IMPACT OF CREDIT ON PRODUCTION EFFICIENCY: EVIDENCE FROM CASSAVA SMALLHODERS FARMERS IN SOUTHWEST, NIGERIA.

ABSTRACT

Aims: This study evaluates credit impact on production efficiency of cassava farmers in southwest Nigeria.

Study design: Cross-sectional study.

Place and Duration of Study: This study was conducted in South West Nigeria, between June 2019 and July 2021.

Methodology: Multi-stage sampling procedure was used to select 210 small holder cassava farmers for the study. A structured questionnaire was used to collect data on respondents' socio-economic characteristics, production efficiency and the efficiency distribution of cassava farmers.

Results: Results show that the mean technical, allocative and economic efficiencies were 0.55, 0.91, and 0.50 respectively. Results of Stochastic production frontier show farm size (Υ = 0.664, $p<0.01$), labour (Υ = 0.183, $p\leq0.01$) and quantity of stem cutting (Υ = 0.160, $p\leq0.05$) increased cassava output, while sex (δ = 0.797, $p<0.01$), marital status (δ = 0.600, $p<0.05$), level of education (δ = 0.062, $p\leq0.01$), number of extension contacts (δ = 0.624, $p<0.05$) and credit (δ = 0.000004, $p<0.05$) significantly influenced efficiency among cassava farmers. Also, result of Maximum likelihood estimates of cost function shows rent on land (ω = 0.455, $p<0.01$), price of fertilizer (ω = 0.078, $p<0.01$) and price of herbicide (ω = 0.069, $p<0.01$) had positive influence on total cost incurred on cassava production while marital status (δ = 0.600, $p<0.05$) and credit (δ = 0.000004, $p<0.05$) significantly influenced efficiency among cassava farmers.

Conclusion: The study concluded that credit had significant influence on cassava farmers' production efficiency. Hence, credits should be made available by relevant stakeholders to cassava farmers in the study area.

Keywords: [Cassava, Credit, Ogun State, Production Efficiency, Smallholder Farmers]

1. INTRODUCTION

Agriculture had been a very important sector among the various sectors that drive Nigerian economy (Samson and Obademi, 2018). According to Mgbakor *et al.* (2014), there is no meaningful development in a developing country that can take place without developing agricultural sector, most especially when it stands as the main stay of the nation's economy, and Nigeria is not an exception. Samson and Obademi (2018) also noted that almost one-third of the Gross Domestic Product (GDP) was accounted for by agricultural sector and employs about two third of the labour force directly and indirectly in Nigeria. Cassava, (*Manihot esculenta* crantz) in many tropical African countries is a crucial staple food, especially in Nigeria as it plays an essential role in the food economy of the country (Yuguda *et al.,* 2013). According to the released statistics in 2012 by National Bureau of Statistics

(NBS), Nigeria is still claiming the top role over the past decades in world cassava production ahead of Thailand, Indonesia and other producing nations. It was also observed that, per annum output by the country grow from 23.8 million tonnes in 1995 to 35.6 million tonnes in 2006. Also, Federal Department of Agricultural Extension (FDAE) in 2013, present the nation's output at 54.02 million tonnes, an increase of 6% more than the earlier year's figure of 50.96 million tonnes (Nwike *et al*., 2017). However, despite all these, Eze and Nwibo (2014) asserted that, the country's full yields potential had not been acquired since small holder production scarcely exceeds 11 tonnes per hectare as contrary to 25 to 40 tonnes per hectare obtainable in other countries. For example, National yields achieved by Thailand in 2002 was 17.1 tonnes/ha, and the district yields in countries like Barbados and India was evaluated to be as large as 25 to 40 tonnes/ha. This revealed that Nigeria's largest productivity yields comes shorts of these rates and this circumstance was caused by a number of factors in which credit and inefficiency of cassava farming takes a greater percentage (Eze and Nwibo, 2014). This is evidence that required inputs such as investment capital, credit to acquire modern technologies for scaled-up production and other inputs are not in place or out of reach of cassava farmers, therefore accounting for high cost of production (Otunaiya, 2007). This becomes essential for Nigerian cassava farmers to raise investment capital that would be sufficient to meet the challenges through the use of agricultural credit. Filli *et al.* (2015) noted that credit is a catalyst with the capacity of driving production. This is an indication that credit is relevant to efficiency needed among small scale farmers and for the success of their farming.

Furthermore, it was noted that the average productivity in Nigeria was 10.5 tonnes per hectare in the early 1970s, in early 1980s it was 11.5 tonnes per hectare and by late 1980s it was 10.5metric tonnes per hectare and, in 1990s it was 11.5 tonnes per hectare (Eze and Nwibo, 2014). This pointing out a low production when contrast with 25 to 40 tonnes per hectare procured in other countries.

