Allocative Efficiency of Resource Use by Cassava Farmers in Wamba Local Government Area, Nasarawa State, Nigeria

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ABSTRACT

The national policy objective of substituting wheat with cassava to cut down on food import bill can only be achieved by enhancing the productivity of cassava farmers who are mainly small scale farmers. But critical to output growth is resource-use efficiency. Efficiency of resource-use enhances farm productivity, guarantee food security and consequently poverty reduction. Thus, in attaining the aforementioned policy objective it is only imperative to ascertain the resource-use efficiency of this category of farmers. It is against this backdrop that this survey is carried out to evaluate the allocative efficiency of resource use by cassava farmers in Wamba Local Government Area of Nasarawa State, Nigeria. This was achieved by ascertaining the socio-economic characteristics of these farmers and estimating their production function to provide coefficients for determining the allocative efficiency of resource-use. Data were generated through the administration of questionnaire to 126 randomly selected farmers in the five villages purposely selected. The findings reveal that resources that account for over 80 per cent (R^2) variation in output are underutilized and this was discovered to be at variance with the national policy objective on cassava production. It is therefore recommended among others that: agricultural credit should be readily available, training and retraining programmes for farmers, and adequate funding of research institutions.
Keywords: Allocative Efficiency, Resource Use and Cassava Farmers

INTRODUCTION

Cassava is the third most important food source in tropical countries with over 500 million people relying on it as their main source of calories with subsistence farmers in sub-Saharan African countries in the majority (IITA, 2011). Apart from being a major source of calories, cassava's derivatives are applicable in many types of products such as confectioneries, monosodium glutamate, drugs, amongst others. As an energy derivative, cassava has been found and shown by the US Department of Agriculture to be more efficient in the production of ethanol, yielding double or triple the amount of carbohydrate for ethanol production that is found in field corn. The discovery of its capacity to also act as substitute for wheat has generated anxiety in the Nigerian federal government policy formulation matrix.

Nigeria currently imports wheat worth N635 billion annually basically for bread production (Adesina, 2011). It is argued that including 50 per cent cassava flour in wheat flour will save Nigeria over N315 billion food import bills, contribute in the reduction of the worsening rate of unemployment and consequently reduce poverty through the value chain mechanism. In 2002, Nigeria adopted a policy compelling flour millers to implement

10 per cent cassava flour into wheat flour and this have resulted in increases in cassava production from the tone of 37 million metric tons as at 2010 (FAO, 2011) to 45 million metric tons as at 2012 (FMARD, 2012). The present administration is poised to double this figure by making production demand driven. But agriculture in Nigeria is dominated by the prevalence of small scale farmers who account for over 90 per cent of the total agricultural output (Olayide, 1990; Ehilebo and Okon, 2009). Allocative efficiency deals with the extent to which farmers make efficient decisions by using inputs up to the level at which their marginal contribution to production value is equal to the factor cost (Akinwumi and Djato, 1997). Chirwa (2003) opined that it reflects the ability of a farm to use inputs in optimal proportions given their respective prices and the production technology. Under competitive conditions, a farm is said to be allocatively efficient if it equates the marginal returns of factor inputs to the market price of output (Fan, 1999).

Allocative efficiency of resource use is critical to enhanced productivity and incomes. The major goal of any production system is the attainment of an optimally high level of output with a given amount of effort or input. In the attainment of optimal level of output, resource productivity is pivotal. Thus, efficient utilization of resources is also instructive in achieving broad-based economic growth. Agricultural growth however, is a catalyst for broad based economic growth and poverty reduction especially in most low-income countries (Amalu, 2005). The national policy of doubling the production of cassava so as to cut down on wheat importation will not only reduce the country's food import bill but will promote food security and in the process alleviate poverty through the value-chain mechanism.

In addressing the above national policy objective, it is only imperative to focus search light on the activities of these small scale farmers by determining how efficient is their resource use in the production of the much valued crop-cassava. In achieving this, States or regions that appear to have comparative advantage should be isolated and resource use efficiency of farmers examined to ensure greater productivity. Nasarawa State happens to be one of the States known for the production of cassava and Wamba Local Government Area is among the leading producers of cassava in the state. It is against this backdrop that this study is carried out to determine the allocative efficiency of resource use of these farmers. The aim of this study was achieve by ascertaining the socio-economic characteristics of these farmers and estimating their production function to provide coefficients for determining the allocative efficiency of resource-use.

