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Resource Use Efficiency of Cassava Production in Emohua Local Government Area, Rivers State

Onu C. and Ajie, E. N.,

Department of Agricultural Economics and Extension, Faculty of Agriculture,
Ignatius Ajuru University of Education, Rumuolumeni, Port Harcourt.
Corresponding author's email: onucatherine@gmail.com

Abstract

The study assessed resource use efficiency of Cassava production in Emohua, Emohua Local Government Area of Rivers State. Multistage random sampling technique was used in the selection of 178 cassava farmers being a 5% sampling proportion of all registered Cassava farmers in the study area. The main tool for data collection were copies of well-structured questionnaires. Data collected were analyzed using descriptive statistical tools, maximum likelihood estimate of stochastic frontier production function. Findings revealed mean age to be 45years. The estimated maximum likelihood of stochastic frontier production function of farm size (20.5308), farm labour (3.8348), stem cutting (3.5310) and capital (2.9034) to be the factors influencing production of cassava output and the relationships were statistically significant at 1% level of probability. The inefficiency model, gender (-5.8850), age (-7.0057), marital status (4.5722), education (-3.1887) and farming experience (-6.0829) were found to be statistically significant at 1% level of probability. Household size (-0.5417) was not significant at 1% level of probability. The mean efficiency of the farmers is 0.85. The farmers were operating in the second stage of production, implying decreasing returns to scale. It was therefore recommended that farmers should be encouraged to acquire higher educational qualifications, farmers should be encouraged to form cooperatives with the sole purpose of meeting their financial needs so that they can easily afford inputs to improve their production, the need for training and retraining of farmers for better management skills and abilities should be pioneered by the government.

Key words: Cassava production, Technical efficiency, Resource use efficiency, Profitability.

Introduction: Nigeria is the largest producer of cassava in the world with other top producers being Indonesia, Thailand, the Democratic Republic of Congo and Angola (FAOSTAT, 2012 and FMARD, 2012). It is considered an indispensible food in Nigeria where it plays a vital role in the food security of the rural economy because of its capacity to yield under marginal soil conditions and its tolerance of drought (Gbigbi, 2021). The crop is a major source of calories for two out of every five Nigerians (Makinde, Balogun, Bello and Afodu, 2015). These and other features endowed it with special capacity to bridge the gap in food security, poverty alleviation and environmental protection (Clair and Etukudo, 2002). Ironically, the gap between food production rate and food demand has continued to widen irrespective of the various programmes by government to increase food production and at the same time reduce hunger and poverty (Ajibefun, 2003). Consequently, Nigeria is being enlisted as one of the most food insecure countries (FAO, 2002). For instance, cassava demand outweighs the supply supporting the fact that Nigeria has not been able to attain self-sufficiency in food production over the years, especially with regards to cassava production despite increasing land area and resources put into food production annually (Henri-Ukoha, Orebiyi, Lemchi, Ibekwe, Onyeagocha and Ben-chendo, 2011). The low productivity of cassava is attributed to the fact that it is mainly cultivated by small scale, low resource farmers who can hardly afford farm inputs (Ezebuiro, Chukwu, Okoye and Obasi, 2008), the inefficiency of farmers in the use of various farm resources (Ohajianya and Onyeanweaku, 2000) and the fact that farm inputs are insufficiently allocated and utilized by the small farmers, this leads to unprofitable production.

