

Effect of Credit Utilisation on the Technical Efficiency of Late-Season Maize Production in Yewa Division of Ogun state, Nigeria

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Abstract: Farmers' limited access to agricultural credit facilities is a major factor limiting agricultural productivity in Nigeria, and this in turn affects the efficiency of production. Hence, this study aims to examine the effect of credit utilisation on the technical efficiency of late-season maize production in Yewa Division of Ogun State, Nigeria. Primary data were obtained from one hundred and twenty (120) maize farmers using a random sampling technique. A stochastic frontier approach was used to generate technical efficiency estimate and Tobit regression model was applied to examine the effect of credit utilisation on the technical efficiency of late-maize production in the study area. Result of the logit regression model of the determinants of maize farmers' accessibility to credit showed that large household size (1.3483; $p < 0.01$); education (0.2281; $p < 0.01$) and cooperative membership (0.1052; $p < 0.05$) increased the likelihood of maize farmers' accessibility to credit facilities in the study area, but male farmers are less likely to benefit from the credit services like their female counterparts. Technical efficiency estimates ranged between 0.06 and 0.91 (mean value = 73%); and the coefficient values of seed quantity (0.6281), fertiliser (0.5319) and labour (0.6481) indicate that a one percent increase in each of these inputs would increase maize output by 0.3829, 0.4791 and 0.3629, respectively. The inefficiency effects of the frontier model revealed formal education and sex of the farmer as being positively influential in determining the technological gap in attaining the desired frontier in late-season maize production systems. The need for enhanced credit accessibility to improve farmers' technical efficiency in the study area was therefore essentially recommended.

Keywords: Credit utilisation, technical efficiency, late-season maize, stochastic frontier model, Ogun State

INTRODUCTION

Agriculture is a key sector of the economy of most countries of the African continent, serving as the main source of food, employment, income and other livelihood means for the teeming population. Despite its vast multisectoral importance, productivity in the agricultural sector is still very low in many African countries (Nakano and Magezi, 2020), partly due to large areas of uncultivated arable land estimated as almost 60% for the continent (Zedillo, 2015). For instance, while the maize sub-sector in the Tanzanian agricultural sector was ranked the second position out of the six flagship agricultural sectors behind cotton up till year 2017 (WFP, 2017), Wossen *et al* (2017) reported that the cultivation of drought tolerant improved maize varieties reduced yield variability by 53% and the probability of food scarcity by 84%.

Maize is a crop of notable interest for food security in many parts of sub-Saharan Africa (SSA). Household food security implies the existences of sufficient, safe and nutritious food available comprising key concepts on sustained basis for all people in all times at prices commensurate with their income (Rukhsana *et al.*, 2017). As in other countries of SSA, maize is an important crop in Nigeria (van Ittersum *et al.*, 2016), where it is largely cultivated by smallholder farmers over 6.5 million hectares of land across diverse agroecological zones of the country (Onumah *et al.*, 2021); being by far the largest cereal crop in terms of area and

production volume and is the most consumed staple food in Nigeria. Approximated 80 percent of the maize grain in Nigeria is consumed by man and his farm animal; aside the relevance of the remaining 20 percent, useful by pharmaceutical industries, food manufacturers, breweries, flour mills, among other industries (Onumah *et al.*, 2021). With a per capita consumption of about 35 kg per person per year, maize accounts for an estimated 10% of the daily calorie intakes in the country. The crop is also an important source of cash income for farmers and contributes significantly to agro-industrial development particularly in the livestock feed industry (Wossen *et al.*, 2017).

While the level of production of this cereal, widely consumed by numerous households in most African countries, makes it possible to cover their food needs, yet the marketable surpluses generated are still not sufficient to meet the foreign exchange needs of most countries in the continent (MAEP, 2017), the insufficient surplus being largely associated with low yield of this important annual cereal crop (Zedillo, 2015). Among several factors causing low productivity in maize yield (e.g. low adoption of modern technologies, such as fertilisers, modern varieties; and poor agronomic practices), previous studies have linked the lack of access to credit as a major obstacle to maize yield (e.g. Guirking and Et Boucher, 2008; Nakano *et al.*, 2016). Credit has been identified as a key factor, providing critical support service for increased

