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Technical Efficiency of Cassava - Based Cropping in Oyo State of Nigeria

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Abstract

This study examined the technical efficiency of cassava-based cropping in Oyo State of Nigeria. The population for the study consisted of all cassava-based farmers in Oyo State. Well structured questionnaire was used in collecting information from 253 cassava-based farmers in the study area. Multistage random sampling technique was employed. The study was analyzed, using descriptive statistics, stochastic frontier production and multiple regression analysis. The result of the Cobb-Douglas stochastic frontier production function revealed that cassava cutting material was statistically significant and positive in all the zones. This implies that cuttings are positive factors that influence output in the study area. The coefficient of farm size was also found to be significant and positive in all the zones except in zone 4 where it was insignificant and negative. This implies that farm size was a significant and positive determinant of cassava output in these zones The estimated gamma parameter (γ) of 0.814 indicates that 81.4% of the total variation in cassava output was due to technical inefficiencies in the study area. The return to scale (RTS) was 0.54 in the study area. This indicates a positive decreasing return to scale and that cassava production was in stage II of the production region where resources and production were believed to be efficient. The mean technical efficiency for the study area was 0.542. The analyses of technical efficiency revealed that cassava-based farmers were not operating on the production frontier. Productivity improvements can be achieved by implementing policies, such as, improved farmers' access to extension services and technical assistance, to ensure farmers used the existing technology more efficiently. This would make farmers operate more closely to the existing frontier.

Key words

Technical efficiency, cassava, stochastic frontier.

Introduction

The agricultural sector is an important sector in the Nigerian economy. Agriculture production remains the mainstay of the Nigerian economy. It is the main source of food for the population. The sector accounts for about 30.8 percent of GDP and employs about two-thirds of the labour force (CBN, 1994).

Cassava is the most widely cultivated crop in the southern part of the country in terms of area devoted to its production and the number of people employed. Indeed, almost every household grows it. The consumption of cassava cuts across all parts of the country. Its adaptability to climatic and soil conditions even in marginal soils has endeared cassava to most people that have to do continuous cultivation on limited available land. The general acceptance of cassava and its products to all classes of Nigerians on its own draws close attention to the producers of cassava (Olanrewaju et al., 2009).

In recent years, cassava has also been transformed from being a subsistent crop to an industrial cash crop. Cassava is one of the most actively marketed food crops and is the most promising in terms of growth and new market opportunities. There is also a regular surplus of cassava in most producing countries and several governments in Africa have taken positive steps to promote cassava production for industrial use since many of these countries have large capacities for cassava production. Cassava is cultivated for its tuberous roots, from which cassava flour, breads and tapioca are derived. It is in demand for several reasons (Oloyede, 2004). In Nigeria, International Institute of Tropical Agriculture (IITA) is committed to the introduction of cassava bread. To this end, the institute, in collaboration with the office of Special Assistant on food security in the Presidency, has mapped out series of training workshops for cassava processors in the country to facilitate prompt implementation of the Federal Government policy. The Federal Government of Nigeria promulgated a policy on the use of cassava. The government directed that composite flour be made which comprises of 10% cassava and 90% wheat. The government further directed that manufacturers should start using this composite flour with effect from 1st January 2005.

According to Njeru (2004), technical efficiency is the ability of a firm to maximize output for a given set of resource inputs while allocative (factor price) efficiency reflects the ability of the firm to use the inputs in optimal proportions given their respective prices, and production technology. Technical efficiency is considered to be an important determinant of productivity growth and international competitiveness in any economy. It is also considered to be an important factor which contributes to stability of production. The role of efficiency in increasing agricultural output has been widely recognized in both developed and the developing countries of the world (Tran et al., 1993; Giroh and Adebayo, 2009).

A number of empirical studies have identified the sources of technical inefficiency, in addition to predicting the technical efficiencies for the firms. One of the earliest empirical studies in stochastic frontier production function was an analysis of the sources of technical inefficiency in the Indonesian Weaving Industry by Pitt and Lee (1983). The study estimated a stochastic frontier production function by the method of maximum likelihood and the predicted technical efficiencies were then regressed upon some variables, including size, age and ownership structure of each firm, and were shown to have significant effect on the degree of technical inefficiency of the firms. Many subsequent empirical studies have investigated the sources of technical inefficiency in different firms using the same two stage analytical methods. However, studies by Huang and Liu (1994) and Battese et al., (1996) have questioned the theoretical consistency of this two stage analytical technique and have proposed the use of stochastic frontier specifications which incorporate models for the technical inefficiency effects and simultaneously estimate all the parameters involved. Seyoum et al., (1998) using a one stage technical inefficiency model investigated the technical inefficiency and productivity of maize producers in Ethiopia and found technical inefficiency to be a decreasing function of the education of farmers and the number of hours of extension services but education was not significant for those farmers practicing traditional farming.

