Comparative Analysis Of The Allocative Efficiency Of Cassava Producers That Use External And Internal Inputs In Imo State, Nigeria

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ABSTRACT
The current unsustainable farming practices, high demand for staple food crops especially cassava, observed low productivity and inefficient resource allocation by farmers motivated this study to comparatively analyse the allocative efficiency of cassava producers that used external inputs and those that used internal inputs in Imo State. A random sample of 100 each of the external and internal input user farmers were collected from a pre-survey sample frame of 400 farmers drawn from across the three agricultural zones of Imo State. Data on the farmers' socio-economic characteristics and the value of factors used and output produced were collected using structured questionnaire. The analyses were done using descriptive statistics and production function analytical tools. A critical analysis of the result of the production function indicates that the Cobb-Douglas production function best explained the relationship. Finally, the computation of the allocative efficiency of the two categories of farmers showed that both categories did not allocate resources efficiently. Therefore it was recommended among others that more efficient resource allocation procedure be sought for and subsequently disseminated to the farmers through the various change agents.

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INTRODUCTION:

The slow growth in staple food production in Nigeria and other Sub-Saharan Africa is attracting attention in the scientific community as well as in the political sphere (Onyegbula, 1999). Cassava (Manihot esculenta crantz) is a major staple food crop in Nigeria. It constitutes about 93% of the major starch staple (Olojede et al, 2000). Cassava is widely accepted by the local farmers and this is attributed to its width of ecological amplitude such as its adaptability to a wide variety of ecological and agronomic conditions (Carter et al, 1992).

The current national concern about the production and use of cassava and the subsequent policy directives on complementing the constituent of wheat flour with 10% cassava flour has attracted the attention of national and international research agencies towards ways and means of increasing the output and hence the productivity of cassava. Recently a research consortium led by the International Institute of Tropical Agriculture (IITA) Ibadan Nigeria and the National Root Crop Research Institute (NRCRI) Umudike Nigeria developed improved cassava cultivars capable of boosting cassava output by 7% per hectare of land (IITA,1994). Besides, the National Seed Service (NSS) has several programmes for Cassava, Maize, Sorghum and other Cereals aimed at multiplying the improved varieties in order to meet the demands of State Ministries of Agriculture. Despite these efforts per hectare, cassava production continues to decline (Sarma and Kunchai, 1991). Low cassava productivity may be due to dwindling resources owing to population pressure, environmental degradation, natural disaster and social conflicts. In addition to these factors, low productivity may also be due to inadequate supply of inputs, lack of improved technology and inefficiency in the use of the productive resources. However, if farmers are adequately provided with inputs and improved technology and not exposed to various input combinations that will enhance their efficiency, the problem of low productivity will persist. Olayide and Heady (1982) attributed the issue of low agricultural productivity to inability of farmers to make use of available resources efficiently. They further pointed out that this problem can be reversed if farmers are conscious of the efficiency of resource use.

Although increases in agricultural productivity are urgently needed, such increases need to be sustainable. Liebhardt, (1987) posits that agricultural sustainability involves minimizing the use of external input and maximizing the use of internal inputs which already exists in the farm. In this study external inputs constitute inputs that are artificially manufactured or created, very capital intensive in procurement, usually purchased, depends on very high skill and technology to produce and use and not readily available to resource poor farmers; Internal inputs constitute those inputs that are naturally endowed, relatively very cheap to procure, do not require high skill to use, depends on indigenous technology, and very readily available and affordable to resource poor farmers.

Consequent upon the following factors that;

- cassava is a very important staple food crop in Nigeria and the world at large,
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- there is obvious low productivity of cassava despite various efforts by research institutions to improve on its production,
- the low cassava productivity is caused by inefficiency in the allocation of available farm resources,
- there is need for sustainability in every agricultural production practice, and
- that agricultural sustainability involves minimizing the use of external input and maximizing the use of internal inputs which exist on the farm, this study aimed at comparing the allocative efficiency of cassava producers that used external inputs and those that used internal inputs in Imo State, stands justified.

It was hypothesised that cassava producers that used external and internal inputs do not allocate resources efficiently.

