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Technical Efficiency among Women Cassava Small Holder Farmers in Ivo Local Government Area of Ebonyi State

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Authors' contributions

This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.

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Case Study

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ABSTRACT

This study was carried out to investigate resource use efficiency of women cassava producers in Ivo Local Government Area of Ebonyi State. A multi stage random sampling technique was used to select 120 women farmers in the local government in the year 2013. Percentage response was used to determine the farmers' socioeconomic characteristics, stochastic frontier and simultaneously, its' determinant were addressed using the maximum likelihood methods. The results of the study show that level of education, farming experience and extension contact were positive and significantly related to technical efficiency while credit access had inverse relationship with technical efficiency. The mean technical efficiency was 0.56, the maximum efficiency was 0.97, while the minimum was 0.23. Policies aimed at encouraging both new entrant and older farmers into farming through provision of improved production inputs and as well as increasing farmers' access to extension contact and educational programmes were therefore recommended.

Keywords: Technical efficiency; women; cassava; small holder farmers.

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1. INTRODUCTION

Agriculture is the economic mainstay of the majority of household in developing countries and of which the importance of women farmers is widely recognized. [1] reported that women are visible eventually in all categories of agricultural production as they contribute about 70% of agricultural labour force and between 60 -70% of domestic economy. In spite of, the roles of women in agricultural production, particularly in certain crops that are stereotyped female crop like cassava in the study area and south east Nigeria, yet the male folk and government have not accorded them the well desired recognition [2].

Cassava is an important staple food and cash crop in several African Countries, especially Nigeria where it plays a principal role in food economy [3]. Recent studies show that although cassava originated from south and Central America, Africa is the world largest producer of cassava. In 1991, a total of 150 million tones of cassava was produced in the world, Africa accounted for 68.9 million tones. This represents 45% of the world output of cassava. Nigeria produced 20 million tones or about 28% of the total Africa production of cassava and of which South East agricultural Zone accounts for more than 37% of the national production [4]. Cassava is produced by small holders who produce a wide range of other crops often as intercrops.

The major reasons for the apparent increasing trend in the production is the availability of improved varieties of cassava and changing status of the crop from subsistence to a major cash or income generating crop [5]. Cassava production expansion is impeded by low yield, relatively high production cost and poor producer price. These myriads of problems decline the domestic production of the crop, thus limiting its traditional role in economic development [5]. However, to increase the cassava farmers' outputs, it becomes imperative that efforts should be to jettison the traditional method of increasing cultivated area. This is true especially now agricultural resources are scarce and are in competition in use with other sectors of the economy. However, to achieve high productivity in cassava production, requires that resources should be used more efficiently with more attention paid on attainment of production goal without waste [6,7]. Efficiency is an important factor in productivity growth, especially in an economy where resources are scarce and opportunities for new technologies are lacking. Specifically, the objectives of the study are to; estimate the technical efficiency of the farmers and identify the determinant factors.

2. MATERIALS AND METHODS

The research was carried out in Ivo Local Government Area of Ebonyi State, Nigeria. It covers an area of 3506 sqkm^2 with population of 220, 919 people [8]. It is bounded in the North by Ohaozara, Aninri, and Awgu Local Government Areas, in the South by Bende and Afikpo South Local Government Areas, in the East by Aniocha local government Area and in the West by Umunneochi and Isuikwuato Local Government Areas of Abia State. The Local Government Area is located between latitude 5°56 and 6°59$^{\cdot}$N and longitude 7°31 and 7°41$^{\cdot}$E. The rainfall ranges from 1500 – 2500 mm, temperature range of 28-45°C and moderate relative humidity of 65%. The Ivo Local Government Area people are mainly agrarians and prominently in the production of rice, okra, yam, cassava, garden egg, sweet potatoes, cocoyam and vegetables. Multi-stage random sampling technique was used to select community, villages and respondents. Firstly, three towns were randomly selected out of five (5). Secondly, four villages were randomly selected from each of the town. This gave a total of twelve villages. Thirdly, ten (10) farmers were randomly selected from each of the villages. This brought to the total of one hundred and twenty (120) farmers for a detailed study.

