PROFITABILITY AND EFFICIENCY OF TOMATO PRODUCTION AMONG FEMALE FARMERS IN IBADAN NORTH LOCAL GOVERNMENT AREA, IBADAN, OYO STATE, NIGERIA

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Abstract: Women farmers in Nigeria particularly in rural areas have always worked and their labour contributes a key role in the survival of millions of Nigeria families. Most rural women in Nigeria are the invisible farmers and they form the backbone of rural development, however more than half of Nigeria's food is produced by female farmers. These studies analyze the profitability and efficiency of tomato production among female farmers in Ibadan North Local Government Area of Oyo State. The study specifically described the socioeconomic characteristics of the respondents, determines the technical efficiency and factors affecting technical efficiency and lastly estimated the profitability of tomato production in the study area.

The study revealed that the female tomato farmers were adult and active, most of the farmers were literate, majority had 5 household sizes and less and most of the female tomato farmers had little experience in tomato production. The study also revealed that farm size, capital and labour were the factors that significantly affected tomato production of the respondents while the variables representing household size and number years spent in school affected the Inefficiency of farmers in the study area. The mean technical efficiency was found to be 0.97 (or 97%) which implied that, on the average, the farmers were 97% technically efficient; hence their observed output was about 3% less than the maximum frontier output.

Furthermore, the total variable cost, total fixed cost and the total cost were found to be ₦61,680.00, ₦32.488.89 and ₦94,168.89 respectively. Also the total revenue, gross margin and profit were found to be ₦253,522.20, ₦191,842.20 and ₦159,353.31 respectively. This indicates that tomato production is profitable in the study area.

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

1.0 INTRODUCTION

Agriculture is an important sector of the economy contributing about 40% of the Gross Domestic Product (GDP) and provides 88% non-oil earnings. The sector is made up of crops (85%), livestock (10%), fisheries (4%) and forestry (1%). More than 90% of agricultural output is provided by small holder farmers with less than two hectares of land under cultivation (FAO, 2007). Agricultural sector in Nigeria has performed far below expectation in providing cheap and affordable food on the table of average Nigerian despite all the productive potentials in terms of land, labour and capital resources that are available in abundance, hence this has necessitated for an increased importation of agricultural products most especially food items to meet local demands.

Among the various vegetables grown in Nigeria, tomato clearly stands out as the most important both in scale of production and level of consumption (Adejobi et al., 2011). Tomato is an excellent source of phosphorus, iron and vitamin A, B and C. it contains small amounts of B complex vitamins; thiamin, niacin and riboflavin (Dam et al.,

2005). According to Mielgo - Ayuso et al., (2018) thiamin, niacin, riboflavin and vitamin B6 are essential ingredients that are mainly involved in energy metabolism which prevent the occurrence of developmental abnormalities and chronic degenerative and neo-plastic diseases.

Tomato is grown for home consumption in the backyard gardens of almost every homestead across sub Saharan Africa (Kale and Derek, 2020). It is a cash crop for both smallholders and medium – scale commercial farmers (Varela et al., 2003). Tomato fruit provides 3 - 4% total sugar, 15 - 30mg/100g ascorbic acid; 7.5 – 10 mg/100ml titratable acidity and 20 - 50mg/100g fruit weight of lycopene antioxidants which helps to prevent cancer (prostate gland, lungs and stomach).

Tomato is cultivated almost throughout Nigeria (Adenegan and Adeoye, 2011) and its cultivation on a large scale can generate employment both for the rural and urban populace. Moreover, in 2013 Nigeria was ranked as the second largest tomato producer in Africa and thirteenth in the world with an estimated total annual production of 1.7 million tonnes cultivated on 1 million hectares of land and an average yield of 20 - 30 tons/hectare (YISA, 2013). However, there is wastage of tomato annually as tomatoes harvested in the country are lost due to poor food supply chain management, instability of price due to seasonal fluctuation in production and the supply preference of farmers and middlemen for urban markets than direct users due to low farm gate prices. Furthermore, most other vegetables have restricted demand in Nigeria, but the demand for tomato is universal (FAO, 2010). Therefore, there is a gap deficit between demand and supply in the country (Ugonna et al., 2015).

