NSUK Journal of Science & Technology, Vol. 5, No. 1, ISSN: 1597 - 5527

TECHNICAL EFFICIENCY IN CASSAVA PRODUCTION: A CASE OF SMALL HOLDER FARMERS IN WAMBA LGA OF NASARAWA STATE, NIGERIA.

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Article received: 7th April, 2015; Article accepted: 15th August, 2015.

ABSTRACT

The study employed the use of the stochastic frontier production function to analyze the technical efficiency of cassava farmers in Wamba Local Government Area of Nasarawa State, Nigeria. A multi stage random sampling technique was used to select 150 cassava farmers from the five districts of the study area. The Data was analyzed using descriptive, inferential statistical techniques and stochastic frontier production function. The empirical estimates showed that an average cassava farmer in the study area had technical efficiency score of 0.879. This implies that cassava farmers in the study area are technically efficient. Non physical factors served as determinants of technical efficiency, they were Age, Education, Family size, Farming experience, Access to credit, Access to cooperative and Extension contact and were however not found to be significant. Majority of cassava farmers in the study area had no access to credit, no contact with extension agents, non formal education which affected the farmers' technical efficiency. It was recommended that government should provide adequate information on credit availability to rural farmers, extension agents should be posted to rural areas and farmers should be sensitized to patronize them and improve production of cassava in the study area, the state and the country as a whole.

Keywords: Cassava, Wamba, Technical Efficiency.

INTRODUCTION

The attention given to agriculture, by the Nigerian government, has increased in the recent past. This is premised on the realization and acceptance by the government that meaningful development and growth of the Nigeria economy cannot be achieved by highly capital intensive activities such as in the oil and gas sector with minimal job creation opportunities. For instance agriculture accounted for 68% of the 8.2% growth rate recorded by the non-oil sector in 2005 (Idowu, 2009), and contributed 33% to Gross Domestic Product (GDP) of the economy in 2009 (Bureau of African Affairs, 2010). It is now better understood that agricultural development has a key role to play in this respect with cassava having a unique importance in food security issues in developing countries.

Cassava can be a powerful poverty fighter in Africa. The cash income from cassava proves more egalitarian than the other major staples because of cassava's low cash input cost (Nweke, 2004). Compared with other major staples, cassava performs well across a wide ecological spectrum. It therefore benefits farmers across broader swath of ecological zones. Cassava is likewise, less expensive to produce. It tolerates poor soil, adverse weather and pests and diseases more than other major staples (Nweke, 2004). The crop puts ready money and food in the very vulnerable segments of society. Cassava stores harvestable portion under ground until needed: it is therefore a classic food security crop. Nigeria grows more cassava than any other country in the world. The production of cassava is concentrated in the hands of numerous small holders farmers located primarily in the south and central regions of Nigeria. A significant population of cassava growers in Nigeria has made the transition from traditional production system to the use of high yielding variety and mechanization of processing activities (Nweke *et al*., 2002). According to Barry (1993), Nigeria and Democratic Republic of Congo posses both large and small scale farms on which cassava is grown by full-time and part-time farmers. In these farming areas an average of about 45 percent of cassava field was cultivated for commercial purposes, but this varied from 0 to 100 percent (Nweke, 1989).

Nigeria is clearly in the lead in cassava production world-wide (FAO, 2004a). Several factors were believed to have facilitated the rapid spread of cassava cultivation in Nigeria. First, the agronomic and nutritional advantages of cassava over other staples and second, the vastly superior, storage potential of cassava products. Other desirable qualities that aided the high distribution of cassava in Nigeria include its adaptability to relatively marginal soil and erratic rain-fed condition. Also, there is certainty of obtaining some yields even under the most adverse conditions and its flexibility with respect to time of planting and harvesting. Nigerians derive much of their food and employment from cassava production, processing, marketing and cassava based agro-industrial schemes, although yam is traditionally the most important food among ethnic groups in Nasarawa State, cassava has gained widespread acceptance as a "Savior" crop being cropped by almost all households in the state with the farm size of 78% of cassava producers range between 0.1 to 0.2 ha (NADP, 2009). According to Robert (2003) cassava is particularly suited for small scale farmers and their families because of their limited resources they can meet the cultivation requirement in terms of labour, capital and land size. A much better returns can be obtained through cassava cultivation than other crops such as rice on lands with less water usage. In general, cassava farming can play a vital role in food security, improved farm economy, conservation of natural resources and improved farm income (Ajewole and Folanyan, 2008). Consequently, cassava is now seen as an ally in the fight against hunger.