A study on efficiency in cassava production is important for many reasons. One, measuring efficiency of cassava producers and identifying the factors impacting on it will provide indications for the formulation of economic policies likely to improve producer efficiency and output in general. Two, at the micro-level, improved efficiency helps to increase the levels of income through increased profit and hence reduce poverty. Three, given the high costs of cassava production and the low productivity, knowledge on technical efficiency levels will provide guidelines to government on how to improve output by farmers. Finally, whereas a number of studies have been undertaken on efficiency measurement in Nigeria, very few use the stochastic frontier approach on cassava-based cropping.

This study therefore examines the level of technical efficiency of cassava- based cropping in Oyo State. There appears to be little previous application of stochastic frontier models in the analysis of the efficiency of cassava-based cropping system in Nigeria. Given the amount of work and available information on previous studies it is believed that this model is very relevant to the Nigerian situation.

Materials and methods

The study was carried out in Oyo States of Nigeria. Oyo State is located between latitudes 2^0 38^1 and 4^0 35^1 east of the Greenwich meridian. Oyo State covers an area of 28,454 square kilometer [2,845,400 H]. According to NPC, Oyo state had a population of 5,591,585 people. The state has two distinct ecological zones – the western moist forest to the south and the intermediate savannah to the north.

The target population of the study was cassava – based farmers in Oyo State. A multi-stage random sampling technique was employed in selecting the sample. The four agricultural zones were taken as the sampling units as a first stage of sampling. At the second stage, two local government areas were randomly selected to represent the zone making a total of eight LGAs. The last stage involved random selection of 253 cassava – based farmers relative to the number of local government area in the zone (Ibadan/Ibarapa-79 – zone 1, Oyo-56 – zone 2, Ogbomoso-45- zone 3, and Saki-73- zone 4). Primary data were collected using well-structured questionnaire and interview schedule. Descriptive statistics, stochastic frontier production function and multiple regression analysis were used to analyze the data collected.

For the purpose of this study, the specific models that were estimated are:

1. A Cobb-Douglas production frontier function in its log transformation

$$LnY_i = Ln\,A + \sum_{I=1}^{6} \beta_i \, Ln\,X_i + V - U \quad (1)$$

Where

Y = Total farm output (kg)

X_1 = The area devoted to cassava production (ha);

X_2 = Quantity of cassava cuttings used (bundle/ha)

X_3 = Family and hired labour used in cassava production (man-days/ha)

X_4 = Quantity of fertilizer used (kg/ha)

X_5 = Quantity of herbicide and pesticide used (litre/ha)

X_6 = Total expenditures on farm tools used for the year.

A and β_i = are parameters to be estimated (i = 1, 2...6)

V_i = is a two-sided, normally distributed random error

U_i = is a one-sided efficiency component with a half-normal distribution where U_i is defined by

$$U_i = \delta_0 + \sum \delta_i Z_i \quad (2)$$

Where

Z_1 = The number of years of formal schooling completed by the farmer

Z_2 = Farming experience in cassava production in years

Z_3 = Age of the cassava farmer in years

Z_4 = Availability of extension service measured by the number of contact with extension agents

Z_5 = Types of cassava cuttings used; equal 1 if improved varieties is used and zero otherwise.

δ_0 and δ_i are parameters to be estimated

(i = 1,2,.........5) together with the variance parameter.

$$\sigma^2_s = \sigma^2 + \sigma^2_v$$

$$\sigma^2 = \sigma^2_v + \sigma^2_u$$

$$\lambda = \sigma_u / \sigma_v$$

The parameters of the stochastic frontier functions were estimated by the method of maximum likelihood, using the computer program FRONTIER version 4.1.

From the stochastic production function specified in equation (2) above, the technical efficiency of farm can be written as

$$TE = Y/Y^* = f(x_i;\beta)\, exp(V_i - U_i)/f(x_i;\beta)\, exp\,(V_i)$$

$$TE = exp\,(-U_i) \quad (3)$$

TE was measured on a scale of 0 to 1. A value of 1 indicates that farm i displays complete TE while a value of zero indicates level of inefficiency. TE is in effect an expression of the farmer's ability to achieve results comparable to those indicated by the production frontier.