Moreover, before the period of oil boom, agriculture was the mainstay of the nation's economy but lack of adequate infrastructural facilities and the neglect of the rural sectors which comprises of small farmers had caused tremendous fall in the agricultural productivity as well as efficiency of cassava production (Samson and Obademi, 2018). According to Iyanda *et al*, (2014), the cassava yearly output statistic given by zone for 1999-2002 revealed that, North Central produce averagely 7,255,510 tonnes of cassava (the geopolitical zone with the highest production of cassava), while North West produce averagely 2,390,251 tonnes and North East, averagely 149,166 tonnes of cassava. In the Southern region, South East cassava production is averagely 5,590,951 tonnes, South West also produce averagely 5,513,600 tonnes, while South South produce averagely 6,374,577 tonnes. In South West Nigeria, Ogun State is the leading producer of cassava followed by Ondo State and Oyo state respectively (Iyanda *et al*., 2014). Inspite of this, there is still a need to improve production efficiency of cassava farming among small holders in the study area to attract more farmers into cassava farming. For example, the real output of cassava extends between 8 and 15 tonnes per hectare, compared to an attainable output of 30 tonnes per hectare (IITA, 2015). Also, according to Okoh, (2016), the prospects for enhanced cassava production is becoming high, given the increasing interest of more buyers in buying cassava products within and outside Nigeria putting pressure on the need to improve the production efficiency of cassava farming among small holders. Samson and Obademi (2018) communicate cases of credit insufficiency among rural farmers in Nigeria while Awotide *et al*. (2015) and, Ibrahim and Yusuf, (2017), also pointed that in rural areas of developing countries, credit constraints have significant unfavourable effects on farm yield. Consequently, Productivity and efficiency are adversely affected. Nandi *et al.* (2011). opined that Nigerians are indigent and hungry despite efforts made by various governments in elevating agricultural productivity and efficiency of the rural farmers who are the crucial stakeholders of agricultural production. Nigeria's Cassava production has more prospective than what it is currently. It was noted that cassava farmers obtained yields which are lower than the expected potential. Farmers are still under producing due to a poor rate of production efficiency (Bamidele *et al*., 2008), prompting a reason to ascertain and estimate the production efficiency of cassava farmers and how it will be impacted by credit to improve the efficiency and increase the productivity of cassava farming. In view of the above, there is a need to improve production efficiency by looking on how credit impact efficiency of cassava farmers. Thus, the focal point of this study was to assess the production efficiency (technical, allocative and economic efficiencies) and to examine the factors that influence production efficiency, including credit among smallholder's cassava farmers in the study area. The results of this study will be of great benefit to the farmers and other stakeholders in the agricultural industry, as it help featured those variables that could be better managed to improve the efficiency of cassava farming.

2. METHODOLOGY

The study area

This study was conducted in South West Nigeria. It lies between latitudes 5^o and 9^o North and longitudes 2^o and 8^o east of the Greenwish meridian. It is bounded in the South by the Atlantic Ocean, in the north by Kogi and Kwara States, in the south by Edo State and in the west by republic of Benin. It has a land area of about 114,270 square kilometers equating about 12 percent of the country total farmable land.

The area has a tropical climate of dry and rainy seasons as the two major seasons. The rainy season occurs between March/April to October/November each year, while the dry season begins in October/November and last till March/April. Although in recent times, minor changes were noticeable in rainfall regimes due to global climate change. The average daily temperature ranges between 25℃ (77.0 ºF) and 35℃ (95.0 ºF), while the annual rainfall ranges between 150mm and 3000mm.

Agriculture is the basis of the economy contributing the crucial single occupation for the people especially those in the rural areas. Arable crops like maize, rice, groundnut, kola-nuts, cassava, yam, cocoyam, oranges and sugar-cane are produced in the area. Southwest is one of the major producers of cassava in the country, and kolanut in the country (IITA, 2004). The natural resource endowment of the area includes land, water, mineral, forest and agricultural resources, through which a wide range of agricultural and forest products, are obtained. Mineral resources include limestone, chalk, phosphates, silica sand, gypsum, and clay (Southwest Investment Exhibition and Summit, 2016).

Data collection and sampling technique

Primary data was used for this study. Data on socio-economic characteristics and production efficiency were obtained through a questionnaire that was administered to the cassava farmers in the study areas.

Multi-stage sampling procedure was used for this study, the first stage was a purposive selection of three states in the southwest region base on cassava production, processing and marketing activities in the states (IITA, 2004). The second stage involved purposive selection of a major cassava producing zone from each state. The third stage was purposive selection of the major cassava producing block from each selected zones. At the fourth stage, the major cassava producing cell was purposively selected from the sampled blocks. In the fifth stage, 96 farmers were randomly sampled from each of the selected cells adopting Israel (1992) sample selection formulae as follows:

$$n_o = \frac{Z^2 pq}{e^2} \quad \text{……………………………………….. (1)}$$

where:

n_o = sample size,

Z^2 = abscissa of the normal curve,

e = precision level,

p = estimated proportion of character present in the population (i.e. smallholder cassava farming),

q = 1 – p.

$$\therefore\ n_o = \frac{(1.96)^2(0.5)(0.5)}{(0.1)^2}$$

$$\Rightarrow n_o = 96.04 \approx 96$$

Table 1: Sampling procedure

Stages	**Selection**	Procedure	Size	**Selection Method**	**Criteria**
1	Southwest State	Ondo, Ogun and Oyo	3 states	Purposive Sampling	Highest producer
2	ADP Zone	1 zone × selected state	3 zones	Purposive Sampling	Highest producer
3	ADP blocks	1 block × selected zone	3 blocks	Purposive Sampling	Highest producer
4	ADP cells	1 cell × selected block	3 cells	Purposive Sampling	Highest producer
5	96 farmers	96 farmers × selected cell	288 farmers	Random Sampling (without replacement)	Small holders
	Total			288 farmers	

However, 59 farmers declined participation while the remaining 229 consented. Albeit, 210 out of 229 responses were found useful for data analysis given a response rate of 91.7%.

