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Productivity and Technical Efficiency of Cassava Production in Ogun State, Nigeria

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Abstract: *This study focused on the productivity and technical efficiency of cassava production in Ogun State, Nigeria. A multistage sampling procedure was employed to collect data from 120 sampled respondents which were purposively and randomly selected. Primary data were used through the use of structured questionnaires. Descriptive analytical techniques, multiple regression analysis and budgetary analysis were employed for data analysis. The result of the study showed that majority of the respondents (80.8%) are male and the age of the majority (55.8%) falls within 31-50 years. About 82.5% of the respondents in the study area are married and about (36.7%) of the respondents are literate and majority (55.8%) of them had between 21-40 years of farming experience. The maximum Likelihood Estimates revealed that the planted size, expenses on other planting materials and labour are critical inputs in cassava production in the study area. The result further indicates that socio-economic condition influences technical efficiency of the cassava farmers. The study indicated that the coefficient for age of the farmers, formal education and gender are negative and are significant suggesting that they significantly and negatively influencing inefficiency. The total revenue obtained was ₦313,525.00 and the Gross Margin was ₦162,285.42. Also the B/C Ratio was ₦1.99k indicating that for every ₦1.00k expended in cassava production 99k was realized as a profit. It was concluded in this study that the socio-economic characteristics shows that cassava farming is dominated by young people who are well experienced in cassava production, the technical efficiency scores range from 0.00 to 91.86% with an average score of 58.6%. This showed that there is room for improvement and efficiency can still improve by 41.4%. The findings of this study showed that cassava production in the study area is very lucrative. Based on the findings, it was recommended that farmers should be encouraged through technical training on production practices that support the optimum use of their resources.*

Keyword: ***Technical, Production, Productivity, Efficiency, Cassava***

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I. Introduction

Cassava (*Manihot esculenta* Crantz) is a perennial shrub, though harvested around a year and it is popularly grown for its tuberous root which consist about 15% peel, and 85% flesh (Olugbemi 2016). As a staple crop, cassava has certain inherent characteristics which make its cultivation attractive to small-holder farmers. Such traits include ability to thrive on soils where other crops failed; cassava is regarded as a famine reserve crop which requires relatively low amounts of inputs.The crop can withstand stress such as drought, available all year round, cheap to cultivate and generates good income for peasant farmers, thus providing household food security. The agricultural sector in Nigeria is the major employer which employs nearly 70% of the country's labour force (Abolagba *et al*., 2010). The sector is characterized by small scale traditional farming methods with very low levels of mechanization and modern technologies leading to low levels of productivity (Abang *et al.,* 2000). Simonyan *et. al*. (2010) stated that Nigerians are poor and hungry despite efforts made by various governments improving agricultural productivity and efficiency of the rural farmers who are the major stakeholders of agricultural production. This effort is geared towardsprograms that will result to effective production. One of such programs is the Root and Tuber Expansion Program aimed at increasing root and tuber crops production.

Specifically, in the area of Cassava, a Presidential Initiative on Cassava Production and Export was unfolded by Nigerian government in 2002. Boosting production without boosting marketing system can lead to glut of cassava in the market. This can depress prices and discourage farmers from investing in cassava cultivation (IFAD, 2013). In recent years, producers in general and especially small farmers have faced considerable difficulties in practice and agricultural services. The production and marketing of cassava have several challenges which include high cost of input materials, high cost of labour, high cost of mechanization, inadequate extension services/technical advice, inadequate funds, inadequate supply of high yielding cassava cuttings, bad access farm roads, effects of weather and climate, production and price fluctuations, lack of price, control, preservation and storage, value addition among others (FMANR, 2006).

Compared to grains, cassava is more tolerant to low soil fertility and more resistant to drought, pests and diseases (Obisesan, 2013). Its roots store well in the ground for months after maturity (Ope-Ewe *et al*., 2011). It also has the ability to be stored in the soil for some period of time after fruiting without being perished. Cassava remains a staple food in many parts of western central Africa and it is found throughout the humid tropics. Its fresh root contains about 30% starch and very little amount of proteins. Its leaf is rich in protein and vitamin B.

