TECHNICAL EFFICIENCY ANALYSIS OF CASSAVA FARMERS IN OGUN STATE, NIGERIA

By

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Abstract

The study was conducted to examine the technical efficiency of farmers in the production of cassava in Ogun State, Nigeria. The study used primary data obtained from a cross-sectional survey of 150 cassava farmers selected using multistage sampling technique. Data were collected using an interview schedule and analyzed using descriptive, and stochastic production frontier methods. The study revealed that majority (75.3%) of the sampled farmers was male with mean age of 50.1years and mean cassava farming experience of 19.7 years. Land holding by inheritance (71.3%) was prevalent. Most of the respondents (98.0%) cultivated cassava in small land holdings below 3ha with a mean farm size of 1.56ha. Also, 80.7% of the sampled farmers sourced their capital from personal savings. Furthermore, farm size ($p<0.1$), agrochemicals ($p<0.1$), family labour ($p<0.01$), hired labour ($p<0.01$) and quantity of fertilizer used ($p<0.01$) were the significant factor affecting cassava production in the study area. The maximum technical efficiency attained by the farmers was 96% while the minimum technical efficiency was 40%. The mean technical efficiency was 88%. The major constraints in cassava production among the sampled farmers were inadequate capital (73.3%), marketing problem (53.3%), inadequate transportation (43.3%), incidence of pest and diseases (33.3%), lack of government support (66.0%) and poor yield (40.0%). In conclusion cassava production is profitable in the study area and farmers were efficient given the current technology. The study recommends, among others, provision of financial assistance to farmers in order to access adequate farm resources and expand the existing scale of production.

Keywords: Cassava, Production, Efficiency, Farmers, Ogun State

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Introduction

Cassava known as *Manihot esculenta or Manihot utilissima*.was introduced into Central Africa from South America in the 16th century by the early Portuguese exporters (Ohadike, 2007). It is estimated that 250 million people in Sub-Saharan Africa derive half of their daily calories from cassava being the second most important food staple and supplier of calories after maize (Nweke, 2004; FAO, 2005; Anyaegbunam *et.al*; 2010). Recently, production figures ranked Nigeria as the leading producer of cassava in the world ((FAO, 2004; Yakasi, 2010) and puts ready money and food in the very vulnerable segments of society of the country. The tubers are mostly processed into cassava flour (lafun), gari and fufu in Nigeria. It can also be cooked or eaten, pounded and consumed in its raw form, most especially the sweet variety (Ogundari and Ojo (2007)

Prior to the pronouncement of the Presidential Initiative on Cassava in Nigeria in 2002, there had been several organizations that had contributed to the development and improvements or the cassava commodity. The Nigeria's Presidential Initiative on Cassava Production is one of the strategies of the past Federal Government's National Economic Empowerment and Development Strategy (NEEDS) whose objective was to generate N3 billion from agricultural exports (National Planning Commission, 2005). Given these various cassava programmes and policies implemented over the years by the government to raise the efficiency of cassava farmers it is expedient to examine the technical efficiency of farmers and its relationship with socioeconomic variables of cassava farmers.

This will unequivocally guide policy makers in making policy that will improve the welfare and standard of living of cassava farmers through increased efficiency in the use of available resources. It is noted that poverty reduction can be attained in Sub-Sahara Africa by improving the technical and economic efficiencies of food production in crops such as cassava IITA (2004)

Thus, the broad objective of this study is to analyze technical efficiency of farmers in Ogun State, Nigeria. The specific objectives of the study are to:

1. analyze the socio-economic variables of cassava farmers in Nigeria;
2. estimate the technical efficiency level of cassava farmers in the study area and
3. determine the effect of the socio-economic variables on technical efficiency of cassava farmers in the study area.

Methodology

The study area was Ogun State, Nigeria. A multistage randomized sampling technique was used in selecting 150 cassava farmers. In the first stage three Local Government Areas namely Remo-North, Ikenne and Ijebu ode were randomly chosen. In the second stage, two farming communities were randomly selected in each of the LGAs. This gave total of (6) communities.

In the third stage, Twenty five (25) farmers were randomly selected from each community giving a total of 150 respondents. Interview schedules were used to elicit information from the respondents on labour, farm size, input use, output, capital and their socio-economic characteristics. Data collected were analysed using descriptive statistics and stochastic production frontier analytical tools.