Analytical techniques

The tools of analysis used to achieve the objectives of this study were descriptive statistics and stochastic frontier analysis.

Descriptive Statistics

Descriptive statistics was used to describe socio-economic characteristics of the respondent such as age, gender, farming experience, household size, marital status, educational status and credit. It was also used to describe the efficiency distribution of the respondents.

Stochastic Production Frontier and Production Efficiency Estimates

Stochastic production frontier was used to estimate the production efficiency and the factors affecting production efficiency, including credit. Following Wassie (2014), the model was specified as:

$Q_i = f(Z_i, \Upsilon_i) + (V_i - U_i)$ …………………………………………………………………...(2)

Where:

Q_i is the output (kg) of the ith farm

Z_i is a vector of input quantities of the ith farm

Υ is a vector of unknown parameters to be estimated

Ωi = composite error term

$\Omega i = v_i – u_i$ ………………………………………………………………………………….(3)

v_i = Decomposed error term measuring technical efficiency of the ith farm.,

u_i = The inefficiency component of the error term.

U_i are non-negative variables, called technical inefficiency effects which are assumed to be half normally distributed N $(0, \sigma^2)$.

A Cobb-Douglas production form of the frontier that was used for this study was specified as:

$LnQ = \Upsilon_0 + \Upsilon_1 lnZ_1 + \Upsilon_2 lnZ_2 + \Upsilon_3 lnZ_3 + \Upsilon_4 lnZ_{4+} + \Upsilon_5 lnZ_5 + V_i - U_i$………………….. (4)

Where;

Ln = Natural logarithm (i.e. logarithm to base e)

Q_i = Output of farmer (kg)

Z_1 = Farm size (ha)

Z_2 = Labour (labour-days)

Z_3 = Fertilizer (kg)

Z_4 = Herbicide (litres)

Z_5 = Stem cuttings (kg)

The inefficiency model was represented by U_i which was defined as;

$U_i = \delta_0 + \delta_1 X_1 + \delta_2 X_2 + \delta_3 X_3 + \delta_4 X_4 + \delta_5 X_5 + \delta_6 X_6 + \delta_7 X_7 + \cdots + \delta_9 X_9 +$
ε_0……………………………………………………………………………………….... (5)

Where:

U_i = Technical inefficiency

X_1 = Age (years)

X_2 = Sex (1 if male, 0 otherwise)

X_3 = Marital status (1 if married, 0 otherwise)

X_4 = Farming experience (years)

X_5 = Education level (years of formal schooling)

X_6 = Extension contact (number of extension visits)

X_7 = Household size (numbers of persons)

X_8= Credit

X_9 = Saving (Yes = 1, No = 0)
$\delta_0, \delta_1, \delta_2 \ldots\ldots\delta_9$ are the parameters to be estimated

The Cobb-Douglas cost frontier function is specified as;
$Ln\ C_i = \omega_0 + \omega_1 lnP_{1i} + \omega_2 lnP_{2i} + \omega_3 lnP_{3i} + \omega_4 lnP_{4i} + \omega_5 lnP_{5i} + V_i + u_i \ldots\ldots$ (13)
Where:
C_i = total input cost of the ith farms (₦)
P_{1i} = rent on land per hectare (₦)
P_{2i} = wage rate of labour per labour day (₦)
P_{3i} = average price of fertilizer per Kg (₦)
P_{4i} = average price of herbicides per litre (₦)
P_{5i} = price of stem cuttings per Kg (₦)
V_i = Random variability in the production that cannot be influenced by the farmer
u_i = deviation from maximum potential output attributed to technical inefficiency
Where:
U_i = Technical inefficiency
X_1 = Age (years)
X_2 = Sex (1 if male, 0 otherwise)
X_3 = Marital status (1 if married, 0 otherwise)
X_4 = Farming experience (years)
X_5 = Education level (years of formal schooling)
X_6 = Extension contact (number of extension visits)
X_7 = Household size (numbers of persons)
X_8 = Credit
X_9 = Saving (Yes = 1, No = 0)
$\omega_1 - \omega_5$ = parameters to be estimated.

3. RESULTS AND DISCUSSION

Socio-economic characteristics of respondents

The result revealed that 30% of cassava farmers were within 31- 40 years as shown in Table 2. The agility and productivity of a farmer is highly dependent on his/her age. It is a general believe that the older a farmer becomes, the less productive such an individual is likely to be, which will invariably affects the income-generating ability of that individual. The mean age of the cassava farmers was 42years which is almost the same value reported by Okoh (2016) who got 46 years as the mean age of cassava farmers, the result indication is that most of the cassava farmers are still in a period of their productive age, that is they are still young, vibrant and dynamic and this may have a beneficial influence on their productivity, income as well as credit availability. This confirm the argument of Akerele (2016), who said that age influence the level of physical work and the willingness to take risk.