agricultural productivity. Credit supply facilitates adoption of innovations, leading to increased farm productivity and income, encourages capital formation and improves marketing efficiency (Otsuka and Larson, 2016). In addition, it enables farmers to purchase inputs, hire labour and procure equipment and improved seed varieties for increased agricultural production. The need for credit is more acute in the rural areas, because access to financial resources is lowered by low productivity and widespread poverty of the rural farm sector. This low productivity is purely due to the fact that they produce for subsistence consumption and a little marketable surplus. Access to credit enhances farmers' ability to acquire productive factors (such as farmlands, skilled and unskilled labour, among others); and affords them the opportunity to deploy modern farm technology to boost production, thereby increasing their production efficiency and consequently, profit margin (Antwi and Onumah, 2020).

Agricultural credit has been reported as an effective tool for sustainable agricultural development in several places in the world. It has positive impact on smallholder farmers' productivity as it enables them to access inputs such as fertilisers, improved seeds and to hire labour when needed. Credit accessibility increases households' per capita income and can be a powerful tool to increase farmers' productivity, wellbeing and food security. Indeed, agricultural credit enhances productivity and improves standards of living by breaking the vicious cycle of poverty that small-scale farmers are prone to (Antwi, 2020). However, despite this positive effect of agricultural credit in improving farms productivity as well as farmers' well-being in general, the expected nexus between farmers and credit sources is still very weak. To improve farmers' access to credit sources therefore, there's the need to strengthen the capacity of critical operators in the credit management system, educate farmers on the merits of credit-use and the procedures for access, and seek to link formal and informal financial service delivery systems.

Many a times, farmers obtain agricultural credit and use it for other purposes, underscoring the ethical and legal purposes for such loan facilities. As a result, they inadvertently face difficulties in their loan obligations (repayment) to the lending institutions. To this effect, a number of recent studies perceive as challenging the high profiling of agricultural credit revealing controversial effects of it on agricultural productivity (e.g., Njeru *et al.*, 2016; Nakano and Magezi, 2020). In Nigeria, in similar vein, Agbodji and Johnson, (2019) equally considered their finding so challenging, establishing contrasting impact of cash credit on maize productivity. The foregoing scenarios notwithstanding, a number of studies have established the positive effects of farmers' access to

credit on agricultural productivity (e.g., Khandker and Et Koolwal, 2014 and Akudugu, 2016). These controversies often constrict the feasibility of securing financial support for agricultural production, especially among late season maize farmers, due to the heightened fear of unexpected shocks occasioned by adverse weather condition. Hence, the aim of investigating the effect of credit utilisation on the technical efficiency of late-season maize farming systems among farmers in the derived savanna zone of Yewa division in Ogun state is justified.

METHODOLOGY

Study area - The study area is Yewa Division of Ogun State, Nigeria. This division of Ogun State is bounded in the West by the Republic of Benin, East by Abeokuta division, North by Oyo State, and South by Lagos and the Atlantic Ocean. The Division is composed of five (5) Local Government Areas (LGAs), namely Yewa South (Ilaro), Yewa North (Ayetoro), Imeko-Afon (Imeko), Ado-Odo/Ota (Ota) and Ipokia (Ipokia), with a total land mass of about 5,878 km². The people are predominantly Yewas, Aworis and Eguns which are Yoruba speaking.

Sampling technique and method of data collection - A multistage random sampling technique was used for this study. In the first and second stages, two (2) Local Government Areas (LGAs) - namely Yewa North and Yewa South - and three (3) communities per LGA were purposively selected due to the prevalence of late-season farming activities in those areas (citation). In the third stage, two (2) villages were randomly selected from each of the six communities to give a total number of twelve (12) sampled communities. Lastly, at the community level, late-season maize farmers were randomly selected proportionate to the size (number) of practitioners in those communities. Primary data were obtained from the sampled farmers using structured questionnaire, which were administered directly on the respondents. From the retrieved questionnaires, only one hundred of twenty (120) were found useful for the data analysis, as some were discarded for their paucity of sufficient information.