Cassava request exceeds the supply adding up to the fact that Nigeria has not possessed the capacity to accomplish independence in food production throughout the years, particularly with respect to cassava production regardless of expanding land zone and assets put into food production every year (Henri-Ukoha et al., 2011). Nigeria is seeing an upward pattern in the cost of foodstuff, which ought not be credited to inflationary inclinations alone. The cost increment is predominantly because of fall in production combined with increased demand popular because of increment in populace and purchasing power. This issue of low efficiency in production may occur from wasteful utilization of assets amongst other reasons Onubuogu, Esiobu, Nwosu and Okereke, (2014). For this reason, efficiency has remained a critical subject of empirical examination especially in production economies where greater part of the farmers are resource poor. Given the state of the affairs above, one will be compelled to ask the following pertinent questions; what are the socio-economic characteristics of cassava farmers in the study area? How efficiently do cassava farmers in the study area make use of available resources in production? What are the costs and returns of cassava production in the study area? What constraints do cassava farmers in study area face? The answers to these questions provoked this study. Describe the socio-economic characteristics of Cassava farmers in the study area.Determine how efficiently farmers in the study area make use of resources in Cassava production; Determine the cost and returns of Cassava production in the study area.; Identify the constraints of farmers in the study area.

Statement of Hypothesis: H_{01}: There is no significant relationship between the efficiency of resource use and cassava production in the study area.

Materials and Methods: The method generally in use for survey research includes personal interviews, questionnaires, observations and telephone interview. This research however will be limited to the use of questionnaires and interview schedule from primary data. The collected data was subjected to descriptive and analytical statistical techniques. Objective 1 was analysed with the use of frequencies and percentages to identify the socio-economic characteristics of the cassava farmers in the study area. Objective 2 was analysed with the stochastic frontier production function method to determine the efficiency of farmers in the study area. Objective 3 was analysed using gross margin analysis to determine the cost and returns of cassava production in the study area. Objective 4 which identifies the constraints of the cassava farmers in the study area is analysed with a 4-point likert scale with the options, very serious (4) serious (3), moderately serious (2), and not serious (1). The study area was Emohua town in Emohua Local Government Area of Rivers State, Nigeria. It is the headquarter of Emohua Local Government Area which is located within the Rivers East Senatorial District and consists of 14 political wards and comprises of eight sub-villages, namely: Oduoha, Elibrada, Isiodu, Rumuakunde, Rumuche, Mbu-eto, Rumuohia, Mbuitanwo. Multi-stage sampling technique was used in this study. In the first stage the eight villages in Emohua town were selected. In the second stage, the lists of registered farmers were gotten from the Emohua Local Government Council office. Finally, a sampling proportion of 5% was used to randomly select the farmers giving a total of 178 respondents from 3519 registered farmers. **Model Specifications**

Stochastic Frontier Production Function

$$lnCAO_{ij} = \beta_0 + \beta_1 lnFMS_{ij} + \beta_2 lnLAB_{ij} + \beta_3 lnNSC_{ij} + \beta_5 lnCAP_{ij} + (V_{ij} - U_{ij}) \quad (1)$$

Where:

Subscript ij refer to the jth observation of the ith farmer.

ln = Logarithm to base
CAO = Cassava Output (Kg)
FMS = Farm size (ha)
LAB = Labour (mandays)
NSC = Number of stem cuttings used (kg)
CAP = Capital (naira)

It is assumed that the technical inefficiency effects are independently distributed and U_i arises by truncation (at zero) of the normal distribution with mean, μ_{ij} and variance δ^2, where μ_{ij} is defined by:

$$\mu_{ij} = \delta_0 + \delta_i Z_i \quad (2)$$

$$\mu_{ij} = \delta_0 + \delta_1 GEN_{ij} + \delta_2 AFM_{ij} + \delta_3 MAR_{ij} + \delta_4 EDU_{ij} + \delta_5 HHS_{ij} + \delta_6 YEX_{ij} \quad (3)$$

Where:

μ_{ij} = The technical inefficiency of the ith farmer
δ_0 = Constant term
δ_i = Coefficient to be estimated
GEN= Gender
AFM = Age of farmers (years)
MAR= Marital Status
EDU = Years of formal education
HHS = Household size
YEX = Years of farming experience

The maximum-likelihood estimates of β and δ coefficients were estimated simultaneously using the computer program FRONTIER 4.1, in which the variance parameters are expressed in terms of $\delta^2_s = \delta^2_v + \delta^2$ and $\gamma = \delta / \delta^2$ (Coelli, 1994).