METHOD

This study was carried out in Wamba Local Government Area of Nasarawa State, Nigeria. The local government lies between 8.93333^0N and 8.60000^0E. It has an area of 1, 156km^2 and a population of 72, 894 at the 2006 population census (NPC, 2006). It shares boundary with Kaduna State in the north and Plateau State in the east. It has rich fertile soils from the loosed soil material of alluvial deposits in lower areas of the Farin-Ruwa waterfalls and undeveloped soils on hills slopes and entrenched river valleys. The Local government is

characterized by a tropical sub-humid climate with two distinct seasons; the wet and the dry season. Annual rainfall figure ranges from 1100mm to about 2000mm. A single maximum temperature is achieved in March of 39°C. The relative humility varies from 40% to 88% with an average of 63%. Agriculture is the major occupation and the main crops grown are cassava, yams, rice, cocoyam, maize, beans, groundnuts, *acha,* and vegetables. Households also keep livestock such as sheep, goats, pigs, poultry, etc. The selection of sample involved a multistage sampling technique in which five villages namely Gwagi, Gwata, Sisimbaki, Wayo and Konva were purposely selected from Wamba Local Government Area. Secondly, Households were randomly selected on the basis of the community's population size using a constant sampling fraction of 1% in order to make the sampling design to be self-weighting thereby avoiding sampling bias (Eboh, 2009). Based on the foregoing criterion, 126 farmers were randomly selected cutting across the five villages marked for the study. Data were collected in the 2010 cropping season. The data collected were mainly from primary sources and obtained through the use of structured questionnaire that were administered to the selected 126 cassava farmers in the study area. Data were analysed through descriptive statistics and regression analysis.

In modeling farm production, the production function is a virile tool to use. The production function is the technical or physical relationship between input and output, estimated for further analysis of technical and economic maximum of output in a production process. When the economic maximum is established, resource-use efficiency can be determined. There are various forms of production function that could be used to analyze agricultural production generally (Heady and Dillon, 1981). However, a general form may be specified for cassava farmers in the study area taking into account the nature of crop, environment and the peculiar category of the farmers. Suppose the output of cassava (q_i) of each farmer in the study area is a function of farm size (*fs*), Labour (*Lb*), Stems (*sm*), and Capital (*k*). The implicit form of the model can be stated thus:

$$Q = f(X_1, X_2, X_3, X_4, e)$$

Where

Q	=	output of cassava
X_1	=	farm size,
X_2	=	Labour,
X_3	=	stems (measured in kg),
X_4	=	capital
e	=	Error term

It is expected *a priori* that the coefficients of $X_1, X_2, X_3, X_4, > 0$.

Four functional forms of the multiple regression model; linear, semi-log, Cobb-Douglas and exponential were estimated and a lead equation selected. The functional forms were expressed in their explicit forms as:

$$Q = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + e \qquad \text{————————1(Linear)}$$
$$LnQ = lnb_0 + b_1 lnX_1 + b_2 lnX_2 + b_3 lnX_3 + b_4 lnX_4 + e \quad \text{————2(Cobb-Douglas)}$$
$$Q = lnb_0 + b_1 lnX_1 + b_2 lnX_2 + b_3 lnX_3 + b_4 lnX_4 + e \qquad \text{—————3(Semi-Log)}$$
$$LnQ = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + e \qquad \text{—————4(exponential)}$$

Where:

b_o = constant

b_1 - b_4 = estimated regression coefficients

X_1 - X_4 = independent variables

The Cobb-Douglas production function was chosen as the lead equation having satisfied the econometric criteria of possessing the best fit, highest number of parameter estimates that are statistically significant, as well as expected signs of the estimated parameters. The input-output relationship as expressed by the production function is important for the measurement of allocative efficiency of resource-use. Allocative efficiency has to do with a firm's/farm's ability to use the inputs at its disposal in optimal proportions given their respective prices and the available production technology. In other words, it is the farmers' ability to produce a given level of output using the cost minimizing input ratios (Asogwa, Umeh and Penda, 2011). The ratio of Marginal Value Product (MVP) to Marginal Factor Cost (MFC) is the measurement for allocative efficiency of resource-use (AER).