Nigeria is the largest producer of cassava in the world followed by Brazil. Although Nigeria produces about 34 million metric tonnes annually (FAO 2014) most of the cassava produced in Nigeria is consumed locally. And in spite of the fact that Nigeria is the world largest producer, its output falls below total demand for the crop as food, for industry and export. Much recently, Nigeria has shown interest in bio-fuel obtainable from cassava. This is evident in the ethanol fuel programme in which sites have been mapped for the cultivation of cassava (Adeoti, 2010). Thus the need for intensification of the product is obvious.

According to Ogunsumi *et al*. (2010), past success of the Agricultural Development Projects (ADP) in Nigeria were based on the availability of right technology, re access to inputs, adequate market and other infrastructural provisions. Nnadi *et al*. (2013) also noted importance of extension services in providing information on modern technologies and management of farm resources. However, with the withdrawal of World Bank funding, the quality of extension officers' training and their performance in supporting subsequent ADPs are on the decline (Chukwuemeka and Nzewi, 2011; Adebayo and Idowu, 2000). Cassava ranks highly as a major staple food crop particularly for the low income earners and resource poor farmers in the developing economies of Sub-Saharan Africa particularly in Nigeria, serving as the major daily calorie intake for over 50 million people in the country. With low cost of production and improved varieties, cassava has a high potential to reduce poverty among the smallholder farm households in Nigeria but also to contribute immensely to the country's Gross Domestic Product (GDP) (Osun *et al*., 2014). Of great importance also is the internal demand for cassava, and the government directive on the use of cassava flour has raised the demand for cassava products in Nigeria. The continuous high demand for cassava could guarantee price stability and improved household income among small-holder cassava farmers (Cassava Action Plan, 2012).

However, the average yield level of cassava in Nigeria is low estimated at 14.7 mt/ha (Nang'ayo *et al*., 2007) as compared with 19 mt/ha in Indonesia, which is also a tropical country where production is similarly constrained by low level of input use, high variability in commodity prices, and lack of adequate infrastructure (Sugino and Mayrowani, 2009). To a large extent, the influence of these constraints could be reduced by changes in the use of modern inputs (e.g., fertilizers and pesticides), changes in tenancy policy, and the use of embodied technologies (Oyewo, 2011).

Most cassava plants lose their root to pests and diseases such as mealy bug or green mites on the leaves and stems of cassava which reduces the growth and yield. Most of the cassava processors in the study area are not literate and they do not know what to do when they experience such problem. Also, some mechanical damage causes loss during harvesting which result in physiological and pathological deterioration. If cassava is processed in a more efficient manner it will gain in export and as well as domestic demand. The major problem facing small scale agriculture in Nigeria is over dependent on traditional technologies which are characterized by poor yield and inefficiency. Transformation of traditional farming system for increased food production calls for the adoption of improved practices. Cassava (*Manihot esculenta* Crantz) is grown nearly by every farming family in Ghana and it is used as animal feed, source of income, agro-industrial uses and accounts for a daily calories intake of 30% (Food andAgricultural Organization [FAO] 2006; Iyagba, 2010).

Many initiatives such as presidential initiative and transformation agenda have been implemented on cassava by the government of Nigeria over the past few years with little or no impact on industrial utilization, competitiveness and export. Export share of the country in the cassava global market has remained very low even after the implementation of the initiatives. Production cost in processing factories remained exorbitant. High production cost has been aggravated by high transportation arising from poor condition of road to the farms of smallholder farmers and high cost of alternative source of energy (generating plant) arising from epileptic power supply in the country. Poor road and transportation facilities have hindered linkage of small-holders to emerging market despite Nigeria being the largest producer of cassava with expanding area under

cultivation of the crop. More worrisome is the abysmally low yield of the crop in Nigeria. Cassava production is now facing the challenge of how to meet the industrial demand towards establishing up to 40 per cent High Quality Cassava Flour (HQCF) in wheat bread and 10 per cent ethanol in gasoline with 50 per cent of that from cassava (FAO 2004).