Methods of data analysis - The study data were analysed using descriptive and inferential statistical tools. Descriptive statistics were used to present the socio-economic characteristics of the late-season maize farmers, and to identify the sources of credit facilities available to them. Logit model was used to estimate the determinants of credit accessibility by the maize farmers. The choice of the logit model was premised upon dichotomous nature of the dependent variable, being a dummy. Several studies on access to credit have shown that there exists some heterogeneity between credit users and non-credit users. Several models used in

measuring credit-use fail to meet the statistical assumptions necessary to validate the conclusions based on the hypotheses tested. To overcome this problem with regards to the use of a linear probability model, the logit and probit models have been recommended as more appropriate (Gujarati, 2004). This study adopted the use of logit model since the probabilities are between 0 and 1. The binary logit model is used in this study, and was specified as follows:

$$\ln(P_i/(1-P_i)) = \beta_0 + \beta_1 X_1 + \dots + \beta_9 X_9 + e_i$$

Where:

P_i = probability of farmer's accessibility to credit for late-season maize production

$1-P_i$ = probability of not accessing credit for production

β_0 = Intercept

β_i (1,2,3,...,9) = Regression coefficients,

X_i (1,2,3,...,9) = Independent variables, and

e_i = error term.

The independent variables specified as factors influencing farmer's decision to access credit for production and are defined below: X_1 = Sex (1=male, 0=female), X_2 = Age (years), X_3 = Household size (number), X_4 = Education (years), X_5 = Farming experience (years), X_6 = Farm size (Ha), X_7 = Type of labour engaged (1=Hired, 0 otherwise), X_8 = Cooperative membership (Yes=1, 0 otherwise), X_9 = Distance to credit source (km).

Technical efficiency estimates in late-season maize production systems

Stochastic frontier approach was used to estimate the technical efficiency of arable crop farming in the study area. The concept of the Stochastic frontier approach depicts a normal production setting that is bedevilled with varied number of factors some of which not under the influence of the producer. The production process may have some stochastic components that are not associated with inefficiency such as luck, weather, measurement errors in the dependent and independent variables. These resulted in the introduction of the stochastic error term which represents different set of errors which were hitherto added to the inefficiency of the producer. The generalised deterministic frontier production function is expressed below:

$$\ln Y = \alpha_0 + \alpha_1 \ln x_1 + \alpha_2 \ln x_2 + \alpha_3 \ln x_3 + \alpha_4 \ln x_4 + \alpha_5 \ln x_5 + V_i - U_i$$

Where:

$\ln$ is logarithm to base e ;

Y = Maize output (kg), X_1 = Quantity of seeds (kg),

X_2 = Quantity of fertilisers used (kg), X_3 = Quantity

of chemical used (litres), X_4 = Quantity of labour

(manday), X_5 = Land area cultivated (ha); and V_i =

Assumed to be independently and identically distributed random errors that have normal distribution. The technical inefficiency effects, U_i is defined as:

$$U_i = \beta_0 + \beta_1 Z_1 + \beta_2 Z_2 + \beta_3 Z_3 + \beta_4 Z_4 + \beta_5 Z_5$$

where: Z_1 = Age of the farmer (years); Z_2 = Household size (number); Z_3 = Formal education (in years); Z_4 = Farming experience (in years); and Z_5 = Sex of the farmer (1=female; 0= male)

Effect of credit utilisation on the technical efficiency of the surveyed farmers

To determine the effects of credit utilisation on technical efficiency of the farmers, a Tobit model was used. The structural equation of the Tobit model is given as: $y_i^* = Z_i \beta + \varepsilon_i$

The model assumes that there is an underlying stochastic index equal to $(Z_i \beta + \varepsilon_i)$ which is observed only when it is some number between 0 and 1; otherwise, y_i^* qualifies as an unobserved latent (hidden) variable. The dependent variable is not normally distributed since its values range between 0 and 1. The empirical Tobit model for this study therefore takes the following form:

$$y_i^* = \beta_0 + \sum_{n=1}^8 \beta_n Z_n + \varepsilon_i$$

Where: Y = Technical efficiency scores of the maize farmer, which ranges between 0 and 1.