Results and Discussions

Table 1: Socio-economic characteristics of Respondents

Variables n=178	Frequency	Percentage	Mean
Gender			
Male	97	54.5	
Female	81	45.5	
Total	178	100	

Age			
19-29years	14	7.9	
30-39years	48	27.0	
40-49years	58	32.6	45
50-59years	36	20.2	
60 and above	22	12.4	
Total	178	100	
Marital Status			
Single	29	16.3	
Married	111	62.4	
Separated/Divorced	6	3.4	
Widow	32	18.0	
Total	178	100	
Educational level			
Non formal education	23	12.9	
primary school	55	30.9	
Secondary school	66	37.1	
Tertiary Education	33	18.5	
Others	1	0.6	
Total	178	100	
Household size			
1-5 persons	22	12.4	
6-10 persons	93	52.2	
11-15 persons	53	29.8	9.7
16-20 persons	6	3.4	
21-25 and above	4		
Total	178	2.2	
		100	
Mode of Farming			
Part time	107	60.1	
Full time	71	39.9	
Total	178	100	
Years of Experience			
1-10 years	40	22.5	
11-20 years	53	29.8	
21-30 years	41	23.0	22
31-40	31	17.4	
41-50	9	5.1	
51-60 and above	4	2.2	
Total	178	100	
Total land area			
<0.5	4	2.2	
0.5-<1.0	35	19.7	
1.0-<1.5	95	53.4	
1.5-<2.0	42	23.6	
>2.0	2	1.1	
Total	178	100	
Extension Agents' Visit	81	45.5	
Never	78	43.8	
Once	3	1.7	
Weekly	16	9.0	
Yearly	178	100	
Total			

Source: Field Survey, 2018

The table above shows that majority of the respondents are males, representing 54.5% of the population. The mean age of 45 years implies that majority of the farmers are in their active age and are likely to adopt new innovation faster than the older ones in cassava production. Cassava production in the area is an enterprise of married individuals, who are seen to be responsible according to societal standards. This finding supports the result of Onubuogu and Onyeneke (2012), Onubuogu, *et al.* (2014) and Onubuogu, Chidebelu and Eboh, (2013) that married farmers tend to have easy access to production variables such as land and large family size which are traditionally owned and provided by household heads (husbands) to compliment family labour which enhances production, reduce the cost of hired labour and resource use efficiency of the household farmers. Approximately 87.1% of the farmers had trainings in formal educational institutions which no doubt increases their literacy levels. It is expected that the higher level of education will contribute significantly to decision making of a farmer. Exposure to high level of education is an added advantage in terms of achieving huge yield/output, efficient marketing and sustainable cassava production Esiobu, Nwosu and Onubuogu, (2014). This finding supports Moyib, Akinwunmi and Okoruwa, (2013); Girei, Dire, Yoguda and Salihu, (2014) that higher level of education determines the quality of skills of farmers, their allocative abilities, efficiency and how well informed they are of the innovations and technologies around them. It also supports the result of Onubuogu and Onyeneke (2012) and Onumadu, *et al*. (2014) that individuals with higher educational attainment are usually faster in adoption of improved farming technologies. A greater percentage of the respondents (52.2%) had household size of 6-10 persons with the mean household size being 10. It implies that cassava farmers in the study area have large household size. Large household size ensures availability of labour and expansion of farm size (Mbanasor and Kalu, 2008; Ninso, 2012 and Nurudeen, 2012). This finding supports the result of Onubuogu and Onyeneke (2012) and Onubuogu et al., (2013); Esiobu *et al.*, (2014) and Onubuogu *et al*. (2014) who reported that large household size compliment labour to enhance production and reduce the cost of hired labour. It is evident from the table above that majority of the respondents engage in other income generating activities aside cassava farming. The implication of this is that most of the farmers are small scaled cassava farmers which is evident in the total land area used for cassava farming, which may result to low yield. This finding agrees with that of Onubuogu *et al*. (2014). Again, it is evident that a greater percentage of the population has good experience in farming cassava, having a mean farming experience of 22 years. Output performance in agribusiness is enhanced by experience as stated by Onyeneke and Iruo, (2011) and Onubuogu and Onyeneke, (2012). This finding supports that of Onubuogu *et al*., (2014) who reported that farmers' with more experience would be more efficient, have better knowledge of climatic conditions, better knowledge of efficient allocation of resources and market situation and are thus, expected to run a more efficient and profitable enterprise. It also supports the findings of Onubuogu *et al*., (2013) and Esiobu *et al*., (2014) that previous experience in agribusiness management enables farmers to set realistic time and cost targets, allocate, combine and utilize resources efficiently and identify production constraints. Majority of the respondents are mainly smallholder farmers operating on less than or equal to 1.5 hectares of farmland. This could be as a result of land tenure system predominant in the area or due to the increasing population. Large farm size increases agricultural productivity and improves farmers' technical, allocative and resource use efficiency. The results show that cassava farmers in the study area are poorly visited by extension agents to ascertain their farming problems, know where they need assistance and pass across to them any new/improved technologies. Also, extension contacts which is a channel through which agricultural innovations and information are passed to farmers for improvement in their standard of living, production and productivity, are missing. This could bring about low productivity and poor resource use efficiency due to lack of innovative information.