The result revealed that, 60% of the cassava farmers were male and 40% were female. The implication of this result is that male dominated cassava farming and the dominance of male over female in the enterprise may be because cassava farming is tedious and requires a lot of energy which female might not be able to provide. The gender of the farmer determines the level of income that comes to the farmer, this is in alignment with the result given by Oladejo, (2016); Okoh, (2016); Shadrack Owusu, (2017).

The result revealed that majority (81%) of the cassava farmers were married, 12.9%, 3.8%, 0.5% and 1.9% of the cassava farmers were single, widowed, divorced and separated respectively. Marital status prompts commitment to business because of the family needs that must be met and this will invariably enhance productivity. The implication of this result is that majority of the cassava farmers were fully-grown enough, capable and responsible to cater for their households as well as have a clear knowledge of their wellbeing. This also support previous findings as revealed by Iyanda *et al*., (2014); Donald *et al*., (2016).

The result revealed that most (33.3%) of the cassava farmers had secondary education, while 17.6%, 32.9% and 16.2% had no formal education, had primary and tertiary education respectively. The adoption capacity of a farmer about a technology requires that the farmer is well exposed and educated, the implication of this result is that most of the cassava farmers were educated and this will have a positive influence on their ability to adopt innovative practices in cassava production which will invariably increase their efficiency and income (Eze and Nwibo, 2014). This also affirm with the finding of Okoh (2016), that said education is needed to enhance productivity among farming households and that a high literacy level will enhance productivity.

The result revealed that majority (50.7%) of the cassava farmers had between 6-10persons in their households. Household size and its determinants are important factors to consider in describing households' pursuit for economic activities and the welfare of the households, household size affects the availability of labour for farming activities (Eze and Nwibo, 2014). The mean size of the household is approximately 6persons which also is visually the same with the result given by Donald *et al*, (2016). The implication of the result is that the households had a fairly large household size they can employ their household labours on their farms when they are free (Donald *et al*, 2016).

The result revealed that most (34.4%) of the cassava farmers had between 11-20years farming experience, the mean farming experience was 20years. Farmer's number of years spent in farming gives an clue of the practical knowledge he/she has acquired on how to deal in production, when experience is properly channeled it can lead to higher efficiency, higher productivity, higher income and can translate to improve standard of living (Okoh, 2016), the implication of this result is that most of the cassava farmers in the three states are well experienced about problem facing them in cassava production, this may have a positive influence on their efficiency and income generated (Akerele, 2016).

The result revealed that, 70.5% of the cassava farmers had no extension contact while 29.5% had extension contact.

The result revealed that most (61.9%) of the cassava farmer were involve in savings while (38.1%) were not involved in savings respectively.

The result revealed that 4s9.5% of the cassava farmer had access to credit while the remaining 50.5% did not have access to credit as shown in Table 2. The implication of this result is that there is likelihood that some farmers are more productive than their counterparts as a result of their access to credit facilities as credit may likely increase their scale of production (Iyanda *et al*., 2014; Awotide *et al*., 2015; Shadrack Owusu, 2017).

Table 2: Socio-economic characteristics of respondents

	Socio-economic characteristics of respondents	
Variable	**Frequency**	**Percentage**
Age		

≤30years	44	21
31-40years	63	30
41-50years	44	21
51-60years	31	14
≥61years	28	13
Mean	**42.71**	
Std.Deviation	**16.47**	
Sex		
Female	84	40
Male	126	60
Total	**210**	**100**
Marital status		
Single	27	12.9
Married	170	81
Divorced	1	0.5
Widowed	8	3.8
Separated	4	1.9
Total	**210**	**100**
Educational level		
Non-formal	37	17.6
Primary	69	32.9
Secondary	70	33.3
Tertiary	34	16.2
Others	0	0
Total	**210**	**100**
Household size		
1-5persons	98	46.9
6-10persons	106	50.7
11-15persons	5	1.9
16-20persons	1	0.5
Mean	**5.81**	
Std.Deviation	**2.44**	
Experience		
1-10years	66	31.6
11-20years	72	34.4
21-30years	40	19.1
31-40years	21	10.0
>40years	11	4.9
Mean	**19.49**	
Std.Deviation	**12.60**	
Extension contact		
No	148	70.5
Yes	62	29.5
Total	210	100.0

Saving		
No	80	38.1
Yes	130	61.9
Total	210	100.0
Access to credit		
Non-access	106	50.50
Access	104	49.50
Total	210	100.00