Z_1 = Age of the farmer (years), Z_2 = Farming

experience (years), Z_3 = Education (years of

schooling), Z_4 = Sex of household head (1 = if male

and 0 = otherwise), Z_5 = Farm size (hectares), Z_6 =

Previous credit obtained (₦), Z_7 = Interest rate (%),

Z_8 = Amount of credit used for late-season maize

production in the 2017/2018 cropping season (₦), Z_9

= Membership of social organisation (Yes=1, and 0

otherwise) and ε_i = Error term.

RESULTS AND DISCUSSION

Socio-economic characteristics of maize farmers

The result of the analysis showed that majority of the maize farmers were male, representing about 86.7% of the sampled farmers. This can be attributed to the fact that men always have more rights to land as a productive resource than their women spouses. The male dominance of agriculture as a source of livelihood to the rural populace stems from the laborious nature of farming operations from tillage to harvest, which the female folks may not easily undertake. This is because peasant farming operations require a lot of energy and are labour intensive, especially under the rural, small-scale engagements, where crude farm implements are still largely adopted.

The distribution of the respondents based on age brackets revealed that the youngest maize farmer was 29 years old while the average farmer was about 42 years old. Majority (49.2%) of the maize farmers were between the ages of 31-40 years,

28.3% were between 41-50 years while 19.2% were between 51-65 years and only 3.3% of the farmers were below 31 years of age while the maximum age of the maize farmers is 65 years. This means that majority of the maize farmers were within the working age bracket. It can be said that maize farmers in the study area were relatively young and falling within their economically active age. Other implication is that maize farmers in the study area could be more effective in land husbandry activities such as weeding, land preparation, digging and planting since these tasks require physical efforts which could positively influence their efficiency level.

Marital status is expected to influence respondents' level of responsibilities which could have positive or negative influence on their disposition to economic activities. Majority (88.3%) of the respondents were married, indicating that they were settled family persons who needed credits to expand their maize farming production. This could enable them to increase their farming output and income with the resultant ability to cater for the

family's needs. It could also have implication for the supply of family labour to the respondents.

Education is an important socio-economic factor that influence farmer's decision making because of its influence on farmers' awareness and adoption of innovations that can bring about increase in productivity. The results in Table 1 revealed that 20.8% of maize farmers had no formal education while 79.2% of the farmers had one form of education or the other; about 20.0% had primary education, 43.3% had secondary education and 15.8% had tertiary education. This result showed that majority (79.2%) of the maize farmers in the study area had one form of formal education or the other implying that there is potential for increased maize production since education will enable farmers to have access to information on new agricultural innovation which can be adopted to enhance their productivity. The result is in conformity with the study of Achille and Dewanou (2023) who observed that productivity of maize farming with access to credit was influenced by being formally educated.

Table 1: Distribution of the socio-economic characteristics of the respondents

Variables	Response options	Frequency	Percentage	Mean
Sex	Male	104	86.7	42 years
	Female	16	13.3	
Age	≤ 30 years	4	3.3	
	31 - 40 years	59	49.2	
	41 - 50 years	34	28.3	
	51 - 60 years	12	10.0	
	61 - 65 years	11	9.2	
Marital Status	Single	8	6.7	
	Married	106	88.3	
	Separated	6	5.0	
Formal education	No formal education	25	20.8	
	Primary education	24	20.0	
	Secondary education	52	43.3	
	Tertiary education	19	15.8	
Household Size	3 - 6	61	50.8	7 members
	7 - 10	44	36.7	
	11 - 15	15	12.5	
Farm size	≤ 1.0	50	41.7	1.67ha
	1.1 - 2.0	39	32.5	
	2.1 - 3.0	16	13.3	
	> 3.0	15	12.5	
Farm experience	1 - 10 years	64	53.3	14 years
	11 - 20 years	34	28.3	
	21 - 30 years	15	12.5	
	31 - 35 years	7	5.8	
	Total	120	100.0	

Source: Field Survey Data, 2023

The distribution of the respondents based on household size revealed that over half (50.8%) of the respondents had a family size ranging between 3-6 members while 36.7% had a family size ranging between 7-10 members in their households and about 12.5% of maize farm households had a family

size ranging between 11-15 people. The average maize farm household was composed of 7 people. Manual labour is observed to be a significant production input in smallholder agriculture which can influence productivity through increase in efficiency. Family size represents the number of

persons that depend on the income generated from the farm and, thus, is likely to influence the farmer's attitude towards managing the farm.