Table 2: Stochastic Frontier Estimation of Production Function

Variable	Parameters	Coefficient	t-ratio
Constant:	β_0	0.3290	8.0492***
Farm Size	β_1	0.8975	20.5308***
Farm labour	β_2	0.1909	3.8348***
Stem cuttings	β_3	0.4758	3.5310***
Capital	β_4	0.3420	2.9034***
Inefficiency Function			
Constant	δ_0	0.1638	2.2837***
Gender	δ_1	-0.1264	-5.8850***
Age of farmer	δ_2	-0.1127	-7.0057***
Marital Status	δ_3	0.9515	4.5722***
Education	δ_4	-0.8367	-3.1887***
Household size	δ_5	-0.2189	-0.5417^{NS}
Farming experience	δ_6	-0.4303	-6.0829***

Diagnostic statistics Sigma squared	σ^2	0.6130	6.2639
Gamma	γ	0.9804	210.4953
Log likelihood function LR Test		38.0465 103.9558	

Source: Computation from Frontier 4.1(2018)
**** Significant at 1%, NS- Not Significant*

The result revealed that the variance parameter estimate for sigma squared and gamma are 0.6130 and 0.9804 respectively. They are both significant at 1% level. The sigma squared indicates the goodness of fit and correctness of the distributional form assumed for the composite error term while the gamma indicates the systematic influences that are unexplained by the production function and the dominant sources of random error. This implies that the inefficiency effects make significant contribution to the technical efficiencies of the cassava farmers in the study area. The estimated gamma parameter of 0.98 indicates that about 98 % of the variation in the value of farm output of farmers was due to differences in their technical efficiency. The coefficients of the parameters of the production function estimated are positive except one. This means that the total farm output value increases by the value of each of the positive coefficients as the value of each variable increases by unity while the total farm output value decreases by the value of the negative coefficient, as the variable increases by unity. The result of the stochastic frontier production function model is discussed as follows;

Farm Size (β_1): The coefficient of farm size was found to have the expected sign (positive) and significant at 1% level. The result indicated that a unit increase in this input will lead to increase in the gross output of cassava. Bearing this in mind, the estimated coefficient for farm size being 0.89 implies that a 1% increase in farm size will result in the increase of the output by 0.89%. The result is in line with the findings of Ndubueze-Ogaraku & Ekine (2015), Ochi, Sani and Idefoh, (2015); Amodu, Owolabi and Adeola, (2011); Umoh (2006) and Okike (2000). They all reported farm size to be significant and positive. The result could mean that it is possible to expand farming activity in the study area. Statistically, the magnitude of the coefficient of farm size show that total value of farm output is inelastic to land area cultivated.