Across the Sub-Saharan African region, agriculture is mostly viewed as a gendered occupation due to the differentiated roles being played by males and females (Angya, 2008). Due to these differentiated roles in agricultural production, productive resources are differently accessed by male and female farmers. In most situations, women are limited (due to cultural and religious factors) in undertaking farming activities. Despite these challenges, women still play prominent roles in agricultural production. For instance, they supply most of the labour needed in agricultural production which is one of the most important factor of production in Agriculture as it is needed at every stage of agricultural production (Kagbu et al., 2016; Iwuchukwu and Udegbunam, 2017).

Women farmers in Nigeria particularly in rural areas have always worked and their labour contributes a key role in the survival of millions of Nigeria families (Adenugba and Raji, 2013). Most rural women in Nigeria are the invisible farmers and they form the backbone of rural development, however more than half of Nigeria's food is produced by female farmers (Adenugba and Raji, 2013). The role that women played in agricultural production and development are quite dominant and prominent. Therefore, their relevance and significance cannot be overemphasized (Nnadozie and Ibe, 2006; Rahman, 2008). Findings from a study financed by the United Nations Development Programme (UNDP) revealed that women make up some 60% to 80% of agricultural labour force in Nigeria (World Bank, 2003), in respective of the region they produce two-thirds of the food crops. Yet, in spite of their contribution, there is widespread assumption that men and not women make the key farm management decisions has prevailed. Sadly, female farmers in the country are among the voiceless, especially with respect to influencing agricultural policies.

Nigeria has the potential to lead in the exportation of tomato and tomato products in the world, as it is ranked as the eleventh largest producing country in the world (Food and Agricultural Organization, 2017). However, it was reported that Nigeria recorded over 45% (750,000 t) of the total tomato crop produced in the country as annual loss (FAO, 2010). Both traditional and improved varieties of tomato are cultivated in Nigeria. Despite the huge potential for the production of tomatoes in south-west Nigeria, particularly the study area, the region still depends largely on the north for the supply of tomatoes. Most of the tomato fruits purchased in the local market are brought from the north, with implications for the price due to the cost of transportation. Also, their quality is affected as a result of greater handling and the long distances they are transported, hence reducing their nutritional content.

Inefficiency in the use of available resources according to Gani and Omonona (2009), has hindered increased food production hence low income among the farmers across the nation. Efficiency is very important to increased agricultural production. This is because the scope of agricultural production can be expanded and sustained by farmers through efficient use of resources. Liu and Zhuang (2000), argued that financial constraints affected technical efficiency because, besides the quantity of input used, the timing of input usage which is been affected by finance also influences the farm output.

Tomato production entails different cost out lays, hence the need to know its profitability before venturing into the production. Profit maximization is one of the important goals of farm business. This can practically be achieved through the knowledge of cost of production and estimation of benefits in monetary terms. Profitability in some businesses exists because they are managed more efficiently than others. The prospect of earning and maintaining profitability serves as the incentive for creativity and efficiency among farmers. Thus, this study tends to analyze the profitability and efficiency of tomato production in Ibadan North Local Government area of Oyo State. The study specifically profiled the socio-economic characteristics of female farmers in the study area, estimates the profitability of tomato in the study area, determined the technical efficiency of female tomato farmers and examined the factors affecting the technical efficiency of female tomato farmers in the study area.

2.0 LITERATURE REVIEW

Efficiency analysis in agriculture typically includes the ability for farms to generate a certain amount of output at least cost from a given resources or a certain amount of yield (Girei et al., 2013; Tambo and Theresa, 2010). Efficiency described the performance of the procedures used to transform inputs into output. This infers that the quantity of existing resources have to be used efficiently to achieve the optimum level of production. However, the allocative efficiency analysis seeks to optimize the objective function of profit maximization subject to resource constraint. Resources are said to be allocated efficiently where the value of each resource's marginal product is equal to its price. Agricultural productivity knowledge and policies are needed to know the resources whose quantity or rates of use are to be increased or decreased for successful results (Alimi, 2000). Thus, the focus is currently on small-scale farmers' cassava production, which dominated the farming population in Nigeria to enhance resource efficiency (Abdulkadir and Umar, 2015; Goni et al., 2013).