Problem statement

Nigeria is one of the countries in sub-Sahara African (SSA,) where self-sufficiency in food production remains a critical challenge even in the absence of wars and natural disasters (ADB, 1999 in Alimi *et al*., 2006). It is reported that the population in SSA is rising at about 2.5% which outstrips food production that is growing at about 1.5% and the result of population pressure and demand of land for non – agricultural uses lead to decrease in available agricultural land and consequently small farm size (Alimi *et al*., 2006). Olutawosin and Olaniyan (2001) noted that Nigeria is a nation of small holder's farmers cultivating an average of 2 hectares per household under traditional system of farming and that about 90% of food production in SSA (Nigeria inclusive) comes from small holders farmers under traditional system of farming. In a situation of small farm size, agricultural intensification is the key to effectively address the problem of self insufficiency in food production. Agricultural intensification is the production of more food per unit of land (Alimi *et al*., 2006). This can be achieved through improvement in resource- use efficiency.

Although, concerted efforts have been made by past and present governments of Nigeria towards improving agricultural productivity and efficiency of the rural farmers who are the major stakeholders of agricultural production, yet millions of people in Nigeria are poor and hungry (Simonyan *et al*., 2010).It has been realized that domestic production of food has not been able to meet the domestic demand for food crop. The reason for this is that there are some problems at the micro level, one of which is the inefficient use of resources in production (Oluwatayo *et al*., 2008). The cost – revenue relationship of the entire production process is influenced by how efficient the resources are utilized. Efficient use of farm resources is important part of agricultural sustainability (Oluwatayo *et al.*, 2008). Also, it has been established that appreciable yield increase could be obtained through the use of modern technologies in production of crops. Hence this has been chosen as a vital way to improve total farm output and to curb food shortage because of its great impact on production (Ogbe *et al*., 2003). Despite this, most farmers still depend on their old method and manual labour for farming. On this premise of the problems encountered by the farmers, this research is aimed at estimating the technical efficiency of cassava production in Wamba Local Government Area, Nasarawa State Nigeria. The specific objectives of the study are to:

i. estimate the inputs and output relationship in cassava production;
ii. determine the technical efficiency in cassava production;
iii. identify the determinants of technical efficiency in cassava production; and
iv. Make policy recommendations that will enhance technical and economic efficiency of cassava farmers in Wamba Local Government Area of Nasarawa state, Nigeria.

METHODOLOGY

The study was conducted in Wamba Local Government Area. Wamba Local Government is located between longitudes 5^0 east to 7^0 west of the equator with an average annual rainfall of about 1500mm. (Wamba Local Government, 2012). The area is noted for its long wet season which often commences as from March to October. And grading with a land area of about 25 – 365km^2 (Wamba Local Government 2012). The establishment of Wamba dates back to the year 1180 AD, it started as Ogri (ganuwa). Most of the populace are farmers and they engage in either crop farming, livestock production, fishing, hunting and trading of farm produce.

Wamba local government has seven districts (7) namely; Gitta, Wamba central, Wamba South, Wamba East, Wayo, Wude and Nekere districts. The people of Wamba which is the head quarter of the

Wamba Local Government Area migrated from "Kwararafa" Empire at the tailed end of the 12^{th} century.
Population of Wamba local government area is about 72, 89400 with 36, 54 200 males and 36, 35200 females (NPC, 2006). Ethnic groups in this area include: Rindre, Kantana, Arum and Buh. Other minor ethnic groups include Kukere, Hausa, Fulani and Ninzom.

