TECHNICAL EFFICIENCY OF CASSAVA FEMALE FARMERS IN SURULERE LOCAL GOVERNMENT AREA OF OYO STATE, NIGERIA.

ABSTRACT

The study analyzed the technical efficiency of female cassava farmers in Surulere Local Government Area of Oyo State, Nigeria. The study specifically determined the technical efficiency of the respondents, examined the factors affecting technical efficiency and estimated the profitability of female cassava farmers in the study area. The study showed that majority of the female cassava were in their active year, most of the farmers were literate, most of the female cassava farmers were married, majority had 4 – 6 members, most of the female cassava farmers were experienced and they were small scale cassava farmers. The study also showed the variable representing farm size, agrochemical, herbicide, fertilizer, planting material and labour were found to be factors that significantly affect production. The result of the inefficiency model showed that the variables educational status and membership of farmer's association were factors that significantly affect farmers' inefficiency. The mean technical efficiency is 0.744 (or 74.4%). This implies that, on the average, the farmers were 74% technically efficient; hence their observed output was about 26% less than the maximum frontier output.The total variable cost, total fixed cost and the total cost were found to be ₦93,500.63, ₦40,806.25 and ₦134,306.88 respectively. Also the total revenue, gross margin and profit were found to be ₦462,373.50, ₦368,872.87 and ₦167,596.66 respectively. This indicates that cassava production is profitable in the study area.

Keywords: Technical Efficiency; Stochastic Frontier Model; Gross Margin Analysis and Female Cassava Farmers.

1.0 INTRODUCTION

Agriculture is the major source of livelihood for many developing countries in Africa particularly in Nigeria. Most of Nigeria's population living in the rural area depends largely on subsistent agriculture for their survival. The sector has contributed immensely in the developing the economy of Nigeria, generating about 70% of employment opportunities and accounts for

about 40% of the Gross Domestic Product (GDP), with crops accounting for 80%, livestock 13%, forestry 3% and fishery 4% (Federal Republic of Nigeria, 2006). Agricultural production in Nigeria is dominated by small scale farmers who account for about 95% of total production (Olujenyo, 2010). This is due to the unattractiveness of agriculture as a result of lack of infrastructures in the rural areas where a bulk of agricultural activities takes place. Also, limited access to credit facilities, modern technology and inefficient use of resources have been problems facing small scale farming in Nigeria.

Cassava (*Manihotesculenta*Crantz) is an important staple food and cash crop in several tropicalAfrican countries, where it plays a principal role in the food economy (Agwu&Anyaeche, 2007).It is the fourth most important crop for farmers in tropics after rice, wheat, and sugarcane, consumed by up to a billion people globally (FAOSTAT, 2010). Cassava also plays a significant role in the national efforts to improve Food Security (Match Maker Associates (MMA), 2007). It is suitable for the making of fufu, gari, flour, tapioca, animalfeed, ethanol, starch, gum, and glucose. Its roots are eaten as food, fed to stock, or used in themanufacture of starch (Eguono, 2015).

Cassava as one of the world's most significant food crops in 2013, recorded a year global output of about 276 million metric tons (MT). The leading producers in the world were Nigeria, Thailand, Indonesia, Brazil and the Democratic Republic of Congo which accounted for 19%, 11%, 9%, 8%, and 6% of the overall respectively. It provides calories for 500 million people and constitutes 37% of the population's dietary energy requirements (Asante-Pok, 2013).

In Nigeria, the role of cassava is not limited to food, as it also serves as cash crop, while its derivatives are useful in many types of products such as confectioneries, monosodium glutamate, drugs, and chips, amongst others (Aerni, 2005). Cassava as an energy derivative has been shown to be more efficient in the production of fuel than most crops used as bio-fuel (United State Department of Agriculture, 2014). Furthermore, cassava tubers and hay are used as good roughage source for ruminants such as dairy or beef cattle, buffalo, goats, and sheep. The multidimensional importance of cassava made itsfarming a choice of enterprise to the resource-poor rural households.