The stochastic production frontier approach and model specification:

The stochastic frontier production function was proposed by Aigner (1977), Meeusen and Van de Broeck (1977). The model specification involves the use of production function which has an error term with two components,

Following Battese *et al*. (1996) , the frontier model of the farm is expressed as

$Q=F(X_{ki}\ e^{v-u}$

Where Q = Output of the ith farm.

X_{ki} = Vector of k inputs of the ith farm,

β = Vector of parameters,

ε = Farm specific error term

The two independent elements of the error term are U_i and V_i .

V= represents random disturbances which are not under the control of the farmer. e.g weather, disease, good luck, measurement error, thus it is assumed to be identically and normally distributed with a mean of zero and constant variance .$V \sim N(0, \sigma^2, V)$ and independent of U

U= it is non-negative random variable associated with technical efficiency in production and it is assumed to be independently identically and normally distributed. U~N (0, σu^2). Where the conditional mean μ is assumed to be related to farm and farmers related social.

This error term has zero value for any output lying on the Frontier and it is positive for an output lying below the Frontier, representing the amount by which the frontier exceed the actual output of the farm.

Technical efficiency of an individual farm is defined as the ratio of the observed output to the corresponding frontier output given the available technology (Onu and Edon,2009). A farmer is said to be technically efficient when it operates on the production frontier. However, the level by which a farmer lies below the production frontier is a measure of his technical efficiency. Empirically, the technical efficiency is measured as follows: Technical efficiency (TEi) = $\exp(X_{ki}\beta vi\text{-}ui) / \exp(X_{ki}+ vi)$

$= \exp(-ui)$

The technical efficiency has a value between 0 and 1, with 1 defining a technically efficient farm.

Where

Yi= observed output

Yi* = the frontier output. Technically efficient farmers are those

The study employed the Cobb-Douglas production to obtain the maximum likelihood estimate of the parameters and coefficients of the selected cassava farmers. The Cobb-Douglas production function is defined and linearised as follows ((Lawson, 2004):

$\ln Y_1=\beta_0+ß_1\ln X_1+ß_2\ln X_2+ß_3\ln X_3+ß_4\ln X_4+ß_5\ln X_5+ß_6\ln X_{6.}+ ß_7\ln X_7 + ei$

Where:

Y_1=Total output/hectare of cassava (kg)

X_1= Farm size in hectares

X_2= Family labour in man days

X_3= Hired labour in man days

X_4= Quantity of tractor used

X_5= Quantity of fertilizer (kg)

X_6= Agrochemicals (lit/ hectares)

X_7 =Quantity of other inputs

ßs = Parameters to be estimated

The inefficiency model is specified thus;

$TE = \delta_0 + \delta_1 C_1 + \delta_2 C_2 + \delta_3 C_3 + \delta_4 C_4 + \delta_5 C_5 + \delta_6 C_6 + \delta_7 C_7 + \delta_8 C_8$

C_1= age of household head (Years)

C_2= marital status (Single= 1, 0 =others)

C_3= sex (dummy variable: 1 if male, 0 = female)

C_4= educational level of household head (Years of schooling)

C_5= household size (Number)

C_6= farming experience (Years)

C_7 = labour used in man days (if family=1, then 0 if otherwise)

TEi= technical inefficiency

δ = production inefficiency of parameters to be estimated

Results and Discussion

The distribution of the socio economic characteristics of respondents in table 1 reveals that the mean age of the farmer is 50years. The result implies that the farmers were in economically active age and as such will respond positively to any intervention aimed at improving their level of production because of their expected capacity and strength to farm. This is consistent with the findings of Rathmen *et al* (2002). Also, the cassava farmers had a household size of between 5–7, in view of the household, agricultural production activities are labour intensive and large household can provide farming labour at least or no cost (Ofemade *et al* 2008). It is equally evident from the table that 75.3% of the farmers were male while 24.7% of the cassava farmers were female. Also, 44% of the farmers had at most primary school education, as compared to (18.7%) of the farmers with tertiary education. This implies that the farmers would find it difficult to understand and adopt technological innovations on method of production because education will predispose farmers to be innovative and put them in a better position to cope with the challenges of new factor and product that the adoption of new technologies introduces to them. The description of the socio economic characteristics variables further shows that majority of the cassava famers (70%) had more than 10 years experience in cassava cultivation, while 78% acquired their land for cassava production through inheritance and the remaining (28.%) got theirs by leasing and renting. Also, 80.7% operate on personal savings which were supplemented from loans in their local cooperatives. Cultivation of other crops (54.7%) and petty trading (28.7%) were the major secondary occupation venture in the study area. Majority (98%) of the farmers had farms sizes of less than 3.0 hectares while all the sampled farmers had a total farm size of 157.30 hectares giving an average farm size of 1.05 hectares per farmer. This shows that farm sizes are small in the study area probably because of the low level of mechanization of traditional agriculture or owing to land tenure problems.