Sampling procedure
Multistage sampling technique was employed, to obtain a sample of 150 cassava farmers. In the first stage, five districts were selected randomly out of the seven (7) districts in Wamba Local Government area. The second stage involved the in each of the selection of districts 10% of the total cassava farmers was randomly sampled to give a total of 150 farmers as sample size for the study (Table 1).

Table 1: Sampling frame and sample size

Selected district	sampling frame	Sampling size
Wamba	400	40
Konvah	350	35
Gbata-ukpe	300	30
Wude	250	25
Wayo	200	20
Total	**1500**	**150**

Data collection
Primary data were collected from cassava farmers for 2011 cropping season and the duration for the collection of the data was September to October 2012, using structured questionnaire and personal interview. Information collected are shown in table 2 below:

Table 2: Data collected

SECTION	INFORMATION COLLECTED
A. Socio-economic characteristic	Age; Gender; Educational Level; Extension Visits; House Hold Size; Farming Experience; Off Farm Income; Credit Availability.
B. Inputs	Farm Size; Labour; Fertilizer; Stem Cuttings; Capital; Pesticides and Other Cost.
C. Output	Quantity of cassava harvested.

Analytical technique
Descriptive statistics such as frequency distribution, percentages and mean were employed to achieve objective 1 of the study while stochastic frontier production function was utilized to achieve objectives 2and 3, respectively.

The Stochastic Frontier Production Function
The Cobb-Douglas functional form of the stochastic frontier production function was employed to estimate the technical efficiency of cassava farmers in the study area. The stochastic frontier production function has the advantage of allowing simultaneous estimation of individual technical efficiency of the farmers as well as identifying determinants of technical efficiency (Battese and Coelli, 1977). The Cobb-Douglas stochastic frontier production function is specified in its log form as:

$$\text{Log } Y_1 = Lna_0 + a_1 L_n X_1 + a_2 L_n X_2 + a_3 L_n X_3 + a_4 L_n X_4 + a_5 L_n X_5 + a_6 L_n X_6 + V_i - U_i \text{ -------(1)}$$

Where;
Ln= the natural logarithm
Y_1 = Output of cassava (kg)
X_1 = farm size (ha)
X_2 = Stem cuttings (kg)
X_3= Fertilizer (kg)
X_4= Herbicides (Litre)
X_5= Labour (Man-hour)
V_i = random errors
U_i = Technical inefficiency predicted by the model

a_0 = Intercept (constant term)

$a_1 - a_5$ = regression coefficients to be estimated.

The determinants of technical efficiency were modeled in terms of factors that were assumed to affect the efficiency of production of farmers such factors are the socio-economic variables of the farmers. These variables were assumed to influence or affect technical efficiency of the farmers. Therefore, any policy that will affect these variables will also affect the technical efficiency of the farmers.

The inefficiency effect model is to identify determinants of inefficiency U_i which is expressed as:

$U_i = b_0 + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + b_5 X_5 + b_6 X_6 + b_7 X_7 + b_8 X_8$

Where,

U_i = inefficiency

X_1 = age of farmers (years)

X_2 = household size (no)

X_3 = farming experience (years)

X_4 = educational level (years)

X_5 = Amount of credit obtained (₦)

X_6 = non farm income (₦)

X_7 = Extension contact (no of times each farmers has extension contact in a year)