Results and Discussions

1. Summary Statistics

The average farm size was 1.6 ha for cassava based farmers in Oyo State. This study is in consonance with that of Awoyemi and Kehinde (2005) who reported an average of 0.52 ha in the study carried out on cassava production in Southwestern Nigeria and that of Ogundari and Ojo (2006) that reported an average of 0.89ha in a study carried out on cassava production in Osun State. The quantity and type of cassava cuttings planted by the cassava – based farmers depend on the production system, size of the farm, availability of varieties, price per bundle, ability of the farmers to take risk and the suitability of the variety to a particular environment and the purchasing power of the farmer. The mean quantity of cassava cuttings planted was 29.52 bundles per hectare for the pooled data. This quantity was below the recommended amount of cuttings per hectare (35 – 50 bundles per hectare). This implies that the plant population may not be optimum and their output would be less than the expected output. This may result in inefficiency on the part of cassava farmers in their production activities.

The mean age of the respondents were 49.4 years, 48.4 years, 49.4 years and 42.8 years in zone 1, zone 2, zone 3 and zone 4 respectively. This indicates that cassava – based farming in Oyo State was in the hands of elderly people who may not have the required labour by themselves to engage in large scale production of cassava. In the entire zone, the average age was tending towards the declining productivity class of greater than 50 years (Ogundele and Okoruwa, 2006). The implication

Variable	Zone 1	Zone 2	Zone 3	Zone 4	Pooled
Output (Kg/ha)	12.7 (11.8)	11.4 (10.7)	10.5 (11.9)	9.5 (7.0)	13.7 (16.7)
Farm Size (ha)	1.6 (1.4)	2.1 (1.4)	1.5 (1.4)	1.3 (1.1)	1.6 (1.3)
Cuttings (bundle/ha)	28.7 (27.0)	26.8 (16.7)	24.4 (19.5)	33.1 (34.0)	29.5 (118.9)
Labour (mandays/ha)	346.5 (300.8)	264.1 (292.5)	465.1 (554.2)	326.4 (404.4)	456.6 (797.7)
Fertilizer (Kg/ha)	396(203.1)	72.5 (26.1)	300 (310.3)	162.5 (93.0)	265 (217.9)
Pesticide and Herbicide (Litre/ha)	11.3 (5.5)	10.0 (9.3)	4.3 (5.3)	3.9 (2.0)	5.2 (5.1)
Equipment (N/ha)	2394.9 (4522.0)	632.8 (594.8)	4106.3 (6331.0)	1867.7 (1337.0)	2843.3 (5202.8)
Age (years)	49.3 (12.2)	48.4 (12.1)	49.4 (10.6)	42.8 (11.3)	47.3 (11.2)
Education (years)	5.7 (5.6)	9.9 (3.9)	5.6 (4.6)	8.0 (6.5)	7.2 (5.4)
Experience (years)	27.1 (16.0)	28.3 (11.8)	17.5 (16.1)	17.0 (12.7)	21.3 (15.4)
Family size (Number)	9.6 (4.8)	7.3 (2.2)	9.7 (2.2)	9.0 (2.4)	9.1 (3.6)
Extension visit (Number)	18.5 (6.7)	16.8 (7.9)	9.7 (9.5)	5.2 (4.0)	13.8 (8.8)

Figure in Parentheses are standard deviation
Source: Field Survey, 2008

Table 1: Summary Statistics.

of this is that except the occupation witnessed the injection of young able men, in the next one decade, many of these farmers would have reached the declining productivity level and cassava-based farming will suffer a set back.

The means of years of farming experience were 27.1 years, 28.3 years, 17.5 years and 17 years in zone 1, zone 2, zone 3 and zone 4 respectively. In essence, majority of the farmers have had long number of years in the production of cassava and could be said to be well experienced in the business. This finding agrees with those of Alabi et al., (2006a) and Alabi et al., (2006b).

2. Estimated Production Functions

The Ordinary Least Squares (OLS) and the Maximum Likelihood Estimates (MLE) of the production parameters for cassava-based farming in Oyo State are presented in Tables 2 and 3 respectively.