The term efficiency is often used synonymously with that of productivity, the most common measures of which relate output to some single input (Lund and Hill, 1979). Efficiency refers to the comparison between the real or observed values of input(s) and output(s) with the optimal values of input(s) and maximal output(s) used in a particular production process (Lovell, 1993). Efficiency is achieved by minimizing the resources required for producing a given output. Moreover, according to the optimal values, two types of efficiency can be distinguished as technical efficiency and allocative efficiency.

Efficiency is considered as technical, if optimal values are defined in terms of the maximum level of output, given the level of input, in terms of the production frontier. In other

words, technical efficiency is achieved by producing at the production frontier. If the optimal values are based on the selection of the mix of inputs, such that a given level of output is produced at the lowest possible cost, given the respective input prices, then the term efficiency can be referred to allocative efficiency (Lovell, 1993).

Technical efficiency is the ability to produce a given level of output with a minimum quantity of inputs under certain technology (Bamiro and Aloro, 2013). Technical efficiency is based on the concept of input and output relationships in farm production. It can also be defined the ability to produce maximum output from a given set of inputs, given the available technology. It is a measure of agricultural productivity, hence having access to a certain minimum set of resources, given the prevailing level of technology determines the level of technical efficiency of farmers.

The challenge that is currently facing Nigeria's agricultural sector is related to the problem of low productivity in production which is as a result of inefficient use of resources by farmers. Although about 70% of her population is engaged in agriculture, Nigeria is still insufficient in food production (Obasi&Agu, 2000). And the constraints to the rapid growth of food production seem to be mainly that of low output of crops and resource productivity (Udoh, 2005).This may not be unconnected with the role that women play in agricultural production in Nigeria. A review of the various studies on the contributions of Nigerian women to agriculture shows that rural women have made considerable contribution to production. They have been found in the production of crops such as yam, maize, cassava, rice and other food crops (Adekanye, 1984; Adeyeye, 1988).

The low growth rate in productivity in the agricultural sector have been widely considered as one of the most important causes of current high poverty rates, food insecurity and discouragement in farming among youths particularly in rural areas. Yields on plots managed by female are lower than those managed by male. This is not because they are worse farmers than male; indeed, evidence (Timothy and Adeoti, 2006; Adeleke*et al.*, 2008; World Bank, 2012; Kilic*et al.*, 2013) shows that adult female are just as efficient as adult male. They spend considerable amount of time in farm activities, while also doing their regular chores. However, they are often found to produce less on their plots of land and thus less productive than their male counterparts in the agricultural sector.

This is because of inadequate accessibility to fertilizer and low applications of modern inputs such as chemicals, fertilizer, improved seeds and pesticides (Mukasa and Salami, 2016). Furthermore, inputs are more difficult for female to access than male. Cultural norms often influence the use of machinery. Adult female access to inputs such as improved seeds, fertilizers and pesticides is limited by their access to extension services and paucity of resources. Government-subsidized inputs to small-scale farmers are also often distributed through

cooperatives. While adult female are rarely members of cooperative, they often lack the funds needed to purchase inputs even when they are subsidized (FAO and CARE, 2019).

Despite the contributions of women in agricultural development in Nigeria, they still face daunting constraints to their productivity, arising from limited access to extension, capital, land and new technologies (Oladeebo and Fajuyigbe, 2007). According to Manasa and Adebayo (2008), the problems facing the farmers are gender specific. The empowerment of women and other vulnerable groups in the society is the most effective way of reducing poverty and improving food security. The separate roles of men and women in the development of agriculture must be critically identified to achieve a meaningful impact on food production in the country. Therefore efforts towards increasing local food production in Nigeria should give prominence to the different roles played by men and women in agricultural activities especially in terms of labour supply. However, policies and programmes that ignore the differential impact on gender groups are often gender-blind and potentially detrimental to human development (UNDP, 2010).