The analysis of efficiency is generally associated with the possibility of farms producing a certain optimal level of output from a given bundle of resources or a certain level of output at least cost (Amaza, 2000). Efficiency can be defined as the relative performance of the processes used in transforming input into output (Lissita and Odening, 2005). It could also be defined as the attainment of production goals without waste (Ajibefun et al., 2002). The pivotal role of efficiency in accelerating agricultural productivity and output has been applauded and investigated by numerous researchers within Africa and outside Africa alike. The decreased output of food crop production over the years may not only be connected with deviations of farmers' practices from technical recommendations but also with the use of resources at sub-optimal levels which ultimately leads to technical and economic inefficiencies (Coelli and Battese,1998). An underlying premise behind much of the research in efficiency is that farmers are not making efficient use of existing technology, then efforts designed to improve efficiency would be more cost effective than introducing new technologies as a means of increasing agricultural output (Belbase and Grabowski, 1985; Huynh, 2008; Adeleke, 2008).

Efficiency measurement has received considerable attention from the theoretical and applied economists. From theoretical point of view, there has been a spirited exchange about the relative importance of various components of firm efficiency. From an applied perspective, measuring efficiency is important because this is the first step in an agricultural production process that might lead to substantial resource saving. These resource saving has important implication for both policy formulation and firm management (Sadiq et al., 2009). The concept of efficiency goes back to the pioneering work of Farell (1957) who distinguishes between three types of efficiencies: Technical efficiency (TE), Allocative or price efficiency (AE) and Economic efficiency (EE).

3.0 METHODOLOGY

The Study Area

This study was carried out in Ibadan North Local Government Area of Oyo State, Nigeria. It has its headquarters located at Agodi in Ibadan. Several households in Ibadan North Local Government area depend on agriculture (Wahab and Abiodun 2018). They are mostly smallholder farmers having less than two (2) hectares of land due to the traditional land tenure system that denied them access to large acreage of land (Nyambo et al., 2019). Major crops produced in the area are horticultural crops which help to augment family needs like feeding, rent and payment of school fees. Unfortunately, they largely depend on rainfed cultivation partly due to their low level of income. Most never bother to find out the cost of irrigation but they depend on the assumption that "it is very expensive" and beyond their reach (Takeshima 2016).

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 Ibadan North Local Government Area of Oyo State due to the dominance of small holder 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 three villages from the two wards selected. And in the fourth and last stage, 90 female tomato farmers were randomly selected from the six 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;

$\ln Yi = \beta o + \beta 1 \ln X1 + \beta 2 \ln X2 + \beta 3 \ln X3 + \beta 4 \ln X4 + \beta 5 \ln X5 + Vi - Ui$
Where; ln= Natural Logarithm
Yi = Output of tomato
X1 = Farm size (ha)
X2 = Capita (Naira)
X3 = Labor input used (man days)
Vi = Error term which are random variables
Ui = Error term which are non-random variables or technical inefficiency effect
βo= Intercept
β1-β5= 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 = Sex
Z3 = Marital status
Z4 = House hold size
Z5 = Level of education
Z6 = Farming experience (years)
Z7 = Years spent in school (years)
Z8 = Amount of credit used (Naira)
δ1-δ7= 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 tomato 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 tomato in Naira
Q = Quantity of tomato
π= Profit

4.0 RESULTS AND DISCUSSION

Socio-economic Characteristics of the Respondents

The Table 1 below revealed that majority of the female tomato farmers fall between the age of 51 – 60 years with a mean age of 50.13 years which implies that majority of the female tomato farmers were adult and in their active year, the female tomato females had one level of education or the other which implies that most of the farmers were literate. The study also revealed that majority of the farmers had household size of 5 persons and less with a mean household size of 7 persons. And the mean farming experience was found to be 6.35 years with most of the respondents having a farming experience of 8 – 9 years.