The adjusted R^2 of the OLS estimate of the parameters for the production function was 0.255in zone 1, 0.381 in zone 2, 0.495 in zone 3, 0.929 in zone 4 and 0.486 in the pooled data. This implies that the inputs used in the model were able to explain about 26 percent in zone 1, 38 percent in zone 2, 50 percent in zone 3, 93 percent in zone 4 and 49% in the pooled data of the variation in the cassava production in the study area. The coefficient of farm size was found to be significant in all the zones except in 4 where it was insignificant and negative. This implies that farm size was a significant and positive determinant of cassava output in these zones. The coefficient of cassava cuttings was significant and a positive determinant of output in all the zones. Use of pesticide and herbicide was found to be statistically significant in zone 2 and 3, however, it is negative in zone 2 at 10% level of significance. The coefficient of equipment was statistically significant and positively related to output in zone 1 while it was negatively related to output in zone 3.

With an upward shift in the constant term, the coefficient of cassava cuttings remained significant in the Cobb-Douglas stochastic frontier production function in zone 1, 2, 3 and pooled data implying that the farmers could be advised to use more of cuttings to increase cassava output. In zone 4, there is need to reduce the use of cuttings. The coefficient of farm size was also found to be significant and positive in all the zones except in zone 4 where it was insignificant and negative. This implies that as the farm size increases, the output also increases. This finding is in line with the study by Ogundari and Ojo (2006) where farm size had a positive relationship with output. The coefficient of labour was found to be significant and negative in zone 2. This implies that output of cassava reduces with increase in the use of labour. Moreover, it was also observed that the coefficient of pesticide and herbicide had a statistical significant and positive relationship with output in zone 3 at 1% significant level. This implies that cassava output tends to increase with increase in the use of pesticide and herbicide. In zone 2 and 4, there is a statistical and negative influence of pesticide and herbicide on cassava output at 5% and 10% significance level respectively. This could be due to overuse or inappropriate use of pesticide and herbicide in these zones. Fertilizer had a significant but negative relationship with output in zone 3. The coefficient of equipment had a significant and positive

Variable	Zone 1	Zone 2	Zone 3	Zone 4	Pooled
Contant	0.054 (0.053)	26.636 (1.312)	3.64 (4.152)	9.013 (8.125)	8.501 (3.165)
Farm size (X1)	0.206 (1.801)	0.953 (3.052)***	0.256 (2.223)**	0.095 (-0.065)	0.406 (5.086)*
Cuttings (X2)	0.212 (2.260)**	0.557 (3.822)***	0.213 (2.104)**	0.347 (3.714)*	0.160 (3.333)*
Labour (X3)	0.011 (-0.129)	0.233 (-0.729)	0.024 (-0.369)	0.055 (0.574)	0.002 (0.036)
Fertiliser (X4)	0.111 (-1.023)	0.158 (0.236)	0.111 (-1.545)	0.056 (0.453)	0.018 (-0.189)
Pesticide and herbicide (X5)	0.055 (0.356)	0.562 (-1.937)*	0.331 (2.874)***	0.178 (-0.874)	0.028 (0.330)
Equipment (X6)	0.217 (2.583)***	0.202 (-1.278)	0.247 (-2.390)**	0.199 (-1.634)	0.027 (-0.466)
Log likelihood function	-79.336	-207.905	-22.666	-64.061	-890.983
R^2	0.255	0.381	0.495	0.929	0.486

Note that when the figures in parentheses are negatives, the coefficient s are also negative
Figure in Parentheses are t-ratios.
* - estimate is significant at 10 % level
**- estimate is significant at 5 % level
***- estimate is significant at 1 % level
Source: Data Analysis, 2008

Table 2: Ordinary Least Squares estimate for cassava-based farmers in Oyo State.