MATERIALS AND METHODS

This study was conducted in Imo State. There are three agricultural zones in the state namely Okigwe, Owerri and Orlu. The topography is generally undulating with conspicuous soil loss due to gully erosion in many areas. The state has high agricultural potentials with available arable land for the growth of tropical crops as yams, cassava, maize, cocoyam, plantains and bananas. Cassava is a staple food generally produced in the survey area (Anuebunwa, 1990). The soils are known to be generally acidic having a P^H between 5.0 and 5.5 (ISMANR, 1986). It was estimated that 84% of the total land area is potentially productive with 48% being devoted to the production of annual crops under the traditional bush fallow system while the rest 36% is under tree crops (ISMANR, 1986).

Imo State has tropical climate characterised by high rainfall and temperature ranges of 1500mm to 2300mm and 34^o C to 37^o C respectively. Correspondingly, the vegetation is tropical rainforest that has suffered lots of deforestation. The occupation of majority of the inhabitants is farming. Almost every family engages in farming as a primary or secondary occupation, cultivating mainly arable crops like cassava, yam, cocoyam, maize, vegetables and tree crops like Oil palm, coconuts, oranges, mangoes and numerous others. The production systems vary from smallholders multiple cropping using internal inputs to those using external inputs additionally.

To ensure that a representative sample of farmers in the State was used in this study, a multi-stage sampling technique was adopted in sample selection. Firstly, a pre-survey sampling frame of 400 cassava farmers was drawn from across the three agricultural zones of Imo state with the aid of the registers of the Village Extension Agents (VEA). Out of this frame, 80 respondents were randomly selected from each of the three agricultural zones to give a sample size of 240 respondents. Furthermore, pre-tested questionnaire were administered to them by the researcher with the assistance of VEAs and some trained enumerators.

Owing to factors like wrong information , mutilations on the questionnaire and some questionnaire that were not returned, some of the distributed questionnaire to the respondents were rendered void and not used in analysis. Hence only 200 questionnaire which is made up of 100 external input users and 100 internal input users were used in the analysis. Information that bothered on the farmers socio-economic characteristics, inputs used and outputs produced in physical and value terms were collected and analysed.

Analytical Procedure

Descriptive statistics such as mean was used to analyse the socioeconomic characteristics of the cassava producers. Data were also analysed using the production function model. Four functional forms were used. They are Double log, Semi-log, Linear and Exponential functional forms. The production function model is implicitly specifed as follows,

Q_{yi} = f(L_d , L_b, C_n, F_z,O_m) and Model 2 for internal input user farmers is similarly stated as follows

Where

i = 1 for external input users, and 2 for internal input users.

Q_y = Value of Cassava (N)

L_d = Land in hectares

L_d = Labour in mandays
C_n = Capital in (N)
F_z = Fertilizer in tons.
O_m = Organic manure in tons.

It is expected a priori that the coefficients of L_d, L_b, C_n, F_z, and O_m > 0.

RESULTS AND DISCUSSIONS

Socioeconomic Characteristics of Cassava Producers

The Socio-economic characteristics of the cassava producers on the average are presented in table 1.

Table 1. Socio-Economic Characteristics of Cassava producers on the Average

VARIABLE	MEAN VALUE	
	External input users	Internal input users
Age (years)	51	53
Educational level (years)	13	7
Household size (number of persons)	5	11
Farm size cultivated (ha)	2.32	1.94
Labour input (mandays)	46	42
Quantity of fertilizer/Organic manure used/ha (tons)	0.84	0.48
Expenditure N/ha	64,956	49,845
Revenue N/ha	93,750	106,443

Source: Survey Data, 2005.

Table 1 shows that both categories of cassava farmers are middle aged. However those that used external input are more literate with 13 years of formal education, have less household size of 5 persons, posses 2.32 hectares of farm land, and use higher tonnage (0.54) of fertilizer than those that used internal inputs with 7 years formal education, 11 persons in a household, 1.94 hectares of farm holding and 0.48 tonnes of Organic manure use. The result is indicative of the effect of education on awareness and adoption of improved technologies such as fertilizer use. Also more household size of internal input user farmers may have favoured the use of bulky organic manure, its generation and handling in the farm. However higher farm size encourages inorganic fertilizer use due to unavailability of enough organic manure to sustain large farmland cultivation.

Estimation of Production Function of Cassava Producers

Table 2 Shows the Multiple Regression Results of Cassava Producers that Used External Inputs.