Land expansion is still regarded as an important source of agricultural growth in Nigeria. Evidence in Table 1 revealed that majority (41.7%) of farmers in the study area had farm sizes ranging ≤ 1.0 ha, 32.5% of farmers had farm sizes ranging from 1.1 – 2.0ha, 13.3% of the farmers had farm size ranging from 2.1 – 3.0ha while only 12.5% had farm sizes more than 3.0 ha with the average farm size put at 1.67 hectares. It is important to note that all the maize farmers had less than 6ha implying that they are all small-scale farmers. Farmers are often encouraged to increase their scale of operations to take advantage of economies of scale and sometimes economies of scope. However, small farmers are better able to utilise efficiently small blocks of land and are more likely to practice intensive farming and fulfil market niches for special farm products.

The results on Table 1 also showed that over half (53.3%) of the respondents had maize farming experience ranging between 1-10 years while 28.3% had maize farming experience ranging between 11-20 years and only 18.3% had more than 20 years of maize farming experience. The average maize farming experience was about 14 years. This

implies that maize farmers were quite experienced in the production of maize in the study area. Experience which is often correlated with age can enhance people's efficiency in terms of allocation of resources, implementation of agronomic practices and reduction of risks through acquisition of better understanding of production practices and marketing. The finding is consistent with the study of Otsuka and Larson (2016) who argued that access to credit enables farmers to adopt the best production technologies and acquire quality input; and also afford them the opportunity to hire quality labour, which ensures they set up production under the most optimal conditions.

Sources of credit facilities available to the farmers

The results of the characteristics of credit available to the maize farmers are presented in Figure 1. Cooperative societies, Commercial Banks, friends and family and money lenders were the only sources of credit available to the farmers in the study area. The result as revealed shows that the major (65.0%) sources of credit available to the maize farmers in the study area was co-operative societies. Others include friends and family (36.7%), money lender (32.5%) and commercial banks (15.8%).