Table 1: Socio-Economic Characteristics of Female Tomato Farmers in the Study Area

Variables	Frequency	Percentage (%)
Age (Years)		
≤30	13	14.14
31 – 40	7	7.78
41 – 50	24	26.67
51 – 60	34	37.78
>60	12	13.13
Total	**90**	**100.00**
Mean	**50.13**	
Education		
Primary	28	31.11
Secondary	33	36.67
Tertiary	27	30.00
Total	**90**	**100.00**
Household Size		
≤5	49	61.25
6 – 7	21	26.25
8 – 9	10	12.50
Total	**90**	**100.00**
Mean	**7**	
Farming Experience (Years)		
<=5	17	18.89
6 – 7	31	34.44
8 – 9	42	46.67
Total	**90**	**100.00**
Mean	**6.35**	

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 tomato 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, capital and labour were found to be positive and significant at 10% and 1% respectively significantly affecting tomato output of the respondents as revealed by the computed t-values. This implies that, any increase in the farm size, capital and labour will increase the production of tomato production.

The result of the inefficiency model showed that the variables household size and number of years spent in school affect the Inefficiency of farmers in the study area and they are at 1% and 5% respectively. These two variables representing were found to positive. This implies that an increase in these variables will decrease farmers' inefficiency and increase farmers' technical efficiency in the study area.

Table 2: Maximum Likelihood Estimates of Parameters of Stochastic Frontier

Variables	Parameters	Coefficients	T-Value
Production Factors			
Constant	β_0	4.168924	1.25
Farm size	X1	0.2943181	1.66*
Capital	X2	0.8392523	3.33***
Labour	X3	0.8437297	2.95***
In-efficiency Factors			
Constant	Z_0	-0.3158699	-1.06
Age	Z_1	0.0433214	1.30
Sex	Z_2	0.0028384	0.00
Marital status	Z_3	0.0138853	0.02
Household size	Z_4	0.0543129	1.91*
Level of education	Z_5	-0.0168534	-0.12
Farming experience	Z_6	-0.0209732	-1.02
Years of schooling	Z_7	0.0149984	2.43**
Amount of credit	Z_8	-1.64e-06	-1.47
Sigma-squared		0.8539053	0.1266425
Log likelihood Function		-100.02439	

Source: Computer output ***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 mean technical efficiency was found to be 0.97 (or 97%). This implies that, on the average, the farmers were 97% technically efficient; hence their observed output was about 3% less than the maximum frontier output.

Table 3: Frequency Distribution of Technical Efficiency of Female Cassava Farmers.

Efficiency Level	Frequency	Percentage
0.70 – 0.79	0	0.00
0.80 – 0.89	0	0.00
0.90 – 0.99	90	100.00
Total	90	100.00
Mean	0.972	
Maximum	0.973	

Minimum	0.970	

Profitability of Female Cassava Farmers in the Study Area

The result on Table 4 below presents the profitability of female tomato farmers in the study area. This involve the estimation of the Total cost (Total variable cost and Total fixed cost) of tomato 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 tomato farmers from their production. The total variable cost, total fixed cost and the total cost were found to be ₦61,680.00, ₦32,488.89 and ₦94.168.89 respectively. Also the total revenue, gross margin and profit were found to be ₦253,522.20, ₦191,842.20 and ₦159,353.31 respectively. This indicates that tomato production is profitable in the study area.

Table 4: Profitability of Tomato Production in the Study Area

Items	Costs (₦)
Total Variable cost	61,680.00
Total Fixed cost	32,488.89
Total cost	94,168.89
Total Revenue	253,522.20
Gross Margin	191,842.20
Profit	159,353.31

Source: Field Survey, 2021.

5.0 CONCLUSION

The study concluded that the female tomato farmers were adult and active, most of the farmers were literate, majority had 5 household size and less and most of the female tomato farmers had little experience in tomato production. The study also concluded that farm size, capital and labour were the factors that significantly affected tomato production of the respondents while the variables representing household size and number years spent in school affected the Inefficiency of farmers in the study area. The mean technical efficiency was found to be 0.97 (or 97%) which implied that, on the average, the farmers were 97% technically efficient; hence their observed output was about 3% less than the maximum frontier output.

Furthermore, the total variable cost, total fixed cost and the total cost were found to be ₦61,680.00, ₦32.488.89 and ₦94,168.89 respectively. Also the total revenue, gross margin and profit were found to be ₦253,522.20, ₦191,842.20 and ₦159,353.31 respectively. This indicates that tomato production is profitable in the study area. This study therefore recommended that inputs should be made available to female tomato farmers and also they should have access to land to help increase their production as well as their efficient.

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