 4 Distribution of cassava producers' technical efficiency

Efficiency class index	Frequency	Percentage
0.31-0.40	4	3.3
0.41-0.50	8	6.7
0.51-0.60	11	9.2
0.61-0.70	16	13.3
0.71-0.80	13	10.8
0.81-0.90	11	9.2
0.91-1.00	57	47.5
TOTAL	**120**	**100.0**
Mean TE		0.790
Minimum		0.334
Maximum		0.972

SOURCE: Field Survey Data, 2014

Conclusion

The farmers were not relatively efficient in the production of cassava as reflected by the mean TE of 0.790. In addition, the study reveals that there was a presence of technical inefficiency among the farmers as indicated by the gamma (γ) coefficient of 0.296 which indicates that about 29 percent variation in the value of cassava output was due to differences in their technical efficiencies or inefficiencies. Out of the 6 variables, 5 inputs were significantly different from zero and of importance in the production of cassava in the study area. Also, analysis of the technical inefficiency model indicated that years of formal education, extension visit, marital status and farming experience were the main socioeconomic characteristics having a significant influence on the cassava producers' technical inefficiency. It was also observed that about 57% of the farmers had a technical efficiency index between 0.81 and 1.00. The technical efficiencies range between 0.334 and 0.972.

Recommendations

The following recommendations were made based on the findings:

1. Cassava farmers should be enlightened on the usefulness and importance of mechanized farming.
2. Improved inputs such as fertilizers and herbicides should be introduced to the farmers to increase their productivity and reduce the cost of production incurred from traditional farming methods
3. Traditional farming methods should be discouraged by subsidizing modern farming equipment to enable the farmers to afford and access modern farming techniques.

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