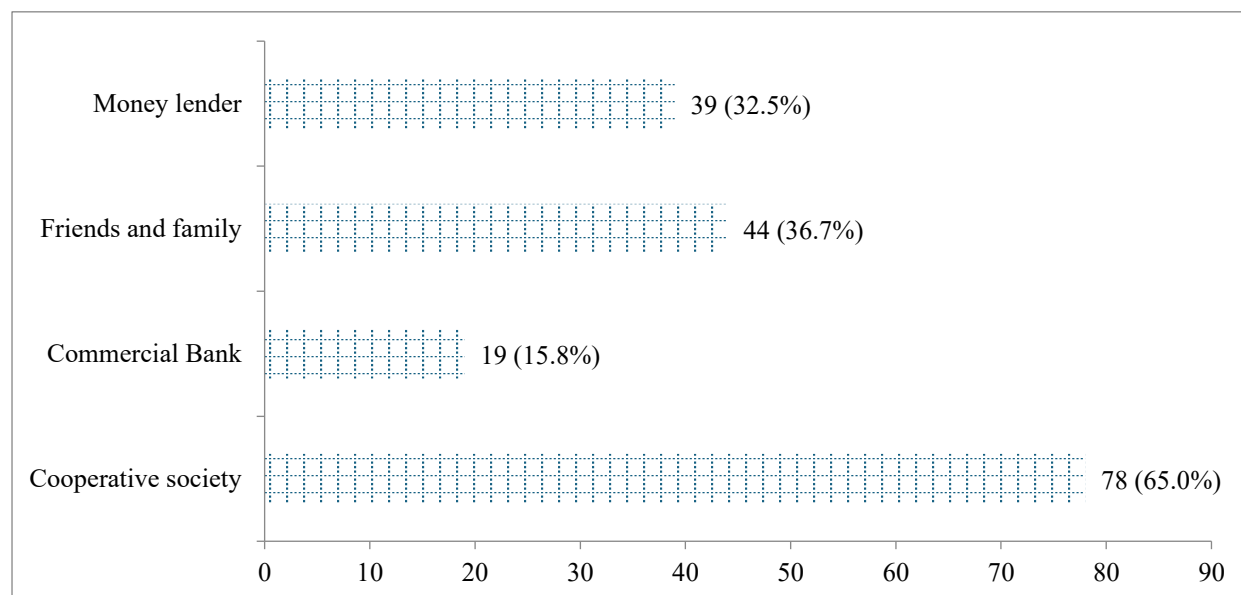


Figure 1: Credit available to the surveyed farmers

Source: Field Survey Data, 2023

The implication is that the major sources of credit among the respondents were non-institutional credit sources. Credit from non-institutional sources is more attractive, because there is little or no insistence on collateral security. On the other hand, formal sources of credit had low patronage from the farmers, which may be due to lack or limited presence of banks in the study area coupled with delay in approval and disbursement of loan and insistence on collateral security.

Determinants of maize farmers' accessibility to credit facilities

The empirical result discussed in this section is based on the Logit model specifications. The log-likelihood of -60.461, and the LR (Chi²) of 42.724 (significant at 1% level), implies that the overall model is fitted and the independent variables included in the model are collectively able to explain the farmers access to credit. Nine (9) variables were hypothesised to explain factors affecting maize

farmer's access to credit. Out of these four (4) of the variables were found to be significant. The maximum likelihood estimates of the logistic regression model show that sex, household size, formal education, farming experience and cooperative membership were important factors influencing farmers' access to credit in the study area.

Sex of household head is significantly related to the dependent variable, and it is significant at 1% probability level. The result of the logit model also revealed that the variable has a negative relationship implying that male headed household

uses credit less than female headed households or the male headed households would be less likely to go for credit. Household size is significantly related to the dependent variable. It is also significant at 1% probability level and increase in it would increase access to credit use. The positive relationship between household size and access to credit is that farmer who had small size of household can utilise more credit for labour and other farm inputs and therefore, this will increase the demand for credit and therefore, as demand increase there will be a chance of access to credit.

Table 2: Parameter estimate of factors influencing maize farmers' access to credit facilities

Variables	Coefficient	Standard error	z- ratio
Constant	1.9531	1.8222	1.072
Sex	-0.2756***	0.0916	-3.009
Age	-0.1230	0.5300	-0.236
Household size	1.3483***	0.1076	12.527
Years of formal education	0.2281***	0.0569	4.011
Farming experience	0.2068	0.6572	0.315
Farm size	-0.2874	0.2945	-0.976
Type of labour engaged	-0.0214	0.0262	-0.818
Cooperative membership	0.1052**	0.0492	2.137
Distance to credit source(s)	-0.0103	0.1205	-0.085
log-likelihood	-60.4606		
LR (Chi ²)	42.7238		

***, **, and * implies significant at 1%, 5% and 10%, respectively.

Source: Field Survey Data, 2023

Education level of household head affected access to credit positively and was statistically significant at 1% level of probability. This may probably mean that literate farmers have more exposure to the external environment and information which helps them easily associate to credit sources. Cooperative membership is another factor, which is significantly related to the access to funding sources, and is significant at 5% probability level. The probability of accessing credit was therefore, positively influenced by cooperative membership. This is due to the fact that cooperatives provide credit from their own source for members only. While for non-members except input credit no other type of credit was provided.

Technical efficiency of late-season maize farming

Maximum Likelihood Estimate (MLE) of the parameters of the stochastic frontier production model used in estimating technical efficiency of late season-maize production in Yewa Division of Ogun State, Nigeria is presented in Table 3. The result reveals that seed fertiliser and labour of the estimated coefficients of the parameters of production function were positive which confirm to a *priori* expectations and were statistically significant at 1 percent level while chemical and land area cultivated was negative, positive and not significant.