Table 1. Distribution of Respondents by Personal Characteristics

Description	Frequency	Percent
Age group (years)		
31-40	26	17.3
41-50	64	42.7
51-60	25	16.7
Above 60	35	23.3
Mean	50.1	
Household size		
2-4	36	24.0
5-7	91	60.7
8-10	23	15.3
Mean	5.7	
Sex		
Male	113	75.3
Female	37	24.7
Educational level		
Primary school	66	44
Secondary school	56	37.3
Tertiary	28	18.7
Farming experience (years)		
10 or less	24	16
10-19	45	30
20-29	60	40
Above 30	21	14
Mean	19.7	
Method of land acquisition		
Inheritance	107	71.3
Lease	13	8.7
Rental	30	200
Source of capital		
Local cooperatives	29	19.3
Personal savings	121	80.7
Supplementary occupation		
Artisanship	12	8.0
Livestock rearing	13	8.7
Trading	43	28.7
Cultivation of other crops	82	54.7
Farm size		
1.00 or less	66	(44.0)
1.00 < 2.99	81	(54.0)
Above 3	3	(2)
Mean 1.05		
Standard deviation 0.61		

Source: Field Survey Data, 2012

The constraints in cassava production in the study area were found to be numerous starting from lack of capital, marketing problems, transportation, pest and disease, lack of government support and poor yield. Majority of the respondents 73.3% reported lack of capital was a major problem in the production of cassava, 66% of the respondent also claimed that Government are not supportive enough in the production of cassava, while 53.3% and 43.3% of the respondent indicated that marketing of the product and transportation was a serious problem in the production of cassava in the study area. Also, 40% and 33.3% of the respondents reported poor yield and incidence of pest and disease respectively as a limiting factor in the study area.

Maximum Likelihood Estimates of the Stochastic Frontier Function and Technical Efficiency

Table 2: Farm - Specific Production Efficiency Indices among Cassava Farmers.

Technical efficiency range		Frequency	Percentage
0.40 - 0.49		6	4.0
0.50 - 0.59		5	3.3
0.60 - 0.69		18	12
0.70 - 0.79		15	10
0.80 - 0.89		43	28.7
0.90 - 1.00		63	42
Total		**150**	**100**
Maximum Technical efficiency	=	0.96	
Minimum Technical efficiency	=	0.40	
Mean Efficiency	=	0.80	
Mode Efficiency	=	0.94	

Source: Computed Data Survey, 2012

The frequency distribution of the efficiency indices for the 150 cassava farmers shows that the specific technical efficiency ranges between 0 and 1. This implies that the crop farmers were operating below the frontier. The distribution of the technical efficiency score of respondents show that 6 farmers had efficiency rate of 4 - 49% while 5 and 8 farmers had technical efficiency score 50-59% and 60-69% respectively. Also, 43 and 63 farmers had efficiency index of 80-90% and 90-100% respectively. If it is accepted that most efficient cassava farmers are those who scored ≥70% and less efficient are those who score ≤ 20% (Adewuyi and Okunmadewa,2001) , it is obvious from the result that131 cassava farmers (80.7%) could be said to be technically efficient. This clearly shows that the cassava farmers in the study area were technically efficient. The most efficient farmer operated at 0.90 efficiency levels, while the least efficient farmer was found to operate at 0.40 efficiency level. The mean efficiency of 0.80 implies that although farmers were efficient they still had room to increase the efficiency in their farming by 20% through better use of available resources, given the current state of technology (Asogwa *et al*, 2005).

Table 3. Maximum Likelihood Estimates of the Stochastic Frontier Function and Technical Inefficiency.