Structured questionnaire and oral interview of respondents were used to collect information on primary data, including farmers' socioeconomic characteristics (such age of the farmer, household size, farming experience, extension contact, access to credit, membership of cooperative and level of education) and prices of inputs and outputs, while secondary data were obtained from seminars, conference papers, journals, workshop and other periodicals. Descriptive statistics were used to discuss the socioeconomic characteristics of the farmers. The farmers' technical efficiency and its' determinants was addressed using Cobb Douglas stochastic production function. This is due to its advantages over the other functional forms, as it's widely used in frontier production function studies in most developing agriculture [9].

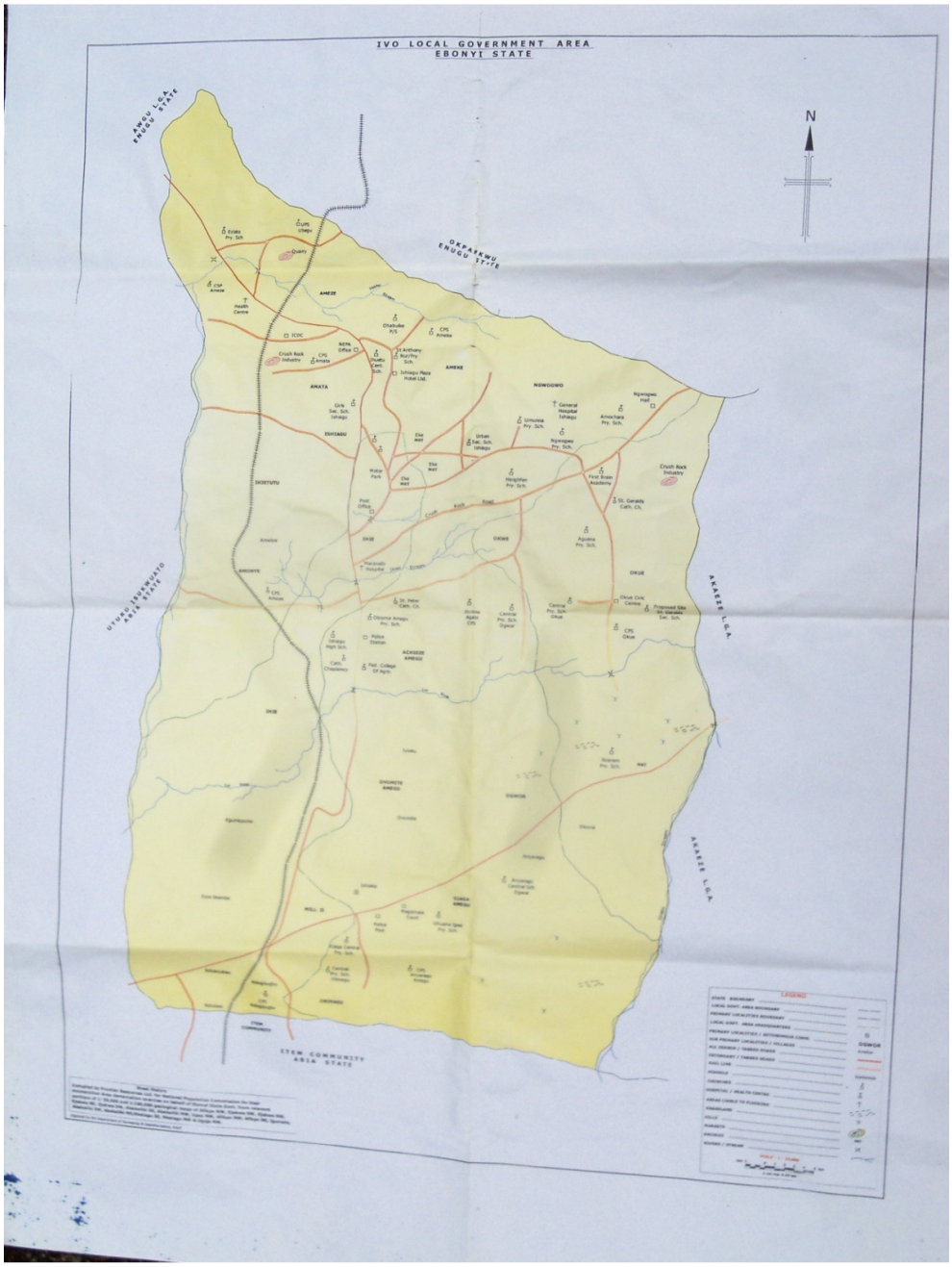

Fig. 1. Map of Ivo Local Government Area (LGA)

