

Resource Use Efficiency of Cassava farmers in Akwa Ibom State, Nigeria

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Abstract
This study examined the resource use efficiency of cassava farmers in Akwa Ibom State, Nigeria. Data collated from 100 farmers selected using a multi stage random sampling technique were subjected to statistical and economic analyses to unveil the pattern of resource use efficiency in cassava enterprise. Result from the ordinary least square multiple regression informed that 92 percent of the variation in cassava output was explained by farm size, fertilizer use, cuttings and labour inputs, with only farm size and cuttings being significant at five percent level. Data on resource use efficiency reveal that the farmers were operating in the second stage of production as regards the use of land (farm size), cuttings and labour, thus, implying decreasing returns to scale, whereas for fertilizer use, they operated within the third stage of the production process as Marginal Physical Product (MPP) was below zero. Based on these findings, the study recommends policies to raise the level of resource use especially through the provision and maintenance of an efficient input delivery system.
Keywords: Cassava Farmers, Resource Use Efficiency, Returns to Scale, Marginal Physical Product

1. Introduction

Nigeria is the world's largest producer of cassava with other top producers being Indonesia, Thailand, the Democratic Republic of Congo and Angola. It was estimated that in 2010, Nigeria's production of cassava reached 37.5 million tonnes and that the country has consistently been ranked as the world's largest producer of cassava since 2005 (FAOSTAT, 2012). Comparing the output of various crops in Nigeria, cassava production ranks first, followed by yam production at 27 million tonnes in 2002, sorghum at 7 million tonnes, millet at 6 million tonnes and rice at 5 million tonnes (FAO, 2004).

Expansion of cassava production in Nigeria has been relatively steady since 1980 with an additional push between the years 1988 to 1992 owing to the release of improved International Institute of Tropical Agriculture (IITA) varieties. The presidential initiative on cassava was launched in 2002 with the aim of creating awareness among farmers on the opportunities in the cassava markets worldwide; increasing the crop's area of cultivation to 5 million hectares, targeting a harvest of 150 million tonnes annually. It also targeted the production of 37.5 million tonnes of processed cassava products annually, such as garri, pellets chips, starch and ethanol for local and export markets. Between 2002 and 2010, IITA implemented the Integrated Cassava Project (ICP) to support the presidential initiative on cassava. Under ICP, IITA and its partners successfully introduced and promoted more than 40 cassava varieties to Nigeria farmers and facilitated the establishment of hundreds of processing centers and fabricating enterprises (IITA 2011).

In Akwa Ibom State bold steps were taken to tap the potential of cassava through its 'cassava competiveness initiative'. As a result, some bakeries adopted the use of 10% cassava flour in the contents of their bread. In 2004, more than 500 hectares of cassava was planted under the Akwa Ibom State Agricultural Development Program (ADP). The government contributed 76.2 million naira to fight cassava mosaic disease in collaboration with the International Institute of Tropical Agriculture (IITA, 2006). In spite of government's good intentions regarding cassava production at the federal and state levels, especially in the creation of favourable production environment, the performance of the State as regards increased cassava production as a major revenue earner has still not reached its full potential. For instance, Benue and Kogi State in the North Central Zone are the largest producers of cassava in Nigeria (IITA, 2004). Of critical importance to Akwa Ibom State in attaining full potential in cassava production are the resources used in production. Therefore, issues relating to how these resources are utilized to enhance income of farmers thus impacting on the growth of the economy of the State need to be addressed. Many researchers have identified resource use efficiency to be responsible for the poor performance of the agricultural sector in Nigeria. Some critical resources which have been identified with low levels of productivity are capital, labour and land use (Akpan, 1982; Olayide and Heady, 1982). In view of the above, there is the need to study the resource use efficiency of cassava production in Akwa Ibom State.

2. Theoretical framework

Production theory attempts to examine the relationship between resources and how they are transformed into output(s). In this context, it tries to uncover factors which are relevant in the production of a given input(s) to output(s). Several definitions in production theory relate input(s) to output, (Doll and Orazem, 1978; Koutsoyianis, 1997; Lipsey, 1979; Whitehead, 1986). These factors must contribute in a positive way to the production of output, but the decision on how much of each to use is dependent on economic theory.

Increase in output may be as a result of three forces. The first is when resources are increased and output increases by more than the proportionate increase in inputs that were added to the production process; the second is when production increases by less than proportionate increase in the resources used in production, and third is when increase in output is proportionate with increase in input. This is the reason the concept of efficiency is central to the field of production economic. In spite of its importance, its actual definition is still in contention. For the purpose of this study, the definition proposed by Olayide and Heady (1982) was used. This definition considers resource productivity in term of individual resource inputs or a combination of them. It implies the attainment of maximum output from a minimum set of inputs. For any given level of technology, and prices of inputs and outputs, marginal value product (MVP) remains the most convenient tool for judging the efficiency of resource use when compared with input prices, assuming the existence of a perfectly competitive market.