**Source: Field Survey, 2019.*

Maximum likelihood estimates of the production function of cassava farmers

The result of the Maximum Likelihood Estimates (MLE) of the parameters of the Cobb Douglas Stochastic Frontier Production Function (SFPF) and inefficiency model of cassava farmers is presented on Table 3. The variance parameters, sigma-square (δ^2) and gamma (γ) were estimated at 0.32 ($p < 0.01$) and 0.575 ($p<0.01$), respectively. The sigma-square attests to 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 errors. This implies that about 57.5% of the variation in output of cassava farmers is due to the differences in their technical inefficiency. The parameter estimates of the production function of cassava farmers revealed that farm size (Υ = 0.664, $p<0.01$), labour (Υ = 0.183, $p<0.01$) and quantity of stem (Υ = 0.160, $p<0.05$) increase the output of cassava. The coefficient of farm size revealed that if the size of farm used for cultivating cassava increases by 1%, the output of cassava will increase by 0.664, the coefficient of labour implies that if the number of labour employed increases by 1%, the output of cassava will increase by 0.183, the coefficient of quantity of stem revealed that if the quantity of cassava stem increases by 1%, output of cassava will increases by 0.160. This result is similar to that of Oduntan *et al*,. (2012) and Nwike *et al*.,(2017) who also reported that cassava input such as farm size, labour and material inputs were significant factors influencing the output of cassava.

Factors affecting inefficiency of the cassava farmers, the contribution of farmer's personal characteristics; age, sex, household size, marital status, farming experience, level of education, off-farm income, numbers of extension contact and credit were examined. The sign of the coefficients of these variables has important policy implications as positive sign implies negative effect on efficiency while negative sign signifies a positive effect on efficiency. Result revealed that male farmers were more technically efficient than their female counterparts, this maybe because most of the cassava farmers were male, this result agrees with that of Donald *et al*., (2016). Also, married farmers were more technically efficient compared to their counterparts. Result further revealed that the higher the level of education, the higher the technical efficiency of the farmers (δ = 0.062, $p<0.01$). This is so because education exposes the farmers to new innovative practices in cassava production thereby increasing their technical efficiency, this agrees with that of Oduntan *et al*., (2012). Furthermore, the higher the number of contacts with extension agents, the higher the technical efficiency of the cassava farmers (δ = 0.624, $p<0.05$). This is so because access to extension agents exposes farmers to innovative practices which will invariably increase their technical efficiency, this supports the findings of Ambali *et al*., (2012). Result also revealed that the higher the credit, the higher the technical efficiency of the cassava farmers. This is so because credit allows farmers to try new innovative practices and allow them to cultivate large expanse of land thereby resulting to higher technical efficiency, this support the results of Oduntan, (2012) and Nwike *et al*., (2017).

Table 3: Maximum likelihood estimates of cobb-douglas stochastic production frontier for cassava farmers

Variable	Coefficient	Standard Error	T-value	P-value
Constant	1.887***	0.217	8.69	0.000
Farm size	0.664***	0.085	7.79	0.000
Labour	0.183***	0.039	4.67	0.000
Fertilizer	-0.048	0.108	-0.44	0.657
Herbicide	-0.011	0.047	-0.24	0.810
Stem	0.160**	0.075	2.13	0.033
Inefficiency Model				
Constant	0.150	0.450	0.33	0.738
Age	0.014	0.012	1.21	0.226
Sex	-0.797***	0.241	-3.30	0.001
Household size	0.073	0.060	1.21	0.226
Marital status	-0.600**	0.294	-2.04	0.041
Farming experience	-0.012	0.011	-1.07	0.284
Education level	-0.062***	0.016	-3.80	0.000
Saving	-3.63e-06	5.08e-06	-0.71	0.476
Extension contact	-0.624**	0.245	-2.56	0.020
Credit	-3.96e-06**	1.22e-06	-2.21	0.023
Diagnostic statistics				
Sigma square	0.320***	0.047		
Gamma	0.575***	0.018		
Log-Likelihood	-236.121			

Source: Field Survey, 2019.* * Significant at 1% ** Significant at 5% *Significant at 10%

Maximum likelihood estimates of the cost function of cassava farmers

The result of the Maximum Likelihood Estimates (MLE) of the parameters of the Cobb Douglas Stochastic Frontier Cost Function (SFCF) and inefficiency model of cassava farmers is presented on Table 4. The variance parameters, sigma-square (δ^2) and gamma (γ) were estimated at 0.826 ($p< 0.01$) and 0.995 ($p<0.01$), respectively. The sigma-square attests to 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 errors. This implies that about 99.5% of the variation in total cost of cassava farmers is due to the differences in their cost inefficiency. The parameter estimates of the cost function of cassava farmers revealed that rent on land ($\omega = 0.455$, $p<0.01$), price of fertilizer ($\omega = 0.078$, $p<0.01$) and price of herbicide ($\omega = 0.069$, $p<0.01$) had positive influence on the total cost incurred on cassava production. The coefficient of rent on land revealed that if the rent on farmland increases by 1%, the total cost incurred will increase by 0.455, the coefficient of price of fertilizer implies that if the price of fertilizer increases by 1%, the total cost incurred will increase by 0.078, the coefficient of price of herbicide revealed that if the price of herbicide increases by 1%, the total cost incurred will increases by 0.069 (Siewe, 2015).