Variable	Parameters	Co-efficient	Standard error	T-Statistics
Constant term	$ß_0$	6.0775^{***}	1.1021	5.5145
Farm sizes	$ß_1$	0.2836^{*}	0.1712	1.6565
Family labour	$ß_2$	0.1267^{***}	0.0392	3.2321
Hired Labour	$ß_3$	0.2308^{***}	0.0615	3.7528
Tractor Use	$ß_4$	0.0136	0.0095	1.4316
Qty of Fertilizer	$ß_5$	0.0893^{***}	0.0289	3.0900
Agrochemicals	$ß_6$	0.0379^{*}	0.0230	1.6478
Cost of other inputs	$ß_7$	-0.0779	0.1225	0.6359
Farmer's Age	C_1	-0.0028	0.0132	0.2121
Marital status	C_2	0.6843	0.6932	0.9871
Farmer's Sex	C_3	0.3509	0.8327	0.4214
Educational level of farmer	C_4	0.0469	0.5457	0.8594
Household size	C_5	-0.2976^{**}	0.1304	-2.2822
Farming experience	C_6	-0.2920^{***}	0.0373	-7.8113
Variance Parameters				
Sigma squared (δ^2)		0.3425^{***}	0.0829	4.1314
Gamma (y)		0.2578	0.2272	1.1347
Log likelihood function		-114.1905		
L R test		17.5698.		

Source: Computed Data Survey, 2012.

- indicates that the variable is statistically significant at 1%

- ** indicates that the variable is statistically significant at 5%
- ,**,*, indicates that the variable is statistically significant at10%

The results of the estimates of the parameters of the stochastic frontier and the inefficiency results in table 3 shows that the variance parameters for δ^2 and ɣ are 0.3425 and 0.2578. The Sigma Squared is significant at 1 percent level. The Sigma squared (δ^2) indicates the goodness of fit and correctness of the distribution form assumed for the composite error term while the gamma ɣ indicates that the systematic influences that are un-explained by the production. Family labour**,** hired labour and quantity of fertilizer were positive and significant at 1 percent level while farm size and agrochemicals used were significant at 10 percent level

The estimated coefficients in the inefficiency model are of particular interest to this study. It provides a sound ground to find out the sources of inefficiencies among cassava farmers in the study area. Variations in technical inefficiencies of the farmers may arise from managerial decisions. The result is presented in table 2, the signs and coefficients in the inefficiency model are interpreted in opposite way such that a negative sign means that the variable increases efficiency and a positive signs decreases efficiency. For years of farming experience, the estimated co-efficient is negative and statistically significant at 1% level. This means that farmers with less farming experience are inefficient compared to their counterparts with more years of farming experience.

The estimated co-efficient for household size (-0.2976) is negative and statistically significant at 5%. This means that farmers with large household size will be more technically efficient, also as the household size increases it will obviously increases his production efficiency, because agricultural production activities are labour intensive and large household can provide family labour at reduced or no cost (Ajibefun and Daramola (2003).

Conclusion and Recommendation

This study aimed at examining the efficiency of cassava production in Ogun State. Primary data were collected from 150 cassava based farmers in Remo-North, Ikenne and Ijebu-Ode Local Government Area of the state. The data were subjected to descriptive, stochastic production frontier analysis. It was discovered that men (75.3%) dominated cassava farming and about (44%) of the farmers had at most primary school education. Many of the farmers were above forty years of age and most of them (71.3%) accessed land through inheritance. They had over ten years of farming experience in cassava production with mostly (5-7) household size. Farmers source their capital from their personal savings and 98% of them plant cassava in small land holdings below 3 hectares.

The Farm level technical efficiency was determined using stochastic parametric method of estimation. The stochastic frontier production function approach using Maximum Likelihood (ML) procedure was used to estimate the model and predict the individual technical efficiency.

The technical efficiency of the cassava farmers is less than one, indicating that cassava farmers operated 44% of the maximum technical efficiency variable of the production co-efficient, family labour and quaintly of fertilizer was significant at $P<0.01$ while, farm size, Hired labour and Agrochemical was significant at $P < 0.1$ probability levels.

From the result obtained in the study, it can be concluded that cassava farmers were efficient and more emphasis should be placed on the adequate resource utilization to sustain the efficiency level. Also, the maximum likelihood estimates reveals that farm size, family labour, hired labour, fertilizer and agrochemical had significant effect on the production efficiency of the cassava farmers. Thus an increase in any of these variables will increase the technical efficiency of the farmers. While household size and farming experience contributed to technical inefficiency of the cassava farmers. Those who are younger and more active also need to be encouraged to be involved in cassava production in the study area

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