It has become imperative to expand supply of cassava for industrial utilization because of the need to attract indigenous and global firms and investors that have indicated interest in making investment in cassava starch and other related products. More importantly, the current global crash in price of crude oil has resulted into dwindled revenue for Nigerian government leading to general economic downturn. The current economic downturn has made it necessary to reposition Nigerian agriculture to generate increased foreign exchange and income to farmers. As an important industrial crop, expanded production and utilization of cassava can be used as a springboard to wriggle out of the economic downturn in Nigeria

Objectives of the study

The broad objective of this study is to determine the Productivity and Technical Efficiency of Cassava Farmers in Yewa Division, Ogun State, Nigeria. The specific objectives are to examine the cost and return structure in cassava production; and determine the technical efficiency of farmers in the study area.

II. Methodology

Study Area

The study was carried out in two selected Local Government Areas (LGA) in the Yewa division of Ogun State, Nigeria namely Yewa North and Imeko/Afon Local Governments Area. Traditionally, Ogun State is divided into four: Egba, Ijebu, Remo and Yewa respectively, But into three (3) for administrative purposes as enshrined in the country constitution. These divisions are Ogun Central Senatorial District mainly made up of Egba with six(6) LGAs, the Ogun East Senatorial Districts made up of Ijebu and Remo with nine (9) LGAs and Ogun West Senatorial Districts which comprises of Yewa with five (5) LGAs which was established in1979, is one the oldest Local Government Area in Ogun State. It lies within latitude 4^0-14N and longitude 3^0-14E and exhibits the typical tropical climate of averagely high temperature and high relative humidity (Ivory *et. al.*, 2010). The main occupants of the study area are the Yorubas who live in such major towns such as Ayetoro, Ilaro, etc. The major occupations of the Yewa people include: Farming, petty trading, among others. Some of the major cash crops/ food crops include kolanut, citrus fruits, cassava, maize and yams to mention a few.

Sources and Methods of Data Collection

Primary and secondary data collection wereused in this study. The primary data were collected through a survey questionnaire from cassava producers in the study area. Information was obtained from the farmers based on their socio-economic characteristics of cassava production efficiency, profitability, cost and return structure, input cost and output cost and so on. The secondary data were collected from relevant journals, bulletins, publications, texts and statistical reports.

Sampling Techniques

Multi-stage sampling technique was used for data collection in this study. The first stage was selecting (2) Local Governments Area in Yewa division which includes Yewa North and Imeko-Afon using random sampling techniques. The second stage of the study was the selection of (4) communities from each selected Local Government Area. The third stage is selection of (15) farmers from each communities giving a total of 60 respondents from each Local Government Area making a total of (120) sampled respondents from the study area.

III. Methods of Data Analysis

Descriptive analytical techniques, multiple regression analysis involving the specification of the Cobb-Douglas production function and also budgetary analysis were used in the research work. The descriptive analytical approach was used to analyze the socio-economic characteristics of the farmers. The Cobb-Douglas production function was used to determine the production efficiency of cassava in the study area. The following Cobb-Douglas stochastic frontier production function was fitted to the study area;

$$LnYi=\beta_{0i} + \beta_1 LnX_{1i} + \beta_2 LnX_{2i} + \beta_3 LnX_{3i} + \beta_4 LnX_{4i} + \beta_5 LnX_{5i} + Vi + Ui$$

Where: Output (Y) is the value of cassava output measured in kg

X_1 = Land size cultivated (ha)

X_2= Fertilizer (kg)

X_3= Stem cutting (kg)

X_4= Expenses on other planting materials (₦)

X_5= Labour (mandays)

The inefficiency model based on Battesse and Coeli (1995) can be specified as:

$Ui = \delta_0 + \delta_1 Z_{1i} + \delta_2 Z_{2i} + \delta_3 Z_{3i} + \delta_4 Z_{4i} + \delta_5 Z_{5i}$

Z_1 = Age of the farmers (years)

Z_2 = Number of School (number)

Z_3 = Household size (Number)

Z_4 = variety of cassava planted

Z_5 = Gender; (if male = 1, if otherwise = 0)

The budgetary analysis was used to examine the profitability of cassava production in the study area. Estimates of production profit, outlays, revenue, gross margin and net margin and net income from cassava processing were processing were derived as follows

$\prod$= TR-TC

TC=TVC+TFC

Where:

$\prod$ = Profit (₦)

TR = Total Revenue

TC = Total Cost

TVC = Total Variable Cost (₦)

TFC = Total Fixed Cost (₦)

The result of the budgetary analysis was used to obtain the Benefit-Cost Ratio (BCR): TR/TC.