There are three generally acknowledged stages of production in economics. These stages are determined by production elasticity. Stages one and three are the irrational and inefficient stages; stages two is the rational and efficient one. Elasticity of production is greater than one and less than zero in stages one and three respectively. This is an indication of irrationality and inefficiency in the production process. In stage two, the elasticity of production is less than one, implying rationality and efficiency. In this stage, changes in output through additional units of input would add less to output than the preceding ones. The optimum level of production which is said to be economic and efficient can however only be specified in stage two when the MPP and prices of inputs and output are specified. The concept of efficiency connotes the relative performance of how resources are transformed into output. In theory, two types of efficiency exist (technical and allocative) and are affected by factors such as managerial ability, type of technology used, environment, economic and non-economic considerations (Okon, 1997). Therefore, the efficiency of how resources are used influence optimal output and in the face of stable prices or rising output prices, this would in turn affect the income capacity of the producer(s) and their allocative efficiencies.

3. Materials and Methods

3.1 Study Area

The study was conducted in Akwa Ibom State located at latitude $4^0 33^1$ and $5^0 33^1$ North and longitude $7^0 25^1$ and $8^0 25^1$ East. It occupies a total land area of 7,246 square kilometers, with a population of 3,920,208 million people (NPC, 2006). The State has 6 agricultural zones namely Oron, Abak, Ikot Ekpene, Etinan, Eket, and Uyo, and has very high potential for agriculture.

3.2 Sampling Technique

A total of 100 farmers were selected using a multistage random sampling technique. Four local governments were selected randomly for the first stage. Then 25 farmers were randomly selected from the list of cassava farmers in each of the four local government obtained at the State Agricultural Development Program (ADP) office. The local governments selected were Oron and Udung Uko (under Oron agricultural Zone) and Ikot Ekpene and Essien Udim (under Ikot Epene agricultural zone). However 94 questionnaires were correctly filled and were used for data analysis.

3.3 Data Collection

The study used both primary and secondary data sources. With the aid of questionnaire and interview schedule, farm level data for the 2011 production season on resource use, prices and output were obtained from respondents. The secondary sources were obtained from textbooks, journals, internet and other relevant literature.

3.4 Analytical techniques

The data collected were analyzed using descriptive statistics (mean, frequency, percentages) and ordinary least squares (OLS) regression technique. The production functions was used in three functional forms (linear, Cobb-Douglas and semi-log) from which the lead equation was chosen based the value of the coefficient of multiple determination (R^2) as well as the signs of the significance of the regression parameters. The model is stated explicitly as:

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + u$$

where

y	=	output /per cassava farmer (in kg)
X_1	=	farm size (ha/per farmer)
X_2	=	fertilizer use (kg /ha farmer)
X_3	=	No. of bundles of cassava cuttings per farmer /ha
X_4	=	Labour (man-days /ha per farmer)
u	=	error term
a	=	intercept; b_1-b_4 are the coefficients

The estimated Cobb-Douglas function of the above specification was found to give the lead equation, which the discussions were based.

3.4.1 Efficiency estimation techniques

Efficiency of resource use was determined by the ratio of marginal value product (MVP) and marginal factor cost (MFC) of inputs based on estimated regression coefficients. Where efficiency of resource, r, is given as:

$$r = MVP / MFC$$

The rule provides that when r = 1, there is efficient use of a resource; r > 1 indicates underutilization of a resource; while r < 1 shows overutilization of a resource. The values of MVP and MFC were estimated as follows;

$$MVP = MPP \cdot Py$$
$$MFC = Px_i$$

where

r	=	efficiency ratio
MVP	=	Marginal value product
MPP	=	Marginal physical product
MFC	=	Marginal factor cost,
Px_i	=	unit price of input x_i
Py	=	unit price of output

4. Result and Discussion

4.1 Selected Resource Statistics

Table 4.1: Output and selected resource statistics of cassava growers in Akwa Ibom State

Variable Output	Frequency	Percentage
Less than 500	67	71
500 - 700	9	10
701 - 900	5	5
Above 900	13	14
Total	**94**	**100**
Farm size (ha)		
0.1 – 3.0	72	77
3.1 – 6.0	15	16
6.1 – 9.0	4	4
9.1 – 12.0	3	3
Total	**94**	**100**
Fertilizer usage (kg)		
None	66	70
Less than 50	4	4
50 - 100	18	19
101 and above	6	7
Total	**94**	**100**
Quantity of cuttings (bundles)		
1 – 20	63	67
21 – 40	13	14
41 – 60	10	11
61 and above	8	8
Total	**94**	**100**
Labour usage (man-days)		
1 – 15	41	44
16 – 30	31	33
31 - 45	13	14
46 – 60	6	6
>60	3	3
Total	**94**	**100**

Source: Survey data, 2012

Table 4.1 presents information on output and selected resource statistics for the study, from the table, 71 percent of the farmers produced less than 500kg of cassava tubers, 15 percent produced between 500kg, and 900kg and above 14 percent had output above 900kg. The mean output of cassava per farmer in the study area was 4.478 tonnes. The mean yield (output/ha) per farmer was about 1.870 tonnes per hectare which is much lower than the national average of 10-15 tonnes per hectare. The mean farm size of cassava was 2.5457 hectares. This is somewhat large and could be attributed to the fact that majority of the farmers in the study area are mostly interested in cassava production with marginal lands being brought into cultivation. Available data on farm size as presented in the table also show that 77 percent of the respondents had farm size between 0.1 and 3.0 hectares, 16 percent had farm size of between 3.1 and 6.0 hectares, with only seven percent of the respondents owning above 6 hectares.