The sigma squared and the gamma (0.3396), (0.8027) were statistically significant at five and one percent respectively. The sigma squared indicates the goodness of fit and correctness of the distributional form assumed for the composite error term. The Gamma implies the existence of technical inefficiency among maize farmers and account for 80.3% of the variations in the output level of maize produced in study area. This confirms that in the specified model, there was presence of one-sided error component. It also implies that the effect of technical inefficiency was significant and that a classical regression model of production functions based on ordinary least squares estimation would be an inadequate representation of the data. Thus, the variance parameters confirm the relevance of the stochastic production function. The variables that were statistically significant can be discussed thus:

The coefficient of seed (0.6281) was positive and statistically significant at one percent level. This implies that one percent increase in viable seed quantity would lead to increase in maize yield by 0.6281 percent. This implies that seed is a positive factor influencing maize output in the area. It indicates that higher seed rate would result in high crop population and subsequently higher yield. The finding agrees with the findings by Diamoutene and Jatoo (2020) that seed was a positive determinant of

maize output among maize farmers in Ogbomoso
south LGA in Oyo State Nigeria.

Table 3: Maximum Likelihood Estimates of the Stochastic Production Function

Variables	Coefficient	Standard-error	t-ratio
Constant	3.5435***	0.6534	5.423
Seed	0.6281***	0.0695	9.040
Fertiliser	0.5319***	0.0748	7.114
Chemical	-0.1671	0.9732	-0.172
Labour	0.6481***	0.0813	7.976
Land area cultivated	0.6813	0.9818	0.694
Inefficiency model			
Constant	-0.0614	0.9762	-0.063
Age	0.0039	0.6667	0.006
Household size	-0.7219	0.8917	-0.810
Years of formal education	-0.1209***	0.0396	-3.054
Farming experience	0.1183	0.0753	1.571
Sex of the farmer	-0.2586***	0.0993	-2.605
Sigma-squared	0.3396**	0.1481	2.292
Gamma	0.8027***	0.2325	3.453

*** and ** implies significant at 1% and 5% respectively.

Source: Field Survey Data, 2023

The elasticity of production with respect to fertiliser (0.5319) was positive and statistically significant at one percent level. The use of fertiliser will improve soil fertility leading to increase in yield of maize. However, fertiliser make its best contribution to the enhancement of soil fertility only if it falls within a hierarchical system of good technological measures and the doses used are related to crop plants, soil, climate and culture technology. The result of the study is in conformity with the work of Usman *et al.* (2015) who found fertiliser to be significant in white maize production.

The elasticity of production with respect to labour (0.6481) was positive and statistically significant at one percent level. This implies that one percent increase in man days of labour, *ceteris paribus*, would lead to increase in maize yield by 0.6481 percent. The quick and effective weeding by hired labourers may be responsible for the increased productivity of maize in the study area. Accordingly, the production of maize in the area does not involve much of farm mechanisation but used traditional technology that relies heavily on labour. The inefficiency parameters included in the model specifically, those related to farmers' socio-

economic characteristics were also presented in Table 3. The signs in the inefficiency model were explained in the opposite way such that a negative sign indicates increase in technical efficiency while positive sign indicates a decrease.

Technical efficiency distribution of the late-season maize farmers

Table 4 shows the distribution of technical efficiency of the farmers in the study area, and it reveals that 14.2 percent had technical efficiency of less than 0.60 and about 48.3 percent had technical efficiency between 0.61 – 0.80. The mean technical efficiency was 0.73 which indicates that the average farmer obtained 73 percent of maximum attainable output for a given input level. This indicates that in the short run, there is scope for increasing technical efficiency in maize production by 27 percent in the study Area. This implies that to improve the technical efficiency of the maize farmers, their knowledge, skills and awareness level need to be improved. The present finding corroborates the findings of Wondimu and Hassen (2014) who reported high mean technical efficiency in maize production in Dhidhessa District of Illuababora Zone, Ethiopia.

Table 4: Distribution of maize farmers based on their technical efficiency levels

Variables	Frequency	Percentage
≤ 0.40	4	3.4%
0.41 – 0.60	13	10.8%
0.61 – 0.80	58	48.3%
> 0.80	45	37.5%
Total	120	100.0

Minimum = 0.0624; Average = 0.7321; Maximum = 0.9077

Source: Field Survey Data, 2023

Effect of credit utilisation on the technical efficiency of maize farmers

The results in Table 5 showed the estimates from the Tobit regression of credit utilisation against predicted technical efficiency scores to determine its effect as a factor on farm efficiency. The model was correctly estimated since the model Log likelihood function was 62.4552 and it was strongly significant at 1% level. Among the selected variables, four were found to have a significant contribution on technical efficiency namely: age, education, farm size and amount of credit used for maize production in the 2017/2018 cropping season.