Labour (β_2): The coefficient of labour was significant at 1% level and had a positive sign. The estimated coefficient of labour is 0.191, meaning that 1% increase in labour would lead to 0.191% increase in output. This shows the importance of labour in Cassava production in the study area. This is supported by several studies which confirmed the importance of labour in farming. Studies by Ndubueze-Ogaraku & Ekine (2015), Onubuogu *et al*. (2014), Amodu *et al*. (2011), Umoh (2006) and Okike (2000) have shown the importance of labour in farming, particularly in developing countries where mechanization is rare on small scale farms. It appears that labour will continue to play important role in the farming of Cassava in the study area, affecting its efficiency, until those factors constraining mechanization are removed. The magnitude of the coefficient of labour shows that total value of farm output is inelastic to the level of labour used. The implication of this is that the total value of farm output can be increased by employing more labour.

Stem cuttings (β_3): The coefficient of 0.476 for stem cuttings was positive and significant at 1% level and means that 1% increase in the stem cuttings used in production would increase output by 0.476%. This implies that planting materials are important in cassava production in the study area. The value of farm output is highly inelastic to stem cuttings and farm output can be significantly increased by increasing the use of planting materials. The result is contrary to that of Ochi *et al*. (2015) which show that the coefficient of stem cutting is negative and leads to a decrease of the output if increased by 1% but agrees with the findings of Amodu *et al*. (2011) and Onubuogu *et al*. (2014).

Capital (β_4): The coefficient of capital as shown in table 4.3 was positive and significant at 1% level and implies that a percentage increase of capital input used would lead to 0.342 increase in cassava output. The findings follow that of Eze, Amanze and Nwankwo, (2012); Girei *et al*, (2013); Ogunbameru and Okeowo (2013); Onumadu *et al*., (2014).

Technical Inefficiency Sources: The technical inefficiency of the inefficiency model analysed showed that the signs and significance of the estimated parameter coefficients in the inefficiency model have important implications on the resource use efficiency of cassava farmers in the study area. The variables are discussed as follows;

Gender (δ_1) : The variable, gender as reported in table 4.3 is negative and significant at 1% level. It implies that gender contributes significantly to the inefficiency of cassava production in the study. The negative value of the gender coefficient means that female cassava farmers were less technically efficient than their male counterpart. Therefore, to enhance the technical efficiency of farmers in the study area more males should be encouraged to cultivate cassava.

Age (δ_2): The coefficient of age of cassava farmers is negatively related to inefficiency and significantly different from zero at 1% level of significance. The implication of this is that age does not contribute to resource use inefficiency to farming cassava in the study area. That is, as the age of farmers increases, the efficiency of cassava farmers increases. This finding is in agreement with Umoh (2006). However, it disagrees with Kolawole and Ojo (2007) who in their study of small-scale farmers in Nigeria found age to be positively related to inefficiency.

Marital Status (δ_3): The coefficient for marital status is shown to be positive and significant at 1% level. This implies that the marital status of cassava farmers in the study area is positively related to technical inefficiency, that is, married farmers are more inefficient in their production than single farmers. Therefore, single farmers have higher efficiency than married farmers in the study area.

Education(δ_4): The coefficient for education is negative and significant at 1% level. From the results, education is negatively related to inefficiency. It implies that the inefficiency of resource use in cassava production the study area decreases as the level of education increases. Therefore, the more educated the farmers are the more their attention will be paid to effective management of their farms. This finding conforms with that of Amodu *et al.,* (2011).

Household size(δ_5)

Household size was negative but not significant in contributing to the inefficiency effects of cassava production in the study area. Results contradicts that that of Onubuogu *et al.*(2014), Amodu *et al.* (2011).

Farming experience(δ_6): The result of the inefficiency variable showed that it was negative and significant at 1% level. The negative coefficient of farming experience indicates that it is negatively related to inefficiency but contributes to the increase of resource use efficiency in the study area. Thus, a percentage increase in the years of experience of would lead to 0.4303% increase in cassava output. This means that the more experienced the cassava farmers are, the more effective they would be in the operation of their farms. These findings contradict that of Ndubueze-Ogaraku & Ekine (2015) who found out that none of the technical inefficiency variables exerted a significant relationship on the technical inefficiency of the cassava farms in Rivers State.