Table 4.1 also reveals that 70 percent (majority) of cassava farmers in the study area did not use fertilizer. This could be attributed to inaccessibility of this important input by the farmers in the area. This situation has implication on farmers yield. The non-usage of this input, combined with fallow periods will result in nutrient mining which adversely affect crop growth. It was observed that the mean quantity of cassava cuttings used per farmer was 23.98 bundles; the mean quantity per hectare was 9.42 bundles which are far below the recommended average of 50 bundles. This may be attributed to the fact that most of the respondents engage in mix-cropping. Table 4.1 also shows that 77 percent of cassava farmers in the study area used less than 30 man-days of labour in the course of their production. This depicts underutilization of this important input, which could have serious implication for output.

4.1 Estimated Production Function

Table 4.2: Estimated Cobb-Douglas production function for cassava

Factor inputs	Regression coefficients	t-values
Constant	2.985*	48.365
Farm size (x_1)	1.081*	18.564
Fertilizer use (x_2)	0.021^{NS}	1.338
Cuttings (x_3)	0.108*	2.333
Labour (x_4)	0.041^{NS}	0.758
R^2	0.926	
Adjusted R^2	0.922	
f-statistics	277.546*	

Source: Survey data, 2012. * Significant at 5% level ^{NS} Not significant

The estimated Cobb-Douglas production function is given in table 4.2.The lead equation is given thus;
$\ln Y = \ln 2.985 + 1.081 \ln X_1 + 0.021 \ln X_2 + 0.108 \ln X_3 + 0.041 \ln X_4$
About 92 percent of the variation in output of cassava is explained by the factor input as indicated by the R^2 value. All the variables have positive coefficients (except fertilizer) and affect output significantly (except fertilizer and labour). For the coefficients of farm size (X_1) and cuttings (X_2), increasing their levels of use could bring about increase in productivity. The result compares to that of Abang et al. (2001), who found farm size and cuttings as significant factors affecting cassava yield.

4.3 Resource use efficiency

Table 4.3: Estimated Index of Resource Use Efficiency in Cassava Production

Variables	MPP	APP	EP (MPP/APP)	MVP (MPP.PY)	AEI (MVP/MFC)
Farm size (X_1)	1,509.5	1,870	0.81	22,635.75	11.32
Fertilizer (X_2)	-14.25	180.13	0.08	-213.75	-3.56
Cuttings (X_3)	172.76	188.39	0.92	2,591.40	431.9
Labour (X_4)	175.57	197.11	0.89	2,633.55	1.76

Source: Computed from estimated equation

Note: Price of labour = ₦1, 500/Manday
Rent on land = ₦2000/ha
Fertilizer = N60/kg
Price of cuttings = ₦6/kg
MVP = MPP. Py = price of output (₦15/kg).
Resource use efficiency was determined through the efficiency index criterion. Economic theory postulates that for optimum efficiency to be attained, the ration of marginal value product (MVP) of the resource must be equal to its resource price. The estimated index of resource efficiency for cassava farmers is presented on table 4.3. From the table, it can be seen that the marginal products (MPx) of farm size, fertilizer, cuttings and labour were 1,509.05, - 14.25, 172.76 and 175.57 respectively. The marginal value products (MVP) were 22,635.75, -213.75, 2,591.40 and 2,633.55 for farm size, fertilizer use, cuttings and labour respectively. The elasticity of production with respect to resources was 0.81, - 0.08, 0.92 and 0.89 for farm size, fertilizer use, cuttings and labour respectively. The implication is that a unit increase in farm size, cuttings and labour will lead to 0.81, 0.92 and 0.89 percent increase in output, while a unit increase in fertilizer will lead to 0.08 percent decrease in output. These values also indicate that farmers are operating in the second stage of production in respect of farm size, cuttings and use of labour, while it is the third stage of production as regards the use of fertilizer. The sum of the elasticity (2.70) shows decreasing returns to scale of all resources (except fertilizer) used in the cassava production enterprises and the need to increase the use of all resources (except fertilizer) used in the production, if farmers are to remain efficient.

5. Conclusion and Recommendations

This study has shown that cassava farmers in the study area are efficient in their use of some variable inputs like land (farm size), cuttings and labour which were efficiently utilized, but not optimally applied; while fertilizer was inefficiently utilized as every additional unit of it resulted in a decrease in output. Measures such as the proper planning and execution of input supply and logistics could help ensure efficiency in the fertilizer supply chain thus bringing fertilizers closer to the farm gate at affordable prices and at the right time, quantity and quality. Once these measures are implemented, productivity will be increased overtime.

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