Factors affecting inefficiency of the cassava farmers, the contribution of farmer's personal characteristics; age, sex, household size, marital status, farming experience, level of education, off-farm income, numbers of extension contact and credit are examined. The sign of the coefficients of these variables has important policy implications as positive sign implies negative effect on efficiency while negative sign signifies a positive effect on efficiency. The coefficient of marital revealed that married household heads are more cost efficient than their counterparts ($\delta = 3.42$, $p<0.10$), this is so because married individuals are more likely to have a large family members which assist them on their farm land thereby reducing the cost on labour and this will invariably increase their cost efficiency. The coefficient of credit revealed that the higher the credit, the higher the cost efficiency of the cassava farmers ($\delta = 0.23$, $p<0.05$), that is increase in credit increases the cost efficiency of the cassava farmers.

Table 4: Maximum likelihood estimates of cobb-douglas stochastic cost frontier for cassava farmers

Variable	Coefficient	Standard Error	T-value	P-value
Constant	6.756***	1.963	3.44	0.001
Rent on land	0.455***	0.043	10.65	0.000
Labour wage	0.097	0.060	1.61	0.108
Price of fertilizer	0.078***	0.019	4.12	0.000
Price of herbicide	0.069***	0.018	3.86	0.000

Price of stem	-0.150	0.301	-0.50	0.620
Inefficiency Model				
Constant	-4.827	3.055	-1.58	0.114
Age	-0.014	0.049	-0.28	0.783
Sex	-0.077	1.279	-0.06	0.952
Household size	0.265	0.296	0.89	0.371
Marital status	-3.424*	1.873	-1.83	0.067
Farming experience	0.077	0.067	1.15	0.249
Education level	0.065	0.079	0.83	0.408
Saving	0.101e-04	0.253e-04	0.40	0.688
Extension contact	2.254	1.504	1.50	0.134
Credit	-0.235e-04**	0.108e-04	-2.18	0.028
Diagnostic statistics				
Sigma square	0.826***	0.041		
Gamma	0.995***	0.023		
Log-Likelihood	-260.341			

Source: Field Survey, 2019.* * Significant at 1% ** Significant at 5% *Significant at 10%

Technical efficiency of cassava farmers' in southwest Nigeria

The result as shown in Table 5 revealed that 15.7% of the cassava farmers had technical efficiency less than 0.20, 6.7% had technical efficiency between 0.201-0.40, 26.7% had technical efficiency between 0.401-0.600, most (39.0%) had technical efficiency between 0.601-0.800 while 11.9% had technical efficiency greater than 0.801, the mean technical efficiency of the cassava farmers is 0.55, this implies that the cassava farmers were able to obtain 55.0% of their output from their input mix or combination, this implies that there is room for 45.0% improvement in technical efficiency. This finding conforms to Eze and Nwibo, (2014) who reported existence of technical efficiency gap in cassava production.

Allocative efficiency of cassava farmers in southwest Nigeria

The result as shown in Table 5 revealed that majority (98.1%) of the cassava farmers had allocative efficiency greater than 0.801 and 1.4% had allocative efficiency between 0.601-0.800 while 0.5% had allocative efficiency between 0.401-0.600, the mean allocative efficiency of the cassava farmers is 0.91 which implies that the cassava farmers were able to minimize 91.0% of their total production cost, this shows that there is room for 9.0% improvement in allocative efficiency.

Economic efficiency of cassava farmers in southwest Nigeria

The result as shown in Table 5 revealed that 16.7% of the cassava farmers had economic efficiency less than 0.20, 8.1% had economic efficiency between 0.201-0.400, 30.5% had economic efficiency between 0.401-0.600 and most (41.9%) had allocative efficiency between 0.601-0.800 while 2.9% had economic efficiency greater than 0.801, the mean economic efficiency of the cassava farmers is 0.50 which implies that the cassava farmers were able to obtain 50.0% of their output at the lowest cost possible, this shows that there is room for 50.0% improvement in economic efficiency. This finding agrees with that of Nwike *et al*.,(2017) who reported existence of efficiency gap in cassava production.

Table 5: **Efficiency Distribution of Cassava Farmers in Southwest**

	Efficiency Distribution of Cassava Farmers	
Class	**Frequency**	**Percentage**
Technical Efficiency		
≤0.200	33	15.70
0.201-0.400	14	6.70
0.401-0.600	56	26.70
0.601-0.800	82	39.00
≥0.801	25	11.90
Mean	0.55	
Minimum	0.02	
Maximum	0.89	
Allocative Efficiency		
≤0.200	0	0.00
0.201-0.400	0	0.00
0.401-0.600	1	0.50
0.601-0.800	3	1.40
≥0.801	206	98.10
Mean	0.91	
Minimum	0.59	
Maximum	0.97	
Economic Efficiency		
≤0.200	35	16.70
0.201-0.400	17	8.10
0.401-0.600	64	30.50
0.601-0.800	88	41.90
≥0.801	6	2.90
Mean	0.50	
Minimum	0.02	
Maximum	0.84	

**Source: Field Survey, 2019.*

4. CONCLUSION

The study was carried out to assess the production efficiency (technical, allocative and economic efficiencies) and to examine the factors that influence production efficiency, including credit among smallholder's cassava farmers in the study area. The study concluded that cassava production is a productive enterprise in Southwest and that credit had significant influence on production efficiency.