Variable	Zone 1	Zone 2	Zone 3	Zone 4	Pooled
Contant	0.068 (0.066)	52.084 (111.863)***	3.577 (4.214)***	9.142 (11.108)***	24.387 (5.451)***
Farm size (X1)	0.206 (1.876)*	1.188 (4.870)***	0.237 (2.244)**	0.032 (-0.246)	0.388 (5.339)***
Cuttings (X2)	0.212 (2.358)**	0.531 (5.480)***	0.299 (2.664)***	0.362 (-5.049)***	0.177 (4.151)***
Labour (X3)	0.011 (0.138)	0.251 (-2.030)**	0.008 (0.116)	0.007 (-0.09)	0.011 (0.240)
Fertiliser (X4)	0.011 (-1.049)	0.312 (1.167)	0.133 (-1.996)*	0.090 (0.948)	0.031 (-0.333)
Pesticide and herbicide (X5)	0.055 (0.371)	0.663 (-2.480)**	0.340 (3.262)***	0.129 (-1.787)*	0.049 (0.617)
Equipment (X6)	0.217 (2.689)***	0307 (4.070)***	0.270 (-2.615)***	0.129 (-1.573)	0.058 (-1.309)
Sigma Square	0.438 (4.892)***	241.277 (241.588)***	1.806 (4.319)***	4.388 (2.896)***	235.4 (3.429)***
Gamma	0.448 (2.560)***	0.999 (193.481)***	0.345 (1.668)*	0.979 (71.942)***	0.814 (11.956)***
Log likelihood function	-79.335	-201.516	-19.705	-53.41	-888.64
Return to scale	0.59	0.81	0.481	0.129	0.54

Figure in Parentheses are t-ratios.
* - estimate is significant at 10 % level
**- estimate is significant at 5 % level
***- estimate is significant at 1 % level
Source: Data Analysis, 2008

Table 3: Stochastic production frontier for cassava-based farmers in Oyo State.

relationship with output in zone 1 while it had a negative relationship with output in zones 2 and 3.

The estimate of sigma squares of 0.438 in zone 1, 241.277 in zone 2, 1.806 in zone 3, 4.388 in zone 4 and 235.498 in the pooled data were significantly different from zero at different levels. This indicates a good fit and correctness of the specified distributional assumption of the composite error term. This suggests that the conventional production function was not an adequate representation of the data.

The estimated gamma parameter (γ) of 0.448 in zone 1, 0.999 in zone 2, 0.345 in zone 3, 0.979 in zone 4 and 0.814 in the pooled data indicates that 44.8 % in zone 1, 99.9 % in zone 2, 34.5 % in zone 3, 97.9% in zone 4 and 81.4% in the pooled data of the total variation in cassava output was due to differences in their technical efficiencies.

The estimated elasticities of the explanatory variables of the stochastic frontier shows that cassava cutting was a positive decreasing function to output in zones 1, 2, 3 and pooled data indicating the variables allocation and use were in the stage of economic relevance of the production function (Stage II). In zone 4, there is over-utilization of use of cassava cuttings and hereby in Stage III of the production surface. The elasticities of farm size were a positive decreasing function to the output in zone 1, zone 3 and for the pooled data indicating optimum use and in stage II in these zones. The elasticity of farm size was a positive increasing function in zone 2 (Stage I) while it was a negative decreasing function to the output in zone 4 (Stage III). The elasticity of labour was a positive decreasing function to the output in zone 1, zone 3 and the pooled data (Stage II) while it had a negative decreasing function with output in zone 2 and zone 4 (Stage III).

The elasticity of fertilizer was positive decreasing function in output in zone 2 and zone 4 (Stage II) while it had a negative decreasing function with output in zone 1, zone 3 and the pooled data (Stage III). The elasticity of agrochemicals was a positive decreasing function to output in zone 1, zone 3 and the pooled data (Stage II) while it had a negative decreasing function with output in zone 2 and zone 4 (Stage III). The elasticities of equipment was a positive decreasing function to output in zone 1 (Stage II) while it had a negative decreasing function to output in zone 2, zone 3, zone 4 and the pooled data (Stage III).

The return to scale (RTS) was 0.59 in zone 1, 0.81 in zone 2, 0.48 in zone 3, 0.13 in zone 4 and 0.54 in the pooled data. This indicates a positive decreasing return to scale in all the zones and that cassava production was in stage II of the production region in these zones where resources and production were believed to be efficient. Hence it is advisable that the production units should maintain the level of input utilization at these stages as this will ensure maximum output from a given level of input *ceteris paribus*.

3. Technical efficiency indexes

The results derived from the ML estimates indicate that technical efficiency (TE) indices range from 0.0467 to 0.987 for the farms in zone 1 with a mean of 0.735 (Table 4). This means that for an average efficient farmer to achieve the technical efficiency level of its most efficient counterpart, he could realize about (1 – 0.735/0.987) savings in cost or increase in production. This gives about 26.8 percent increase in production or cost savings. The least efficient farmer can now save a cost or increase in production of 96.6 percent (1 – 0.0467/0.987) to achieve the required technical efficiency of the most efficient farmer in the zone.

