

## Cropping Intensification and Technical Inefficiency of Maize-Based Farming Households in Southern-Guinea Savanna (SGS) of Nigeria

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**Abstract:** Maize being a main staple food in Nigeria, high productivity and efficiency in its production are critical to food security and poverty alleviation. Thus, this paper estimates technical efficiencies of 252 maize-based farming households in southern-guinea savannah (SGS) of Nigeria and provided an empirical analysis of the determinants of technical inefficiency. Descriptive and inferential statistics, crop intensity index, and multiple regression analyses involving the stochastic frontier production function were the analytical tools employed to achieve the research objectives. The results showed that crop production intensity scores among the farming households ranged between 5.5 and 38.5 with a mean score of 23.1. Technical efficiencies of smallholder maize-based farming households ranged from 0.18 to 0.93 with a mean of 0.48. This result indicated the possibility of improving the efficiency of the sampled farming households by 52% with the existing resources and technology. The result of the inefficiency model shows that cropping intensification, farming experience and household size are the significant variables determining technical efficiencies these households. Favourable agricultural inputs prices as well as other policies that could facilitate households' access to agricultural inputs are suggested. Policies aimed at reducing household size should also be vigorously pursued.

**Keywords:** Domestic food production, importation, intensification and productivity, maize-based households and cropping systems.

### INTRODUCTION

The attainment of food self sufficiency is a prominent development agenda facing most nations of Sub-Saharan Africa (SSA). Nigeria as the most populous nation in the region also faces challenges of reducing the country's dependence on food importation. Increased domestic food production is required to improve food self sufficiency ratio. Maize, one of the major staple foods in Nigeria, is important in agricultural policy decisions. Current maize production is about 8 million tonnes and its average yield is 1.5 t ha<sup>-1</sup>. The average yield is lower compared to the world average of 4.3 t ha<sup>-1</sup> and to that from other African countries such as South Africa with 2.5 t ha<sup>-1</sup> (FAO 2009). There has been a growing gap between the demand for maize and its supply. The stronger force of demand for maize relative to supply is evidenced in frequent rise in price of maize and therefore, has great implication for the food security status and economic development of the Nigerian economy. It is reported that among other causes of the food crisis, gross underinvestment in agricultural production and technology in the developing world has contributed to static productivity, weak markets, and underdeveloped rural infrastructure (CSIS 2008).

The total land area planted to maize in 2003 was about 4.7 million hectares with an estimated output of about 5.2 million metric tonnes. The output increased by 14.5 percent to 5.9 million metric tonnes in 2005 (FAO 2006). This increase in maize production was attributed mainly to expansion in cultivated land

areas rather than crop production intensification which according to Tiffen et al. (1994); is the use of increased average inputs on smallholding for the purpose of increasing the value of output per hectare. In an attempt at meeting the goal of increased domestic maize production, it has been observed that maize-based farming households do not take cognizance of the effectiveness of resource use in production. This is attributable to ignorance on the part of the households of the appropriate combination of inputs that gives the maximum output. Studies have shown that technical efficiency measures for Nigerian agriculture are low (Ajibefun and Daramola 2003, Rahji 2005, Oluwatayo et al. 2008, Oyewo et al. 2009). One of the reasons often attributed to decline in productivity is depletion in soil fertility primarily resulting from poor production practices characterized by low use of modern inputs. In order to avoid over generalization which often leads to ineffectiveness in government policies, there is the need to assess the current levels of technical efficiency of maize-based households and to identify the factors that affect the levels in the zone.

### METHODOLOGY

**Area of the Study:** The study area is the Southern Guinea Savanna ecological zone of Nigeria located at longitude 38° 148° E and latitude 78° and 108° N. The zone is majorly made up of Kwara, Niger, Kogi, Taraba, Plateau and Benue States. The Southern Guinea Savanna of Nigeria has great potential for the intensification of maize production

beyond the present level due to its bimodal rainfall pattern, (a short early growing season followed by fairly long late season) high solar radiation and favorable temperature during the growing season. However, the zone is characterized by variable weather, fragile soils with low moisture holding capacity that is prone to drought (Fakorede et al. 2001). The soils are also mainly Alfisols that are low in organic matter. Thus, the region offers a lot of potential for intensification with a view to bringing about much required growth in the maize sub-sector of the Nigerian economy.

**Sampling Procedure and Sample Size:** The target population was the farming households in maize-based production systems in the Southern Guinea Savannan zone of Nigeria. A three-stage sampling technique was used to select sample for the study. The first stage involved a purposive selection of Kwara and Niger States. The two states had the least number of crop farmers in the zone in the year 2007 (NBS 2008). The ADPs zones are four and three in Kwara and Niger states respectively. The second stage involved the proportionate sampling of villages in each zone in the two states. Five percent of the villages were selected in each zone to give rise to a total of twenty-eight villages. The upgraded 2001 Agricultural Development Projects (ADPs) village listing served as the sampling frame for the selections in the two states. In each village, 10 farming households were selected among the farming households in the areas to make up a sample size of 280. However, only 252 questionnaires were found useful and analyzed.