Based on the findings of this study, the following recommendations were made to improve efficiency of cassava production in the study area; 1) Credit should be made available to the cassava farmers by stakeholders to increase the production efficiency of the cassava farmers.

2) Emphasis should be put on encouraging the participation of younger and agile people in Agriculture especially in cassava farming. 3) Extension services like technical advice, giving of information, integrated pest management for farmers, farmers training, provisions of agricultural inputs etc. should be provided by government, private and non-governmental Organization (NGO) authorities, as this will help farmers to improve their production efficiency. 4) Farmers should be encouraged to go for adult education and training, since the level of education increases their production efficiencies.

ACKNOWLEDGEMENTS

With all due sense of humility, my profane and sincere appreciation goes to my heavenly Father, God almighty for His divine help granted to me through his only and true son, Jesus Christ, during the cause of this work. All glory belongs to Him alone. I cannot express enough thanks to my supervisors, Prof. (Mrs) D. A. Adegbite for her immense contributions, advice, corrections and most especially her motherly love all through my research work. My co-supervisor, Prof. R. A. Sanusi for his relentless assistance, critical questions, corrections, guidelines and detailed comments that sharpened every aspect of this research. And the contribution of my external supervisor, Dr. S. O. Ayansina who had been very helpful in the completion of this project. I owe my parents, Pastor and Mrs. Adeosun for their care, obvious prayers, encouragement, financial support, attention, and love given to me, they had been my secret in the completion of this research work. May God bless you all immensely. Also, my heart gratitude to Dr. (Mrs.) Oke for her labour of love and time towards the success of my project work, she is one of the nicest person I met in FUNAAB.

I will like to acknowledge the immense supports of the Head of Department, Professor A. M Shittu, the Dean of the College, Professor E. O Fakoya, and all other lecturers in the department; Professor (Mrs) C. A. Afolami, Professor P. A. Okuneye, Late Professor S. Momoh, Professor L. O. Okojie, Professor A.O Dipeolu, Professor O. F. Ashaolu, Dr A. E Obayelu, Dr. (Mrs) E. O. A. Oluwalana, Dr. (Mrs) T. O. Oyekale, Dr. E Tolorunju, Dr. Dele Oladeji, Mr Funminiyi Oyawole, Mr Tunji Aminu, Mr Samson Afolayan. May God bless you all abundantly. I will not forget to thank all the staff in Agricultural Economics and Farm Management, FUNAAB for the sound knowledge imparted on me. Special thanks go to Mr. Tolu Adebayo, who stands as a beacon of light during a period of dark season in the course of my project. I pray from the bottom of my heart that you will not lack help in times of need in Jesus mighty name. Also my departmental colleagues, Grace, Kazeem, Oriade, Kikelomo and Sesan.

My special appreciation also goes to all Post Graduate Christian Fellowship Members and to all my friends for their contributions spiritually and physically towards the success of this project and Also to Excel and Cooper for their profound help doing my program, May God bless you all abundantly.

COMPETING INTERESTS

Authors have declared that no competing interests exist

AUTHORS' CONTRIBUTIONS

Author A did the research work under the strict supervision of other authors. All authors read and approved the final manuscript.

CONSENT (WHERE EVER APPLICABLE)

Not applicable

ETHICAL APPROVAL (WHERE EVER APPLICABLE)

Not applicable

REFERENCES

[1] Akerele, E. O. (2016). Effects of Cooperative Credit on Cassava Production in Yewa Division, Ogun State, Nigeria. *Journal of Resources Development and Management,* 23: 2422-8397.

[2] Ambali, O. I., Adegbite D. A., Ayinde, I. A. and Awotide, D. O. (2012). Analysis of Production Efficiency of Food Crop Farmers in Ogun State, Nigeria. *Journal of Agricultural and Biological Science* 7(9): 1990-6145.

[3] Awotide, B. A., Abdoulaye, T., Alene, A. and Manyong, V. M. (2015). Impact of Access to Credit on Agricultural Productivity: Evidence from Smallholder Cassava Farmers in Nigeria. A contributed paper prepared for oral presentation at the International Conference of Agricultural Economists (ICAE) Milan, Italy August 9-14, 2015.

[4] Bamidele, F. S., Babatunde, R. O. and Rasheed, A. (2008). Productivity Analysis of Cassava-based Production Systems in the Guinea Savannah: Case study of Kwara State, Nigeria. *American-Eurasian Journal of Scientific Research* 3(1): 33-39.

[5] Donald, D. D., Josephine, B. A., Joseph, A., Peter, I. A., Lateef, S., Michael, N., *et al*. (2016). Technical Efficiency Among Small and Medium Scale Entrepreneurs in High Quality Cassava Flour in Four Geo-political Zones of Nigeria. *European Journal of Physical and Agricultural Sciences* 4(3): *2056-5879.*

[6] Eze, A. V. and Nwibo, S. U. (2014). Economic and technical efficiency of cassava production in Ika North East Local Government area of Delta State, Nigeria. *Academic journals* 6(10): 429-436. ISSN: 2006-9774.