The TE indices range from 0.056 to 0.995 for the farms in zone 2 with a mean of 0.395. This means that for an average efficient farmer to achieve the TE level of it most efficient counterpart, he could realize about 60.3 percent (1 – 0.395/0.995) savings in cost or increase in production in the zone. The least efficient farmer can now save a cost or increase in production of 94.9 percent (1 – 0.056/0.995) to achieve the required technical efficiency of the most efficient farmer in zone 2.

The TE indices range from 0.419 to 0.972 for the farms in zone 3 with a mean of 0.848. This means that for an average efficient farmer to achieve the technical efficiency level of its most efficient counterpart, he could realize about 12.8 percent (1 – 0.848/0.972) savings in cost or increase in production. The least efficient farmer can now save a cost or increase in production of 59.8 percent (1-0.419/0.972) to achieve the required TE of the most efficient farmer in zone 3.

The TE indices range from 0.09 to 0.9 is with a mean of 0.696 in zone 4. This means that for an average efficient farmer to achieve the TE level of its most efficient counterpart he could realized about 23.5 percent (1 – 0.699/0.910) cost savings or increase in production. The least efficient farmer in the zone can now save a cost or increase in production of 90.1 percent (1 – 0.09/0.910) to achieve the required TE of the most efficient farmer in the zone.

In the pooled data, the TE indices range from 0.000432 to 1 with a mean of 0.542. This means that for an average efficient farmer to achieve the TE level of its most efficient counterpart, he could realize about 45.8 percent cost savings or increase in production. The least efficient farmer in the state can now save a cost or increase production by 99.9 percent to achieve the required TE level of the most efficient farmer in the state. From table 30, it can be seen that farmers in zone 3 are more technically efficient than farmers in other zones. The mean TE of 73.5 %, 39.5 %, 84.8 % and 69.6 % were achieved by cassava – based farmers in zone 1, zone 2, zone 3 and zone 4 respectively. This shows that there is scope for increasing cassava production by 26.5 %, 60.5 %, 15.2 % and 30.4 % with the present technology in zone 1, zone 2, zone 3 and zone 4 respectively.

The mean TE found in this study is in line with the findings reported by others. Ajibefun et al., (2002) estimated technical efficiency of Japanese rice farmers to be 74.5 %. Awoyemi and Kehinde (2005) computed TE of cassava-based Small farm holdings in South-Western Nigeria to be 82.7 %. Awoyemi et al., (2003) estimated TE of aquaculture production in Nigeria to be 24 %.

4. Relationship between Technical Efficiency and Some Socio-economic Variables

To investigate the relationship between technical efficiency and socio economic variables, regression analysis was carried out.

Levels (%)	Zone 1	Zone 2	Zone 3	Zone 4	Pooled
<10	4 (5.1)	9 (16.1)	0	1 (1.4)	34 (13.4)
100-20	8 (10.1)	9 (16.1)	0	3 (4.1)	37 (14.6)
21-30	5 (6.3)	7 (12.5)	0	1 (1.4)	33 (13)
31-40	4 (5.1)	8 (14.3)	0	1 (1.4)	14 (5.6)
41-50	1 (1.3)	4 (7.1)	2 (4.4)	6 (8.2)	7 (2.8)
51-60	2 (2.5)	5 (8.9)	0	5 (6.8)	7 (2.8)
61-70	2 (2.5)	4 (7.1)	3 (6.7)	8 (11)	9 (3.6)
71-80	2 (2.5)	2 (3.6)	5 (11.1)	23 (31.5)	9 (3.6)
81-90	3 (3.8)	3 (5.4)	17 (37.8)	21 (21.8)	24 (9.6)
>90	48 (60.8)	5 (8.9)	18 (40)	4(5.5)	79 (31.2)
Means (%)	73.5	39.5	84.8	69.6	54.2
Minimum (%)	4.7	5.6	41.9	9	0.04
Maximum (%)	98.7	99.5	97.2	91	1
Average (save in cost)	26.80 %	60.80 %	15.60 %	23.50 %	45.80 %
Least (save in cost)	96.60 %	94.90 %	59.80 %	90.10 %	99.90 %

Figure in parentheses are the percentages
Source: Data Analysis, 2008

Table 4: Frequency distribution of technical efficiency for cassava-based farmers in Oyo State.