The Cobb Douglas frontier production function is specified by [10] as follows:

$$\ln Q = \beta_0 + \beta_1 \ln x, + \beta_2 \ln x_2 + \beta_3 \ln x_3 + \beta_4 \ln x_4 + \beta_5 \ln x_5 + V_1 + U_1 \ldots\ldots\ldots(1)$$

Where Q = quantity of cassava root produced by farmer (kg), X_1 = planting- materials (kg); X_2 = fertilizer use (kg); X_3 = labour Input (man days); X_4 = farm size (ha); X_5 = depreciation (N), Vi = random error and Ui = technical efficiency.

In order to determine factors contributing to the observed technical efficiency, the following model was formulated and estimated jointly with stochastic frontier model in maximum likelihood estimation procedure using the computer software frontier version 4.1 [11,10].

$TE = a + d_1 m_1, + a_2 m_2 + a_3 m_3 + a\ m_4 m_4 + a_5 m_5 + a_6 m_6 + a_n m_n$.

Where TE = Technical efficiency, X_1 = planting material (cassava cuttings) (bundles), X_2 = fertilizer (kg), M_1 = age of the farmers (years), M_2 = educational level (years), M_3 = farming experience (years), M_4= household size (Number), M_5 = Extension visit (Number), M_6 = membership of cooperative (1 = member, 0 = non member), $a_o - a_6$ are parameters to be estimated.

3. RESULTS AND DISCUSSION

The average statistics of the sampled women cassava farmers is presented in Table 1. On the average, a "typical female cassava" is 45 years of age with 8.17 years of formal education, household size of about 7 persons, about 9.20 of farming experience, cultivated 0.52 hectare of land, employed 32.68 mandays of labour and produced an output of 238.81 kg of cassava per annum.

Table 2 showed that the estimated square of the total variance was significantly different from zero at 1% alpha level, this give credence to the goodness of fit of the model and the correctness of assumption of the composite error term. The variance ratio parameter (λ) was 0.7862 and statistically significant at 1% probability level. This indicates that 78.62% of the total variation in cassava output was due to technical inefficiency. This implies that the variation in actual output from maximum output between farms mainly arose from differences in farmer-practices rather than random variability. The coefficient of planting material, fertilizer and labour inputs had the desired positive signs and statistically significant. This implies that increase in any of the variable will increase the output of cassava farmers. The coefficient of farm size was negative against a prior expectation, implying that the more the increase in farm size used, the less the quantity of cassava output produced. The sign identity of the variable could be attributed to its' paucity as agriculture competes with infrastructural developments over it [8]. The

Table 1. Average statistics of cassava farmers in Ivo LGA

Varaibles	Description	Mean	Standard deviation	Maximum	Minimum
X_1	Age of farmers	45.00	0.46	69.00	24.00
X_2	Educational level (yrs)	8.17	0.57	17.00	0.00
X_3	Household size (no)	7.00	1.46	14.00	3.00
X_4	Farming experience (yrs)	9.20	0.67	18.00	1.00
X_5	Farm size (ha)	0.52	0.27	0.74	0.04
X_6	Labour (manday)	32.68	4.04	92.20	4.43
X_7	Output (kg)	238.81	3.27	332.65	36.50

Source: Field survey, 2013

Table 2. Maximum livelihood estimation of Douglas stochastic frontier production function

Production factor	Parameter	Coefficient	Standard error	T-value
Constant term	β_0	12.88661	0.5682	22.679***
Planting material	β_1	0.3467	0.0326	10.634***
Fertilizer use	β_2	1.0782	0.2261	4.768***
Labour input	β_3	0.3611	0.0442	8.169***
Farm size	β_4	-0.0993	0.956	-0.103
Depreciation	β_5	0.0087	0.0125	0.696
Diagnostic Statistics				
Total variance	б2	0.7862	0.2061	3.815***
Variance ratio	Y	0.8847	0.01122	78.50***
Likelihood ratio test	-	318.2612		
Log likelihood function	-	4.7844		

Source: computed from survey Data, 2013.
****, **, * statistical significance at 1%, 5%, 10% respectively*

Table 3. Estimated determinant of technical efficiency in cassava farmers in Ivo LGA