IV. Results And Discussion

Table 1: Socio-Economic Characteristics of Respondents

Variables	Frequency	Percentage	Mean Value
Age (years)			
30 - 40	22	18.3	49.9 years
41 - 50	45	37.5	
51 - 60	39	32.5	
> 60	14	11.7	
Sex			
Male	97	80.8	
Female	23	19.2	
Marital Status			
Married	99	82.5	
Divorced	6	5.0	
Widow/Widower	15	12.5	
Household Size (persons)			
3 – 6	88	73.3	6 members
7 – 10	28	23.4	
11 – 14	4	3.3	
Educational Level			
Primary School	35	29.2	
Secondary School	44	36.7	
Tertiary School	22	18.3	
No formal Education	19	15.8	
Farming Experience (years)			
5 - 10	7	5.8	
11 – 20	34	28.3	28 years
21 - 30	39	32.5	
31 - 40	28	23.3	
41 - 50	11	9.2	
> 50	1	0.8	
Farm Size (hectares)			
≤ 1.0	38	31.7	2.0ha
1.1 - 2.0	38	31.7	
2.1 - 3.0	18	15.0	
> 3.0	26	21.7	

Source: Field Survey, 2018

Age classification is relevant to this study in that physical ability and productivity depend on age and this will influence their investment positively or negatively. Table 1 shows the age distribution of the cassava famers. The result indicated that more than half (55.8%) of the respondents are between 31 to 50 years of age. The result implies that majority of the farmers are in their economically active age. At this stage in life, Anyanwu *et al.* (2001) recognised that people are more likely to be energetic and have the capacity to use innovation. This justified the findings of Ebukiba (2010), who reported that 76% of the cassava farmers were aged between 31 to 50 years.

Gender determines the ability to perform some physical work. The gender distribution of the cassava farmers revealed that majority (80.8%) of the cassava farmers were male while only 19.2% werefemale. These imply that most of the farms were managed by men as heads of the farm families. This collaborate the findings of Akerele and Aihonsu (2015), who reported that 82.5% of the cassava farmers were males. This is also an indication that the nature of work seems to be more stressful for some women to be involved at higher rate.

Marital status is expected to influence farmers' level of responsibilities which could have positive or negative influence on their disposition to economic activities including the cassava production. It was noted that most (82.5%) of the cassava farmers were married, while 5.0% were divorced and 12.5% were widowed. This is justified on the ground that the majority of respondents who engaged in cassava farming are married people. It also implies that cassava production is the means of livelihood for these households. The implication of this is that household head that are married would be most beneficiaries of cassava production as they cater for their family. They can also be source of family labour.

Household size is a very important factor especially in determining labour for farm work. A farmer with a large household size has the chance of using them as their farm labour. This will affect the size of land cultivated and enhance returns. From the result, it was observed that the farmer had an average household size of 6 persons. Majority (73.3%) of the respondents had a household size of between 3 and 6 persons.This conforms to the findings of Oladeebo and Oluwaranti (2012), who reported average of 8 persons per cassava farmers in South Western, Nigeria.

Education is of great importance in decision making. It can indirectly influence the farmers' understanding of cassava production and ways to maximize gains. Majority (36.7%) of the respondents had attended secondary school education, 29.2% of them had attended primary school and 18.3% of them had acquired tertiary school education, while a few (15.8%) of them have no formal education. By implication, a reasonable number of farmers in the area should be able to understand the use of improved technologies and apply it to achieve increased cassava production. Through education, the quality of labour is improved and with it there is increased propensity to adopt new techniques (Tijani *et al.,* 2006). Thus, cassava farmers in the study area would easily adopt new technologies which could improve their level of profit *ceteris paribus*.