Table 2. Multiple Regression Results of Cassava Producers that Used External Inputs

VARIABLES	Linear function	Double-log function	Semi-log function	Exponential function
Land (L_d)	7477.91	0.035102	3246.80	-0.27934
	(2.803034)**	(0.307704)	(0.979859)	(-1.31374)*
Labour (L_b)	-785.75	0.1761	-1290.6	0.026019
	(-1.33814)*	(0.70217)	(-0.1771)	(0.555915)
Capital (C_n)	0.465911	0.53503	9896.47	7.14E05
	(1.45997)*	(3.298664)***	(2.1002292)**	(1.25909)*
Fertilizer(F_z)	3346.34	-0.78094	4374.86	-0.19477
	(0.629082)	(-20.8584)***	(4.021613)***	(-0.45928)
Constant	239779.7	2.315	64376	5.78
R^2	0.103	0.838	0.194	0.035
F-Value	2.732	123.24***	5.741	0.875
E	63990	2.07	6.0169	5.07

*** = Significant at 1% ** = Significant at 5% Source: Survey Data, 2005.

Table 3 Shows the Multiple Regression Result of Cassava Producers that Used Internal Inputs.

Table 3. Multiple Regression Results of Cassava Producers that Used Internal Inputs.

VARIABLES	Linear function	Double-log function	Semi-log function	Exponential function
Land (L_d)	2018.28	-0.01197	3444.45	-0.13678
	(0.63083)	(-0.17949)	(0.70135)	(-0.3456)
Labour (L_b)	2468.84	0.189205	6826.99	0.030618
	(1.954354)	(1.070734)	(0.524604)	(0.40218)
Capital (C_n)	0.218668	0.734148	7565.78	0.31389
	(0.96389)	(9.047122)***	(1.2666002)*	(0.013789)
Organic Manure (Om)	50156.21	0.100879	7935.99	0.585919
	(0.704047)	(0.941956)	(1.006128)	(1.101348)
Constant	11214	3.02	-8175.99	-
R^2	0.0645	0.487	0.0345	0.17
F-Value	1.625	22.60 ***	0.8544	0.6553
E	99726.69	1.37	101778.2	1.74

*** = Significant at 1%
** = Significant at 5%
Source: Survey Data, 2005.

Allocative Efficiency of Cassava Producers

Table 4 Shows the Allocative Efficiency Indices for cassava producers that used External Inputs.

Table 4: Allocative Efficiency Indices for Cassava Producers that Used External Inputs.

Input	Marginal Value Product(MVP)	Marginal Factor Cost (MFC)	Efficiency Index Wi=MVP/MFC	Implication
Land	0.035102	3500	0.00001002	Inefficient Allocation (over-utilized)
Labour	0.1761	550	0.00035	Inefficient Allocation (over-utilized)
Capital	0.53503	1	0.53503	Inefficient Allocation (over-utilized)
Fertilizer	-0.78094	50,000	-0.000016	Inefficient Allocation (over-utilized)

Source: Survey Data, 2005.

Table 5 Shows the Overall Elasticity of Production of External Inputs Used

Table 5: Overall Elasticity of Production of External Inputs Used

Input	Factor Coefficient e_i	Implications
Land	0.035102	
Labour	0.1761	
Capital	0.53503	
Fertilizer	-0.78094	
Summation of e_i	-0.035	$e_p < 0$ (Negative returns to scale)

Source: Survey Data, 2005.

Table 6 Shows the Allocative Efficiency Indices of Cassava Farmers that Used Internal Inputs.

Table 6: Allocative Efficiency Indices for Cassava Producers that Used Internal Inputs.

Input	Marginal Value Product(MVP)	Marginal Factor Cost (MFC)	Efficiency Index Wi=MVP/MFC	Implication
Land	-0.01197	250	0.000047	Inefficient Allocation (over-utilized)
Labour	0.189205	100	0.0018	Inefficient Allocation (over-utilized)
Capital	0.734148	1	0.734148	Inefficient Allocation (over-utilized)
Organic Manure	-0.0100879	5000	-0.000020	Inefficient Allocation (over-utilized)

Source: Survey Data, 2005.

Table 7 Shows the Overall Elasticity of Production of External Inputs Used

Table 7: Overall Elasticity of Production of External Inputs Used

Input	Factor Coefficient e_i	Implications
Land	-0.01197	
Labour	0.189205	
Capital	0.734148	
Organic Manure	- 0.0100879	
Summation of e_i	0.901	$e_{p<1}$ (decreasing returns to scale)

Source: Survey Data, 2005.

DISCUSSION

Tables 2 and 3 presented results of multiple regression analysis in four functional forms, namely Double-log (Cobb-Douglas), Semi-log, Linear and Exponential forms. It is very obvious from these tables that the Double-log functional form gave the best fit in both models for the two categories of farmers. Therefore it was selected as the lead equation and used for discussion and further analysis.