Table 3: Profitability Analysis of Cassava Production in the Study Area

Gross Margin Analysis (Items)	Cost (Naira)
Variable Cost (I)	25,009,957
Revenue (II)	54,937,500
Gross Margin (II-I)	29,927,543
Gross Margin/Naira invested	0.544756
Gross Margin (percentage)	54.5%

Source: Author's Computation, 2018

From the table above, it is evident that cassava farmers in the study area are small holder farmers as well as part time farmers. Thus, supporting the statement "part-time farmers were mostly small-scale farmers" (Amodu, 2010). Costs were dominated by variable costs which include; cost of stem cuttings, labour, land preparation and other costs incurred during production. The average prevailing market prices of cassava harvested were used to derive the gross farm revenue or the total value of production. The gross margin per Naira invested showed that cassava production has a return of 0.54 which translates to 54%. It thus implies that for every one naira invested in cassava production in the study area, 54% returns are expected, which is profitable.

Table 6: Constraints of Cassava farmers in the Study Area

Constraints	Very serious	Serious	Moderately serious	Not serious	Total	Mean	Interpretation
Lack of capital	175	2	0	8	185	1	Very serious
Scarcity of cassava stem cuttings	127	52	51	32	262	1	Very serious
High cost of labour	158	34	3	8	203	1	Very serious
Lack of land	160	6	39	8	213	1	Very serious
Poor farm maintenance ability	6	152	270	24	452	1	Very serious
Unfavourable price of cassava in the market	173	6	6	0	185	1	Very serious
High cost of land preparation	171	4	12	4	191	1	Very serious
Pest and diseases	165	22	6	0	193	1	Very serious

Source: Field Survey Data, 2018

The table above identifies the major constraints of cassava farmers in the study area. It reveals lack of capital, scarcity of cassava stem cuttings, high cost of labour, lack of land, poor farm maintenance ability, unfavourable price of cassava in the market, high cost of land preparation and pests and diseases as 'very serious' constraints.

Testing of Hypothesis

Table 8: Relationship between Efficiency and Cassava Production in the Study Area.

Variables	Coefficients	Std. Error	t-statistics	Sig.
Constant	-191.427	319.586	-0.599	-
Efficiency	2659.010	371.832	7.151***	0.550
R-squared	0.874			0.000
Adjusted R-squared	0.675			
F-statistics	51.138			
F-Probability	0.000			

Source: Computed from SPSS, 2018

The table shows that there is a significant relationship between efficiency and cassava production in the study. This is evident from the R^2 value of 0.675 which implies that there is a strong positive relationship between them, which implies that as efficiency increases, cassava production also increases. This fact is further proven by the significance of the independent variable shown to be significant at 1% level. Therefore, the null of no relationship between efficiency and cassava production in the study area is rejected and the alternative accepted.

Conclusion/Recommendations: The purpose of this study was to examine the resource use efficiency of cassava production in Emohua town of Emohua Local Government Area in Rivers State. The study revealed that the farmers in the study area were technically efficient although these still room for improvements in the efficiencies. It also revealed that cassava production is faced with some constraints but proofed to be a profitable venture. There is an urgent need for commercializing the production of cassava as subsistence management cannot sustain the increasing population. Based on the findings of this study, the following recommendations are made;

The government should endeavour to meet the financial needs of farmers so that they can easily afford inputs to improve their production. The need for training and retraining of farmers for better management skills and abilities should be pioneered by the government. Such trainings should include youth entrepreneurship in agriculture, agri-business and agricultural techniques to enhance sustainable livelihoods from agriculture. Measures should be put in place to ensure that extension agents visit farmers regularly to serve as a guide to farmers on improved cassava production technologies.

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