The results presented in Table 5 revealed a negative and non significant relationship between education and technical efficiency in zone 1 and zone 3. In zone 2, there was a positive and significant relationship between education and TE indicating that TE increases with increase in the years of schooling. The coefficient in pooled data was negative and statistically significant at 1% level of significance. This implies that TE tends to decrease with increase in education. Various studies have found a positive correlation between TE and education (Belbase and Grabowki, 1985), while several others have reported no significant relationship between these variables (Bravo-ureta and Evenson, 1994).

Experience was found to have a negative and significant relationship with TE in zone 3 and pooled data while it was not significant in zone 1, 2 and 4. This implies that TE tends to decrease with increase in years of experience. While some of these results were consistent with that of Ogundele and Okoruwa (2006) whose results had a negative relationship between experience and TE, some differed from those of Alabi et al., (2006b) and Kalirajan and Flinn (1983) whose results had a positive relationship between experience and TE.

In zone 3, the coefficient of age variable with TE was positive and statistically significant at 1% level of significance. This implies that older farmers are more technically efficient than younger farmers. This result was consistent with the findings of Bravo-ureta and Evenson, (1994) and Ogundele and Okoruwa, (2006).

In zone 4, there was a negative and significant relationship between extension visit and TE. This implies that farmers with more frequency of extension visits tend to be less technically efficient in cassava production. One will expect that increase in number of extension visits to farmers would increase efficiency in cassava – based cropping, but this was not so in this study rather increase in number of extension visits leads to a decrease in the TE in zone 4. It was either that the quality of extension service is poor in this zone (for example, may be wrong information is being passed to the farmers from extension quarters) or the farmers do not follow extension advice. This finding differs from those of Alabi et al., (2006a) and Ogundele and Okoruwa (2006). In the pooled data, there is a positive and significant relationship between frequency of extension visit and TE. This implies that technical efficiency increases with increase in frequency of extension visit. This finding was consistent with those of Alabi et al., (2006a) and Ogundele and Okoruwa (2006). Frequency of extension visit was insignificant in determining technical efficiency of cassava farmers in three zones.

The positive coefficient of varieties of cassava used and TE in zone 2 implies that farmers that used improved varieties of cassava tend to be more technically efficient than farmers that planted local varieties. However, variety was not significant in determining TE in three zones and pooled data.

The F – statistics in zone 1 was not

Variable	Zone 1	Zone 2	Zone 3	Zone 4	Pooled
Constant	1.064 (3.772)	0.207 (0.059)	0.623 (6.007)	1.174 (2.002)	0.760 (3.864)
Education	0.112 (-0.101)	0.265 (1.920)*	0.005 (-1.196)	0.011 (1.434)	0.179 (-2.724)***
Experience	0.013 (0.345)	0.006 (0.1)	0.007 (-4.511)***	0.005 (-0.214)	0.052 (-1.934)*
Age	0.029 (-0.708)	0.070 (-1.512)	0.008 (3.556)***	0.006 (-1.589)	0.001 (-0.045)
Extension	0.008 (0.108)	0.081 (1.066)	0.004 (-0.012)	0.014 (-2.495)**	0.084 (2.144)**
Variety	0.157 (-1.339)	0.224 (2.104)**	0.013 (0.160)	0.006 (0.011)	0.342 (-0.481)
F-test	0.909	2.523**	5.132**	3.75**	2.543**
R^2	0.068	0.387	0.397	0.273	0.08

Figure in Parentheses are t-ratio.
* - estimate is significant at 10 % level
**- estimate is significant at 5 % level
***- estimate is significant at 1 % level
Source: Data Analysis, 2008

Table 5: Regression Result of Relationship between technical efficiency and some selected socio-economic variable.

statistically significant, the hypothesis that technical efficiency of cassava- based farmers was not affected by their socio-economic characteristics was accepted in zone 1 and rejected in all other zones and pooled data.

Therefore, technical efficiency level of farmers is affected by their socio- economic characteristics in Oyo State that is, the pooled data.

Conclusion

The following conclusion could be drawn based on the findings of this study.

1. The factors affecting cassava production in Oyo State was farm size and stem cuttings.

2. There is scope for increasing cassava production by 45.8% for technical efficiency, with the present technology in Oyo State.

3. There is a negative relationship between the extension contact and efficiency in zone 4 while it is positive in pool data.

In view of the above conclusion, there is a need to strengthen the extension agencies and the agents trained to increase their efficiency at training and providing information to farmers.

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