Farming experience is used as a measure of management ability, the more experienced the farmer is, the more his ability to make farm decision. Majority (55.8%) of cassava farmers had between 21 and 40 years' experience, while 10% of the cassava farmers had above 40 years respectively. The mean farming experience was 28 years. This is an indication that majority of the farmers has taken into cassava farming for quite a while in the area and are more experienced in cassava production which will have positive effect on their output.

Farm categorization is justified only in the context of the particular environment. Majority (63.4%) of the respondents had between below 2 hectares of farm land, and while 21.7% of the respondents had above 3.0 hectares of farmland. The mean farm size was 2.0 hectares. The result implies that most of the farmers in the study area had relatively small farm holdings and hence were small scale farmers.This limits their cassava production potentials (Ibekwe *et. al.,* 2012).

Stochastic Frontier Production function MLE for Cassava Output.

As shown in Table 2, the results confirmed that the estimates of planted land size, expenses on other planting materials and labour are critical inputs in cassava production. The results indicated that planted land size was a factor that influence on production, determining the amount of output at 1% level. The elasticity of different outputs with respect to the mean farm size was estimated to be 1.048. The high elasticity of the farm size value in the three data sets suggests that expansion in production among the farmers was mainly due to an increase in farm size rather than an increase in technical efficiency. This implies that if farmers enlarge their cassava farm area by 1 percent, it will lead to an increase in cassava output of 1.048 percent.

The estimated coefficient of expenses on other planting materials is statistically significant at 1% level. This implies that the expenditure for other planting materials for cassava plantations in the study area has an effect on cassava yield. If farmers increase their capital in terms of expenditure for other planting materials, they could choose healthy and disease-free planting materials and better root-soaking fertilizers. The implication of this finding, however, is that policies that provide affordable farm land, planting materials, and labour would improve farm production.

Labour used in this estimation also presented a positive correlation at 1% level. This means that a 1 percent increase in labour will increase the yield of cassava. This evidence could indicate that cassava farmers apply simple but labor-intensive methods. Most farmers do not use any machinery or herbicides for planting, growing, weeding, and harvesting. Therefore, the more labour used in the farm, the more output in terms of cassava yield attained. These results are consistent with previous work by Ogunniyi *et al.* (2012).

The variance parameters, sigma-square (δ^2) and gamma (γ) were estimated at 32.576 (at 5%) and 0.994 (at 1%), 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 99.4% of the variation in cassava output of farmers is due to the differences in their technical inefficiency. Thus, inefficiency effects were present and make significant contribution to the efficiency of the cassava farmers.
The coefficient for age of the farmers, formal education and sex are negative and significant, suggesting that they significantly and negatively influence inefficiency. 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. Age of the farmers, formal education and sex had significant negative effect on the efficiency of the farmers. This implies that the technical efficiency of the farmers decline as they grow older.

Table 2: Stochastic Frontier Production function MLE for Cassava Output.

Variables	Coefficient	Standard-error	T-ratio
Constant	12.867***	0.166	77.524
Land size cultivated	1.048***	0.085	12.183
Fertilizer	0.101	0.081	1.244
Stem cutting	-0.017	0.057	-0.296
Expenses on other planting materials	0.157***	0.016	9.879
Labour	0.325***	0.087	3.745
Inefficiency			
Constant	-4.740*	2.753	-1.722
Age of the farmers	-8.263*	4.172	-1.981
Formal education	-4.511*	2.563	-1.760
Household size	2.701	1.997	1.353
Variety of cassava	0.204	1.007	0.202
Sex	-8.191***	1.001	-8.181
sigma-squared	32.576**	14.342	2.271
Gamma	0.994***	0.048	20.817
Log likelihood function = -149.176			
LR Test of the one-sided error = 117.006			

*** implies sig at 1 percent, ** implies sig at 5 percent, * implies sig at 10 percent.
Source: Field Survey, 2018

The coefficient of years of formal education showed a negative relationship with the predicted technical inefficiency effect and was significant at 10% level. This implies that increase in years of formal education reduces technical inefficiency or improves efficiency. This agrees with the findings of Ajibefun and Abdulkadri (2004). They confirmed that education was key to enhanced productivity among cassava farming households.The negative coefficient of sex which was significant at 1% level indicates that male farmers had lower inefficiency.