Furthermore, cassava farming has been found to be a productive enterprise with highest net margin in most parts of the nation, thus making its production common among poor rural smallholder farmers (Fakayode*et al.,*2008). It's production has been identified to be constrained by a wide range of technical, institutional and socio-economic factors (Manyong*et al.,* 2005) which among others include pests and diseases, agronomic problems, land degradation, shortage of planting materials, access to markets, limited processing options, ineffective extension delivery systems and lack of institutionalized form of social capital which is available in rich stock in the rural communities. Due to these constraints, smallholder farmers having a yield estimate of 11 tonnesper hectare are unable to compete with its counterpart in some other countries such as India, which has a yield estimate of 34.8 tonnes per hectare (FAOSTAT, 2015).

Given the various cassava programmes and policies implemented over the years by Government to raise farmers 'efficiency and productivity and considering the role played by rural female farmers in in Nigeria and particularly the study area, it has become imperative to empirically analyze the relationship between technical efficiency and socio-economic variables among female cassava farmers. Such an analysis will further guide policy-makers in developing policies aimed at improving the welfare of femalecassava farmers, and such an improvement will give them the potential to expand their cassava production activities. This study therefore, analyzed the technical efficiency of female cassava farmers in Surulere Local Government Area of Oyo State, Nigeria.The study specifically determined the technical efficiency of the farmers, examined the factors affecting the technical efficiency of female cassava farmers and estimated the profitability of cassava production.

2.0 METHODOLOGY

The Study Area

This study was carried out in Surulere Local Government Area of Oyo State,Nigeria. Surulere Local Government area comprises of different villages which are rural in nature. The Local Government Area is located approximately on the intersection of latitude $8^{o}08^{i}$ North and longitude $4^{o}15^{i}$ East. It is about 105km North East of Ibadan (state capital), 58km North West of Oyo town. The population was approximately 166,034 as of 2006 census, an area of $23km^2$ with about 30% civil servant who as well engaged in farming, and the other 60% are into full time farming (both crops and animal production).

Sources and Method of Data Collection

Primary data was used for this research and it was collected through the use of well-structured questionnaire and interview schedule.

Sampling Technique and Sample Size

A multistage random sampling technique was used in selecting respondents for this study. The first stage involved purposive selection of Surulere Local Government Area of Oyo State due to the dominance of cassava based farmers in the study area. In the second stage, two (2) wards were randomly selected from the LGA, the third stage was the random selection of four villages from the two wards selected. And in the fourth and last stage, 80 female cassava based farmers were randomly selected from the eight villages which constitute the sample size.

Method of Data Analysis

Stochastic Frontier Production Function Analysis

This study specified the stochastic frontier production function using the Cobb-Douglass frontier production function. The Cobb-Douglass stochastic frontier model is specified as;

$ln\ Yi = \beta o + \beta 1 lnX1 + \beta 2 lnX2 + \beta 3 lnX3 + \beta 4 lnX4 + \beta 5 lnX5 + Vi - Ui$

Where; *ln*= Natural Logarithm

Yi = Output of cassava produced (kg)

X1 = Farm size (ha)

X2 = Quantity of seed used (kg)

X3 = Labor input used (man days)

X4 = Quantity of fertilizer (kg)

X5 = Agrochemicals (Liters)

X6 = Cost of planting(Naira)

Vi = Error term which are random variables

Ui = Error term which are non-random variables or technical inefficiency effect

βo= Intercept

$\beta 1$-$\beta 5$= Regression coefficient

The technical inefficiency model is defined by; $Ui = \delta o + \delta 1 Z1 + \delta 2 Z2 + \delta 3 Z3 + \delta 4 Z4 + \delta 5 Z5 + \delta 6 Z6 + \delta 7 Z7 + ei$

Where,

Ui = Technical inefficiency effect of the ith farm
Z1 = Age (years)
Z2 = Household size (Number of persons)
Z3 = Education level
Z4 = Access to credit (amount borrowed in N)
Z5 = Extension contact (Number of visit per year)
Z6 = Gender
Z7 = Farming experience (years)
$\delta 1$-$\delta 7$= Parameters to be estimated
ei= Error term

Gross Margin Analysis

Gross Margin Analysis was used to estimate the profitability of the respondents in the study area. The gross margin analysis tells us the profit a farmer makes on its cost of sales, or cost of goods sold. In other words, it indicates how efficiently the management uses labor and supplies in the production process. Gross Margin analysis is a great way to understand the profitability of farmers. It tells us how effectively management can wring profits from sales.