In table 2 (farmers that used external inputs), the coefficient of multiple determination R^2 is 0.838 . This implies that the variation in the dependent variable has been explained up to 83% by the model showing strong relationship between the endogenous variables and the exogenous variables. Also in table 3, the R^2 is 0.48, which implies that 48% of the variation in cassava output are explained by the joint action of the independent variables included in the model. Besides, the F-value in tables 2 and 3 are 123.24 and 22.6 respectively. These values are significant at 1% indicating that the model gave a good fit to the data. Finally, the t-statistic shows the degree of significance of the independent variables in explaining the variation in the dependent variable.

The results of table 2 shows that two exogenous variables out of four tested are significant at 1% level. They are amount of Capital (Cn) used and quantity of Fertilizer (Fz) used. The positive coefficient of capital (0.53) implies that change in the quantity of capital is directly proportional to the change in the value of cassava produced. Also the quantity of fertilizer used is significant at 1% with a negative coefficient of -0.78094. The negative sign implies that there is an inverse relationship between the value of cassava and the quantity of fertilizer used; which means that the higher the quantity of fertilizer used, the lower the value of cassava produced and vice versa. When the allocative efficiency of cassava producers that used external inputs were computed as shown in table 4, it was found that all the farm resources were over-utilized implying inefficiency in allocation because the marginal factor costs (MFCs) were higher than the marginal value products (MVPs) in each case. This invariably means that these inputs land, labour, capital, and fertilizer should be increased in quantity or quality to ensure efficiency in production.

Furthermore, when the overall elasticity of production of the external inputs were computed as shown in table 5 using the coefficients from table 4, it yielded -0.035, that is $e_p < 0$. That implies a negative return to scale of production. In conclusion we fail to reject the null hypothesis Ho and conclude that farmers who used external input do not allocate resources efficiently.

Similar to the result of table 2, the result of table 3 shows that out of four independent variables tested, only one shows a very significant relationship in the variations observed on the dependent variable. That is to say that only capital out of land, labour, and organic manure has a very significant effect on the output of cassava. Looking at the coefficients of the independent variables, it was observed that the coefficient of land is -0.01197. The negative sign implies that the quantity of land used by cassava producers that used internal input is inversely related to the value of cassava produced. This implies that the higher the size of land, the lower the value of cassava and vice versa. This usually implies that bringing more land into cultivation does not guarantee higher value of cassava if there is no more capital to invest as capital is the only significant factor to the value of cassava produced under internal input use. Also the coefficient of labour is 0.1892. The positive sign also implies that labour use is directly proportional to the value of cassava produced. Similarly, the coefficient of capital is 0.734. The positive sign shows a directly proportional relationship to the value of cassava produced. The coefficient of organic manure is 0.1, which implies a directly proportional relationship also. Finally, when the allocative efficiency was computed as shown in table 6, it was found that all the resources employed by cassava producers who used internal inputs were similarly over-utilized, signifying inefficient allocation because the marginal factor costs (MFCs) are higher than the marginal value products (MVPs) in each case. Also when the overall elasticity of production of the internal inputs was computed using the coefficients as shown in table 7, it yielded 0.901, which means (e_p <1). That implies decreasing returns to scale of production, which is not still within the recommended optimal region of production. In conclusion therefore, we fail to reject the null hypothesis, and say that farmers who used internal input do not allocate resources efficiently.

CONCLUSION AND RECOMMENDATIONS

It is noteworthy to recall at this point the finding of (Olayide and Heady, 1982) that the problem of low agricultural productivity was identified as the inability of farmers to make use of available farm resources efficiently; and therefore draw the inference from this study that both categories of farmers who used external and internal inputs do not allocate resources efficiently. This would have negatively affected the level of cassava productivity in the study area. Besides, it could be the resultant cause of low level of food production as observed by Idachaba (1991) and Ehui and Spencer (1990).

Consequently, more efficient resource allocation process should be sought for by our co-research fellows and appropriate results fully disseminated to the farmers through the extension agents. Also, considering the implications of use of external inputs which is not a sustainable practice, it is also recommended that an indebt study into a more efficient allocation of internal inputs should be intensified and funded by various agencies that promote researches in agriculture. Finally, recycling or incinerating plants capable of converting garbage and other household and industrial wastes into usable organic manure should be encouraged since it has been found to ensure agricultural sustainability.

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