AER = $\dfrac{\text{MVP of a factor input}}{\text{Price of the factor}}$

But MVP_{Xi} = $MPP_{Xi} \cdot P_{Xi}$

MVP_{Xi} = Marginal Value Product of a factor

MPP_{Xi} = Marginal Physical Productivity of a factor (In the case of the Cobb Douglas function, the *MPP* are the direct elasticities of production-parametric values)

P_{Xi} = Unit price of a factor or the opportunity cost of the factor.

AER = Allocative Efficiency Ratio

Decision rule

If *AER* = 1, resource is efficiently utilized

If *AER* > 1, resource is under utilized

If *AER* < 1, resource is over utilized

The use of this ratio in determining allocative efficiency enjoys rich support in literatures (Agom, Ohen, Idiong and Oji, 2009; Rahman and Lawal, 2003)

RESULTS AND DISCUSSION

Socio-economic characteristics of respondents: From the socio-economic profile of farmers on table 1, males constituted the majority of cassava farmers in the study area with 86.50% of total respondent as against females with 13.50%. Females were less involved because of the high labour requirements and land ownership pattern which favour the males. Most of the respondents were aged 41-50 years while 31.72% of them were aged between 31-40 years. The mean age of the farmers was about 43.4 years implying that the farmers were at their active stage of life to produce the needed quantities of output if given the enabling environment such as inputs support. Also, the youthful nature of most of the farmers may be an advantage to innovation, since youths are said to be less risk averse

and may have better exposure to new ideas. Majority of the farmers had 9 – 12 persons in their families with a mean family size of 9 persons. These large family sizes are advantageous in labour supply for agricultural output production. On farm size, majority of the farmers had farm sizes of 0.6 – 0.1 hectares, 26.19 per cent had above 1 hectare while the mean farm size was 0.79 hectares implying that most of the sampled farmers are small scale farmers. On the distribution of farmers based on their farm incomes, most farmers earned an annual income of N50,000 – N100,000 with only about 7% earning above N150,000 per annum. The mean annual farm income was N89,141.97 which is less than N8,000 per month in spite of large families which they supported. The marginal propensity to consume the produce of these farmers far exceeds their propensity to save making the generation of financial capital almost impossible. This further perpetuate the vicious cycle of poverty that had engulfed these farmers. The educational level was low as a total of 71.42% had either no formal education training or had only attended primary school. This is bound to have adverse effect on their resource use efficiency and income generating ability.

Estimation of Production Function: From table 2, the study reveals that about 87.7% of the total variation in output was explained by the factor inputs included in the model. All explanatory variables under the Cobb- Douglas function came out with the expected positive sign. These positive coefficients imply direct relationship between inputs and output and that increase in the quantity of one of these inputs holding others constant would increase the output. The relationship was significant at 1 per cent for farm size and stems and 5 per cent for labour and capital. Also, from table 2, cassava farming in the study area for the 2010 cropping season had output elasticities of farm size (X_1), stems (X_2), labour (X_3) and Capital (X_4), as 0.512, 0.161, 0.214, and 0.968. The sum of these elasticities is a measure of return to scale. For this study, the sum was discovered to be 1.855 implying that the farmers are operating under increasing returns to scale (since sum of elasticities is greater than 1). Again, the magnitude of these elasticities are reflections of the potentials of each input towards enhancing productivity. The study futher reveals that capital has the highest potential of 0.968 suggesting, holding other variables constant, a 10 per cent increase in capital requirement of these farmers will increase output by 9.68 units.

Estimation of Allocative Efficiency: To obtain the parametric measure of efficiency, a functional form of the production model is estimated to obtain the Marginal Physical Products (MPP) of each factor input. The Marginal Value Product (MVP) was divided by the Marginal Factor Costs (price of unit input) to ascertain if the inputs were used efficiently. Table 3 reveals the findings in that regard. Based on the decision rule specified above, farm size, labour and stems were under utilized by cassava farmers in the study area. The study area is rural in setting with inherited pattern of land ownership. Large portions of land within these areas are arable with insufficient labour to cultivate the farm lands. While the crave for city-life and white collar jobs is depriving rural agriculture of the most productive labour force, most children of farmers and graduates of agriculture are not attracted to agriculture.