However, the Gross margin (GM) analysis of cassava production in the study area can be expressed as;
GM = TR – TVC
TR = P x Q
π = GM - TFC
Where GM = Gross Margin in Naira
TR = Total Revenue in Naira
TVC = Total Variable cost in Naira
P = Price of rice in Naira
Q = Quantity of rice in Kg
π= Profit

3.0 RESULTS AND DISCUSSION

Socio-economic Characteristics of the Respondents

The Table 1 below revealed that majority of the female cassava fall between the age of 46 – 55 years which implies that most of the respondents were in their active year, the respondents had one level of education or the other which most of the farmers were literate, most of the female cassava farmers were married, majority had 4 – 6 members, the mean farming experience was found to be 28.23 years which implies that most of the female cassava farmers are experienced and the mean farm size was found to be 3 hectares which implies that the respondents were small scale cassava farmers.

Table 1

Variables	Frequency	Percentage (%)
Age (Years)	14	17.50
25 – 35	11	13.75
36 – 45	23	28.75
46 – 55	18	22.50
56 – 65	18	22.50
66 – 75	9	11.25
>75	5	6.25
Total	80	100.00
Education		
Primary	16	20.00
Secondary	38	47.50
Tertiary	26	32.50
Total	80	100.00
Marital Status		
Single	0	0.00
Married	71	88.75
Widowed	9	11.25
Total	80	100.00
Household Size		
4 – 6	49	61.25
7 – 9	21	26.25
10 – 12	10	12.50
Total	80	100.00
Farming Experience (Years)		
<=20	35	43.75
21 – 30	19	23.75
31 – 40	9	11.25
>40	17	21.25
Total	80	100.00
Mean	28.23	
Farm Size (Hectares)		
<=3	53	66.25
>3	27	33.75

Total	80	100.00
Mean	3	

Source: Field Survey, 2021.

Maximum Likelihood Estimates of Parameters of Stochastic Frontier

The maximum likelihood estimates (MLE) for the stochastic production function used in explaining the influence of production inputs on the output of cassava among female farmers, and also in determining the effect of farmer specific characteristics on technical inefficiency is presented in Table 2 below. The parameters were estimated simultaneously using frontier 4.1c developed by Coelli (1996).The results show that the coefficients of farm size, agrochemical, herbicide, fertilizer were found to be positive and significant at 1% significantly affecting cassava output of the respondents as revealed by the computed t-values. This implies that, any increase in the use of the variables would bring about increase in cassava output. While the variables representing planting material, and labour were found to be negative and significant at 1%. This implies that an increase in the quantity of labour and planting material will lead to an increase output of cassava of female farmers.

The result of the inefficiency model showed that the variables educational status and membership of farmer's association affect the Inefficiency of farmers in the study area and they are all significant at 1%. The variables representing educational level and membership of association were found to positive and significant at 1%. This implies that an increase in these variables will decrease farmers' inefficiency and increase farmers' technical efficiency.

Table 2

Maximum Likelihood Estimates of Parameters of Stochastic Frontier

Variables	**Parameters**	**Coefficients**	**T-Value**
Production Factors			
Constant	β_0	2.5174	18000***
Farm size	X1	0.01397	1976.47***
Planting Material	X2	-0.1678	-1300***
Agro-Chemical	X3	-0.04238	-4579.02***
Herbicide	X4	0.2315	1700***
Fertilizer	X5	0.07884	2100***
Labour	X6	-0.1864	-2400***
In-efficiency Factors			
Constant	Z_0	5.004	2.03**
Age	Z_1	-0.4125	-0.31
Household size	Z_2	-0.4010	0.620
Educational level	Z_3	1.0386	3.57
Farming Experience	Z_4	-0.0298	-0.89

Cooperative member	Z_5	0.31743	0.18
Association	Z_6	4.5443	2.93***
Access to credit	Z_7	1.6510	1.00
Sigma-squared		-39.3096	-0.08
Log likelihood Function		18.076183	

Source: Computeroutput ***Significant at 10%, ** Significant at 5%, * Significant at 1%.