Determinant	Parameters	Coefficient	Standard error	t-ratio
Constant	α_0	10.0810	1.4906	6.766***
Age of farmers	α_1	-0.2240	0.6881	-0.325
Educational level	α_2	1.9446	0.36061	5.392***
Household size	α_3	0.0074	0.0124	0.596
Farming experience	α_4	1.2277	0.4948	2.481**
Membership of crop	α_5	0.0054	0.0142	0.402
Credit access	α_6	-6.4421	0.5110	12.60***
Extension contact	α_7	0.957	0.935	1.024*

****, **,* statistical significance at 1%, 5% and 10%, respectively,*
Source: Computed from Survey Data, 2013

determinants of technical efficiency in cassava were shown in Table 3. Education and farming experience coefficients had a positive effect on the efficiency of the farmers and significant at 1% alpha level respectively. These are consistent to a priori expectation that the high the level of attainment of the variables, the more efficient the farmer is in resource use. Credit was negative and significantly related to technical efficiency at 1% alpha level. The diversion of credit to non farm uses could be the explanation for the sign identity. This finding disagrees with [6].

Table 4. Distribution of respondents according to technical efficiency index

Technical efficiency index	frequency	Percentage
.21 – 0.30	5	4.2
0.31 – 0.40	11	9.2
0.41 – 0.50	9	7.5
0.51 - 0.60	20	16.7
0.61 – 0.70	30	25.0
0.71 - 0.80	40	33.3
0.81 - 0.90	5	4.2
Total	120	100
Maximum technical efficiency		0.97
Minimum technical efficiency		0.56
Mean technical efficiency		0.23
Mean of best 10		45.4%
Mean of worst 10		81.4%

Source: Computed from survey data, 2013

The distribution of the efficiency estimates obtained from the stochastic frontier is presented in Table 4. The mean technical efficiency was 56.0 percent which implied that the output of cassava can be increased by about 44% with the farmers' level of resources. This suggested that opportunities exist for increasing productivity and income through increased efficiency in resource utilization and use of improved technologies by cassava farmers in the study area. The production elasticity as shown in Table 5 were all positive and with return to scale of 1.6951. This implies that the farmers are in stage II of production phase. This means that cassava farmers in Ivo L.G.A. were either under or over utilizing their inputs.

Table 5. Elasticity and return to scale for cassava production

Inputs	Elasticity
Farm size	-0.0993
Planting material	0.3464
Labour	0.3611
fertility	1.0782
Depreciation	0.0087
Return to scale	1.6951

Source: Computed from Survey data, 2013

4. CONCLUSION AND RECOMMENDATIONS

The major conclusions drawn from the study were; Most respondents were youths, relatively educated, with moderate household size and small scale in operations. The production factors to cassava farmers in Ivo LGA were planting materials, fertilizer use and labour. Age of farmer, educational level and farming experience were the major determinants of technical efficiency in among female cassava farmers in Ivo LGA. More so, cassava farmers in Ivo LGA had technical efficiency ranges between 0.56% to 0.97% with mean efficiency of 0.23%, which implies that there is still a room for improvement. The distribution of the efficiency estimates obtained from the stochastic frontier shown that the production elasticity considered were all positive and with return to scale of 1.6951. This implies that the farmers are in stage II of production phase. Based on the result above, the following recommendations were made: the positive influence of education on farmer's

efficiency has been noted. In this direction, there is need to strengthen the current policies on education such as the universal basic education, adult education and nomadic education, the need to encourage new entrant, especially young and educated into cassava production to absorb the available labour in order to reduce poverty and ensure farmers' access to credit access through micro credit bank and other financial institutions.

Other recommendations proffered are;

(i) Policy options aimed at providing fertilizer to farmers at cheap and subsidized rate should put in place by government.
(ii) Nigeria 1999 land use act should be reviewed to ensure genuine farmers have access to land in order to improve their productivity and income.
(iii) There is need to develop labour saving devices such as hand driven plough and make them available to farmers in order to reduce cost of labour.
(iv) There is need to bridge the wide between extension- farmers ratio through employment of more extension personnel.
(v) More so, the efficiency of the change agent should be enhanced through provision of motivations and other incentives.
(vi) National Root Crop research institute and universities should be sponsored to develop and disseminate many more improved cassava varieties to the farmers in order to boost their productivity and income.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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