Age of the farmer showed a negative effect on technical efficiency of the farms, and it was significant at 1% level. This means that older farmers were less technically efficient in maize production than their younger counterparts. The

finding is attributed to the fact that older farmers in the study area are relatively more reluctant to take up better technologies, instead they prefer to hold to the traditional farming methods thus become more technically inefficient compared to their younger counterparts. This negates the finding of Sani and Oladimeji. (2017) who opined that age of household head is critical for occupational experience and responsibility, and in consonance with the findings of Abdulazeez *et al.* (2018) who observed the mean age of rice farmers to be 42 years and concluded that farmer's age significantly influence the production-related decision process among arable crop farmers.

Farmers' education showed a positive effect on the technical efficiency as hypothesised and was significant at 1% level. The results indicated that a unit increase in the years spent in school will increase technical efficiency.

Table 5: Tobit regression estimates of the effect of credit utilisation on the technical efficiency of late-season maize farming

Variable	Coefficient	Standard error	t-ratio
Constant	0.8699***	0.1500	5.801
Age of the farmer	-0.0289***	0.0024	-12.150
Farming experience	0.0024	0.0046	0.509
Education	0.1009***	0.0110	9.171
Sex of household head	-0.0113	0.0505	-0.224
Farm size	0.0878***	0.0159	5.523
Previous credit obtained	-0.0020	0.0232	-0.087
Interest rate	0.0047	0.0204	0.231
Amount of credit utilised	0.0486***	0.0057	8.564
Membership of social organisation	-0.0659	0.0461	-1.429
Sigma	0.1438***	0.0093	15.492
Log likelihood function	62.4552***		

*** and ** implies significant at 1% and 5%, respectively.

Source: Field Survey Data, 2023

Farm size was found to have a positive effect on technical efficiency as hypothesised and it was significant at 1% level. According to the results, an increase in the size of the farm increases the technical efficiency of the maize farmer. It may be argued that farmers with larger farm sizes can engage productive resources more effectively, thus reducing soil fertility losses, and making their farming operations more efficient. Reverse is the case for farmers with small units of land, since the land is cultivated every year, thus reducing its productivity, and with resultant technical inefficiency effect.

Amount of credit used for late-season maize production also showed a positive and significant influence on technical efficiency at 1% level. According to the findings, farmers who had access to more credit showed higher levels of technical efficiency than those who failed to access credit in the same production season.

CONCLUSION

The study concludes that, the stochastic production function of the coefficients of farm seed, fertiliser and labour were found to be positive and significantly affect maize output of the farmers with the mean technical efficiency is 0.864 (or 86.4%) an indication that the farmers are fairly technical efficient in maize production. This indicates that there is scope to further increase the output by 13.6% without increasing the levels of inputs. It therefore suggests that productivity and output of the farmers can be increase for every increase in the resource efficiency use of the farmers. The inefficiency effects model revealed that formal education and sex of the farmer have positive effects on technical efficiency. Finally, the Tobit regression model estimation revealed that technical efficiency was positively influenced by education, farm size and amount of credit utilised all at 1% level; and negatively influenced by age.

RECOMMENDATIONS

In line with the finding of this study, it was recommended thus, that:

- i. Amount of credit used for late-season maize production in the last cropping season positively and significantly influenced the technical efficiency of the maize farmers. Therefore, enhanced access of late-season maize farmers to financial facilities, through such institutions as cooperatives and agricultural/micro finance banks, must be facilitated in the study area, for improved technical efficiency in the maize production systems.
- ii. Inefficiency of operations (up to 26.79%) was established in late-season maize production systems among farmers in the area. Thus, integrated efforts that will improve the existing level of input utilisation, and corresponding policy measures towards reducing inefficiency levels, will have paramount importance in improving food sufficiency in the study area.
- iii. Improved education among maize farmers will equally improve access to credit funding and thus, simplified literacy modes that are applicable to credit outsourcing is recommended for maize farmers in the study area.
- iv. Engaging larger farm plots will enable maize farmers utilise their resources more effectively, thus reducing soil fertility losses, and increasing technical efficiency in maize production.

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