Technical Efficiency of Female Cassava Farmers in the Study Area.

The summary of the technical efficiency scores for the respondents is presented in Table 3. The technical efficiency is less than 1.0 indicating that all the farmers were producing below the maximum efficiency frontier. A range of technical efficiency is observed across the sampled farmers and the spread is large. The best farmer had technical efficiency of 0.99 (or 99.99%), while the worst farmer had a technical efficiency of 0.30 (or 30%). The mean technical efficiency is 0.744 (or 74.4%). This implies that, on the average, the farmers were 74%technically efficient; hence their observed output was about 26% less than the maximum frontier output.

Table 3

Frequency Distribution of Technical Efficiency of Female Cassava Farmers.

Efficiency Level	Frequency	Percentage
<0.40	10	12.5
0.40 – 0.49	0	0.00
0.50 – 0.59	13	16.25
0.60 – 0.69	8	10
0.70 – 0.79	19	23.75
0.80 – 0.89	11	13.75
0.90 – 0.99	19	23.75
Total	80	100.00
Mean	0.744	
Maximum	0.303	
Minimum	0.999	
Total	**80**	**100.00**

Source: Field Survey, 2021.

Profitability of Female Cassava Farmers in the Study Area

The result on Table 4 below presents the cost and return analysis of female cassava farmers in the study area. This involve the estimation of the Total cost (Total variable cost and Total fixed cost) of maize production, Total revenue (TR) and net revenue (NR) incurred from production which in pure economic term represents the profit. Gross margin analysis was used to estimate this. It involve the addition of total variable cost (TVC) and total fixed cost (TFC) to get the total cost (TC), then the total revenue gotten from the sales of cassava produced by the farmers was calculated. Subsequently, the total variable cost was deducted from the total revenue to obtain the gross margin. Finally, the net revenue (profit) was calculated by deducting the total

cost from the total revenue which gave the profit made by the female cassava farmers from their production. The table revealed the cost of variable items(hoe, cutlass, shovel, labour, fertilizer, herbicide, pesticides, rake etc), cost of fixed items (depreciated land, equipment and buildings), the total cost (which the sum of the variable and fixed cost), the total revenue gotten from cassava production, the gross margin and profit. The total variable cost, total fixed cost and the total cost were found to be ₦93,500.63, ₦40,806.25 and ₦134,306.88 respectively. Also the total revenue, gross margin and profit were found to be ₦462,373.50, ₦368,872.87 and ₦167,596.66 respectively. This indicates that cassava production is profitable in the study area

Table 4

Cost and Returns Analysis of Cassava Production in the Study Area

Items	Costs (₦)
Total Variable cost	93,500.63
Total Fixed cost	40,806.25
Total cost	134,306.88
Total Revenue	462,373.50
Gross Margin	368,872.87
Profit	328,066.62

Source: Field Survey, 2021.

4.0 CONCLUSION

The study concluded that the female cassava were in their active year, most of the farmers were literate, most of the female cassava farmers were married, majority had 4 – 6 members, most of the female cassava farmers are experienced and most of the respondents were small scale cassava farmers. The study also concluded that farm size, agrochemical, herbicide, fertilizer and labour were the factors that significantly affected cassava production of the respondents while the variables representing educational status and membership of farmer's association affect the Inefficiency of farmers in the study area.The best farmer was found to have technical efficiency of 0.99 (or 99.99%), while the worst farmer had a technical efficiency of 0.30 (or 30%). The mean technical efficiency was found to be 0.744 (or 74.4%) which implied that, on the average, the farmers were 74% technically efficient; hence their observed output was about 26% less than the maximum frontier output.

Furthermore, the total variable cost, total fixed cost and the total cost were found to be ₦93,500.63, ₦40,806.25 and ₦134,306.88 respectively. Also the total revenue, gross margin and profit were found to be ₦462,373.50, ₦368,872.87 and ₦167,596.66 respectively. This indicates that cassava production is profitable in the study area. This study therefore recommended that cassava farmers should have access to loans with little or no interest rate to help improve their revenue and also female farmers should be granted access to land for production.

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