Frequency distribution of technical efficiency of cassava Farmers

Data in Table 3 presents the technical efficiency distribution of the cassava farms in the study area. The mean technical efficiency of the sampled farmers in the study area was 0.586, with 0.919 for the best farmer and 0.003 for the least farmer. About 56.6% of the cassava farmers were predicted to have technical efficiency exceeding 0.60. This implies that there are some technical inefficient farmers in the study area.The average farmer has 58.6% result also indicated that for the average farmer in the sample to achieve technical efficiency of his most efficient counterpart, they need about 41.4% cost savings.

Table 3: Frequency distribution of technical efficiency of cassava farmers

Efficiency (Range)	Frequency	Percentage
≤ 0.21	8	6.7
0.21 - 0.40	15	12.5
0.41 - 0.60	29	24.2
0.61 - 0.80	64	53.3
> 0.80	4	3.3
Total	120	100.0
Minimum = 0.003		
Maximum = 0.9186		
Mean = 0.586		

Source: Field Survey 2018

Cost and return structure of cassava production in the study area.

The cost – return structure analysis of cassava production in the study area was presented on Table 4. The analysis indicating the total revenue, total variable cost, total fixed cost, total cost, gross margin, net income, and Benefit and cost ratio (B/C ratio).

Table 4: Analysis of cost and returns of cassava production per hectare

Variables	Average (₦)	% of TC
Cassava output	313,525.00	
Variable Cost		
Hired labour	99,560.00	63.1
Cassava stem (Cutting)	4,275.00	2.7
Fertilizer	18,905.83	12.0
Herbicides	7,534.58	4.8
Transportation	20,964.17	13.3
Total Variable Cost (TVC)	151,239.58	95.8
Total Fixed Cost (TFC)	6,663.98	4.2
Total Cost (TC)	157,903.56	100.0
Gross Margin (GM = TR – TVC)	162,285.42	
Net Income (NI)	155,621.44	
Benefit and Cost Ratio (B/C ratio)	1.99	

Source: Field Survey 2018

From the result in Table 4, total cost of producing cassava per hectare was ₦157,903.56, the total revenue obtained was ₦313,525.00 and the gross margin was ₦162,285.42. The profit of ₦155,621.44 was actualized, this implies that cassava production in the study area was profitable. Also the Benefit Cost Ratio was ₦1.99k, indicating that for every ₦1.00k expended in cassava production, 99k was realized as a profit. This follows the findings of Eze, and Nwibo, (2014) who reported BCR of N2.0:1.0 for cassava farmers.

V. Conclusion

The study was designed to investigate the productivity and technical efficiency in cassava production in Yewa Division of Ogun State, Nigeria. Specifically, the study described the socio-economic characteristics of cassava farmers in the study area, determine the technical efficiency of farmers in the study area, examine the cost and return structure of cassava production in the study area and examine the factors affecting the production efficiency of cassava in the study area. A multistage randomized sampling technique was used to select the cassava farmers. Descriptive and inferential statistical tools were used in analyzing the study data.

The conclusion drawn from the study showed that most of the cassava farmers are male and within the economic and active age range which really favoured the production of cassava. Most of the cassava farmers are married and are highly experienced in the production of cassava Technical efficiency scores range from 0.00 to 91.86% with an average score of 58.6%. This shows that there is room for improvement and efficiency can still improve by 42.4%.The finding of this study shows that cassava production in the area is very lucrative.

VI. Recommendations

Based on the findings of this study and to forestall the problems associated with input efficiency in the study area, the following recommendations are made:

(i) Farmers should be encouraged through technical training on production techniques/practices that support the optimum use of their resources especially farm size, expenses on other planting materials and labour in order to ensure that cassava production can reap optimal benefits.

(ii) More farmers should also be encouraged to go into cassava farming since it is profitable.

(iii) In addition, further comprehensive and careful study on the improvement of technical efficiency for cassava production should be done to support cassava farming practice toward commercial crop promotion to achieve the agricultural development goals of food security.

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