[7] International Institute of Tropical Agriculture (IITA) (2004). Preemptive Management of the Virulent Cassava Mosaic Disease through an Integrated Cassava Development Approach

for Enhanced Rural Sector Economy in the South-south and South-east zones of Nigeria, IITA, Ibadan, Nigeria, (79). *(In press)*.

[8] International Institute for Tropical Agriculture (IITA) (2015). Scientists and Development Partners Spot Agronomy as a Cure for Cassava Production Issues in Africa: *Research to nourish Africa*. IITA headquarters, Ibadan, Oyo State, (5). Accessed 29 August 2019. Available: http://www.iita.org/news-item/scientists-development-partners-spot-agronomy-cure-cassava-production-issues-africa/

[9] Israel, Glenn D. (1992). *Sampling the Evidence of Extension Program Impact*. Program Evaluation and Organizational Development, IFAS, University of Florida. PEOD-5. October.

[10] Iyanda, J. O., Afolami, C. A., Obayelu, A. E., Ladebo , O. J. (2014). Social Capital and Access to Credit among Cassava Farming Households in Ogun State, Nigeria. *Journal of Agriculture and Environmental Sciences* 3(2): 175-196. ISSN: 2334-2404

[11] Mgbakor M. N., Uzendu P. O. and Ndubisi D. O. (2014). Sources of Agricultural Credit to Small-Scale Farmers in Ezeagu Local Government Area of Enugu State, Nigeria. *Journal of Agriculture and Veterinary Science (IOSR-JAVS)* 7(8): 01-08. ISSN: 2319-2380.

[12] Nandi, J. A., Gunn, P. and Yurkushi, E. N. (2011). Economic Analysis of Cassava Production in Obubra Local Government Area of Cross River State, Nigeria. *Asian Journal of Agricultural Science,* 3(3): 205-209.

[13] Nwike, M. C., Okoli, T. O., Oghenehogagame, P. and Ugwumba C. O. A. (2017). Economic Efficiency and Returns to Scale of Cassava Production in Southeast Nigeria. *International Journal of Agriculture Innovations and Research,* (6): 108-113. ISSN (Online) 2319-1473

[14] Oduntan.O., Amos, T.T. and Oseni, J.O. (2012). Efficiency and Profitability of Small-Scale Cassava Production in Akure Area of Ondo State, Nigeria. A publication of the School of Agriculture Technology, The Federal University of Technology, Akure, Nigeria. Department of Agricultural and Resource Economics. *(In press)*.

[15] Okoh, M. A. (2016). Analysis of profitability and resource use efficiency in cassava farming in benue state of Nigeria. A dissertation submitted to the school of postgraduate studies, Ahmadu Bello University, Zaria. M.Sc. /AGRIC / 2701 / 2009-10. Department of Agricultural economics and rural sociology, Faculty of Agriculture Ahmadu Bello University, Zaria, Nigeria, 2016. *(In press).*

[16] Oladejo, J. A. (2016). Profitability Analysis Of Cassava Tuber Marketing In Oyo State, Nigeria: Implication For Sustainable Development Goals. *Science Agricultural* 16(2): 67-73. ISSN: 2311-0228.

[17] Otunaiya, A. O. (2007). Access to informal credit and its effect on cassava production in yewa division of Ogun State, Nigeria. *The Nigeria Journal of Resesacrh and Production* 11(4).

[18] Samson, A., and Obademi, O. (2018).The determinants and impact of access to agricultural credit on productivity by farmers in Nigeria; Evidence from Oyo State, Nigeria. *Advances in Social Sciences Research Journal* 5(3): 252-265.

[19] Shadrack Owusu, (2017). Effect of Access to Credit on Agricultural Productivity: Evidence from Cassava Farmers in the Afigya-Kwabre District of Ghana. *International Journal of Innovative Research in Social Sciences & Strategic Management Techniques* 4(2): 55-67. ISSN: 2467-8155

[20] Siewe, F. 2015. Impact of cassava market participation on farmers' economic efficiency and poverty level in maigana agricultural zone, Kaduna State, Nigeria. A dissertation submitted to the school of postgraduate studies, Ahmadu Bello University, Zaria.M.sc. /Agric/5174/2011-2012. Department of Agricultural Economics and Rural Sociology, Faculty of Agriculture, Ahmadu Bello University, Zaria.

[21] Southwest Investment Exhibition and Summit, (2016). http://Southwestinvest.com/ondo-state/

[22] Wassie, S. B. (2014). Efficiency of Agricultural Production: Technical Efficiency of Major crops In Ethiopia: Stochastic Frontier Model. Department of economics Universitetet i Oslo. *(In press)*. http://www.duo.uio.no/

[23] Yuguda, R. M., Girei, A. A., Dire, B., and Salihu, M., (2013). Social-Economic Factors and Constraints Influencing Productivity among Cassava Farmers in Taraba State, Nigeria. *International Journal of Advances in Agricultural Science in Technology*, 1(1): 1-15. ISSN: 2348-1358.

APPENDIX