X_8 = Membership of cooperative (years of participation in cooperative)

b_0 = Constant

$b_1 - b_8$ = regression coefficients

RESULTS AND DISCUSSION

The Cobb – Douglas functional form of the stochastic frontier production was used to estimate input – output relationship for the cassava production. The result in table 2 shows that land (farm) size (x_1), stem cuttings (x_2), labour (x_3) and fertilizer (x_4) have positive coefficients. This means that the variables were directly related to cassava output. This indicates that an increase in farm size, stem cuttings, labour and fertilizer will increase significantly cassava output. This result highlights the importance of land (farm) size, stem cuttings, labour and fertilizers in increasing crop yield as small farm size, low stem cuttings, low labour and low fertilizer application tends to decrease agricultural productivity. Furthermore, the result of the study showed that at 5% level of significant, stem cuttings and fertilizer have positive and significant influence on output while at 1% level of significant, land and labour also have positive signs, suggesting that the higher the inputs values the higher the output of cassava in the study area. On the other hand, chemicals have negative coefficient and had significant influence on output of the respondents, suggesting that as farmers wrongly applied chemicals output of cassava would also decrease.

Table 3, stochastic frontier production function

Variable	REGRESSION coefficient	Standard error	t – value
Constant	6.021	0.642	9.079**
Land (x_1)	0.025	0.094	0.269
Stem cuttings (x_2)	0.572	0.096	5.987**
Labour (x_3)	0.128	0.085	1.510*
Fertilizer (x_4)	0.061	0.091	6.710**
Chemical (x_5)	-0.033	0.045	-0.072
Sigmma Squared	0.084	0.117	0.720
Gamma	0.729	0.378	1.927

Source: computed from survey data (2012).

Table 4 shows technical efficiency indices of cassava farmers in the study area. It can be seen that cassava farmers had high technical efficiency in the production of cassava. The technical efficiency of the farmers ranged from 0.50 – 0.99 indicating high technical efficiency among the cassava farmers in the study area. The maximum technical efficiency of the farmers was 0.959 while the minimum technical efficiency was 0.576 and the mean technical efficiency of 0.879. Generally, there was a high level of technical efficiency among the farmers, which according to Idiong (2006) indicates that only a small fraction of output can be attributed to wastage. The result also indicates that many of the respondents produce close to their production frontier where profit is maximized.

Table 4, Technical Efficiency in cassava production.

Technical efficiency indices	Frequency	Percentage
0.50 – 0.59	1	0.67
0.60 – 0.69	7	4.67
0.70 – 0.79	14	9.33
0.80 – 0.89	54	36.00
0.90 – 0.99	74	49.33

Source: computed from survey data (2012)
Maximum efficiency = 0.959
Minimum efficiency = 0.576
Mean technical efficiency = 0.879

In table 5, the determinants of technical efficiency of cassava farmers were presented. The Age, educational level, family size, access to credit and extension contact were directly related to technical efficiency of the farmers because of the positive coefficients. This shows that the efficiency of cassava farmers increases with the increase in age of farmers, educational level of farmers because education enhances the acquisition and utilization of information on improved technology by farmers (Idiong *et al.* 2009) and this increases efficiency Haruna and Kyiogwom 2009). The coefficients of farming experience and that of access to co-operative society are negative showing inverse relationship with technical efficiency. This implies that as the farmers experience in farming decreases , the farmer will become technically inefficient in resource utilization in farming and thereby leading to low output. So, also access to co-operative in the study reveals a negative sign, this implies that farmers will not have adequate information on improved inputs in agriculture that can spur productivity.

Table 5, Determinants of technical efficiency in cassava production.

Variable	Regression coefficient	Standard error	t-value
Constant	0.478	1.641	2.529
Age	0.265	0.064	4.158
Education	0.033	0.054	6.119
Family size	0.807	0.131	3.142
Farming experience	-0.063	0.013	-.0.463
Access to credit	0.068	0.016	2.132
Access to co-operative society	-0.128	0.025	- 0.507
Extension contact	0.094	0.148	1.927

Source: Computed from survey data (2012).

CONCLUSION AND RECOMMENDATION

The result of this study revealed that cassava farmers are technically efficient. However constraints such as inadequate extension contact, lack of experience in farming, lack of credit and lack of proper education among others were found to hinder agricultural productivity.

Based on the findings, cassava farmers in wamba local government should be encouraged to increase the use of variable inputs at optimal level. Cassava farmers should involve an intergrated and policy approach that will promote education among members.

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