Table 1: Socio-Economic Characteristics of farmers

Variable		Frequency	Percentage
Gender:	Males	109	86.50
	Females	17	13.50
	Total	126	100
Age:	Less than 30	17	13.49
	31 – 40	40	31.72
	41 - 50	50	39.68
	Above 50	19	15.10
	Total	126	100
Family size (No. of persons):	4 and below	06	4.76
	5 – 8	36	28.57
	9 – 12	63	50.00
	Above 12	21	16.66
	Total	126	100
Farm size (Hectares):	0.1 – 0.5	37	29.37
	0.6 – 1.0	56	44.44
	Above 1.0	33	26.19
	Total	126	100
Average annual income:			
	Less than N50,000	30	23.80
	N50,000 – N100,000	50	39.68
	N101,000 – N150,000	37	29.36
	Above N150,000	09	07.14
	Total	126	100
Educational Attainment			
	No formal education	48	38.09
	Primary school	42	33.33
	SSCE/NECO/GCE	27	21.40
	Post secondary	09	7.14
	Total	126	100

Source: Field Survey, 2012

Table 2: Regression estimates, t-value and level of significance of the independent variables

Variable	Regression Coefficient	Standard Error	t-value	Level of significance
Farm size (X_1)	0.512	0.118	4.399	0.01
Stems (X_2)	0.161	0.043	3.940	0.01
Labour (X_3)	0.214	0.117	2.196	0.05
Capital (X_4)	0.968	0.254	3.072	0.05
Constant	4.930	0.683	6.135	0.01

Source: Adapted from Appendix B

Table 3: Marginal Physical Products and Marginal Value Products for farm size, stem and labour inputs in cassava production.

Resources	MPP	MVP	MFC(#)	MVP/MFC
farm size(ha)	14.081	14.081	1000	14.1
stems(kg)	0.851	34.06	25	1.36
labour(manday)	0.552	22.13	20	1.11

Source: Author's computation

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GET
  FILE ='C:\Users\PIUS\Documents\Untitled1.sav'.
DATASET NAME Data Set 1 WINDOW = FRONT.
REGRESSION
  /MISSING LISTWISE
  /STATISTICS COEFF OUTS R ANOVA
  /CRITERIA = PIN(.05) POUT(.10)
  /NOORIGIN
  /DEPENDENT y
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Regression

[DataSet1] C:\Users\PIUS\Documents\Untitled1.sav

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.938[a]	.877	.743	5.00960

a. Predictors: (Constant), X_1, X_2, X_3, X_4

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	4.936	.683		6.135	.010
X_1	.512	.118	1.230	4.399	.010
X_2	.161	.043	1.126	3.940	.010
X_3	.214	.117	.116	2.196	.051
X_4	.968	.254	.807	3.072	.053

a. Dependent Variable: Cassava_yield

CONCLUSION AND RECOMMENDATIONS

Productivity increase in agriculture is an effective driver of economic growth and poverty reduction especially in the rural areas. Growth in agriculture is heavily depended on efficiency of farm production. The inefficiency in farm production is a contributory factor to stagnation in agriculture resulting in soaring food import bills and consequently food insecurity. Though, Wamba Local Government Area is one of the leading producers of cassava in Nasarawa State, yet resources are still sub-optimally utilized by farmers as revealed in the study. This situation is in conflict with the policy objective of the Federal Government to not only double the current production of cassava in the country but in the long-run completely substitute wheat in bread production with cassava flour. The educational attainment of farmers, poor access to improved technologies among others appears to be factors mitigating efficient utilization of resources. To this end, the following recommendations are made in line with the findings of this research.

i.   From the estimate of our production function, capital has the highest marginal productivity. This is an indication of the dire need of agricultural credit by these farmers. Provision of adequate agricultural credit will guarantee timely and adequate utilization of agricultural inputs for improvement in farm production efficiency.

ii.   There is the need for training and retraining of farmers for improved quality of labour and management skills, training such as youth entrepreneurship in agriculture, agric-business, agricultural techniques among others to make sustainable livelihoods from agriculture.

iii.   Agricultural research and technological improvements are requisites for enhanced agricultural productivity. The use of traditional tools in farming activities is still the common practice in most rural areas. Funding requirements for research institutes is highly recommended.

iv.   Poor infrastructure affects cost of production and value of produce adversely and consequently farm production efficiency. Most rural settlements are isolated in Nigeria and are usually inaccessible during rainy seasons limiting access to inputs, new technologies and equipment. Rural development schemes should be reactivated and basic infrastructural provisions made.

v.   Cost effective storage facilities for these farmers should be developed to make products readily available on demand. This is responsible for the cyclical glut in the local markets. Significant losses are still incurred due to bush fire and post-harvest losses resulting from lack of adequate storage facilities.

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