**Analytical Techniques:** Descriptive and inferential statistics, crop intensity index, and multiple regression analyses involving the stochastic frontier production function were the analytical tools employed to achieve the research objectives. Following Shriar (2005) intensification activities such as intercropping, use of legume, use of fertilizer, pesticides use per hectare, use of herbicides, ploughing methods, use of organic fertilizer and improved seeds have been assigned a particular weight based on its contribution to production intensity. These led to weight values ranging from 2 to 3.5 points (Table 1)

Table 1: Scale ranges and weights associated with agricultural intensity index

Intensification activity	Scale range	Weight	Max. Points
Scale of cereal/ legume plots	0-3	3.5	10.5
Scale of improve seeds	0-3	3.0	9.0
Scale of Ploughing	0-3	2.5	7.5
Scale of intercropping	0-3	3.0	9.0

Intensification activity	Scale range	Weight	Max. Points
Scale of fertilizer use per ha	0-3	3.0	9.0
Scale of pesticides use per ha (excluding herbicides)	0-3	2.0	6.0
Use of organic fertilization	0-1	3.0	3.0
Scale of herbicides use per ha	0-3	2.0	6.0
<b>Total</b>			<b>60.0</b>

Adapted from Shriar 2005 but modified.

As evident from the Table 1, not all farming activities could be assessed in sufficient detail to justify using a 0-3 scaling and that the maximum points attainable by the household from all the intensification activities is 60. The index is stated as:

$$CI_i = \sum_{j=1}^8 S_j W_j \quad \text{Eq(1)}$$

Where

CI is the crop intensification index for the  $i^{th}$  household; S is the scale range for the agro-technology and strategy employed by the  $i^{th}$  household and W is the weight of the agro-technology and strategy employed by the  $i^{th}$  household

A scale range of 0-1 for the use of organic fertilization implies a yes/No dummy variable. If the household is engaged in the activity they get 1point and 0 if otherwise. In contrast, a scale range of 0-3 indicates whether the household undertakes the activity and if so, does so at low (1point), medium (2 points), or high (3 points) scale. The multi-level scales (low, medium, high) used in the index are based on the proportion of the total area cropped on which the strategy is practiced except for fertilizer and pesticide scales which are based on the quantities of these items used, calculated on a per hectare basis. Cereal/legume plots received the highest weighting of 3.5, because production values are likely to be more sustainable over time with legume (Shirar 2005). The scale of cereal/legume plots involves the intercropping of cereal with any leguminous plants .It takes the value of 0, for no, and 1, 2, 3 for low, medium and high levels of activity respectively.

The scale of improved seeds on the other hand, indicates the proportion of the area cropped on which improve seeds are grown. It takes the value of 0, for no, and 1 (if less than 40% is cropped), 2 (if 40-69% is cropped), 3 (if 70% and above is cropped) for low, medium and high levels of activity respectively. The primary tillage or cultivation implement used in land preparation in the study area represents the Scale of

Ploughing. It takes the value of 0, for no, and 1, 2, 3 for use of cutlasses and hoes, animal traction and tractor respectively. The scale of intercropping entails the intercropping of maize with other crops apart from legumes. It takes the value of 0, for no, and 1 (if less than 40% is intercropped), 2 (if 40-69% is intercropped), 3 (if 70% and above is intercropped) for low, medium and high levels of activity respectively (Shriar, 2005).

Based on the recommended fertilizer input rate by ADP (2000), fertilizer application rate per hectare of between 50-100kg, 150- 200kg and 250-300kg is hereby regarded as low, medium and high application rate respectively for scale of fertilizer use per hectare. The quantities of herbicides such as Altrazin, Gramozone, Primextra etc that are used up in the production processes on per hectare basis represents the scale of herbicide use per hectare. Based on ADP (2000) recommended rate of 3litres/ hectare, the following classifications are made: 0.1-1.5 litres, 1.6-3.0 litres and 3.1-4.5litres and are thus regarded as low, medium and high application rate respectively. The scale of pesticides use per hectare (excluding herbicides) involves the quantities of insecticides, fungicides, nematicides etc that are used up in the production processes on per hectare basis. Based on the ADP (2000) recommended rate of 4 litres/ hectare, the following classifications are made: 0.1-1.5 litres, 1.6-3.0 litres and 3.1-4.5litres and are thus regarded as low, medium and high application rate respectively. The scale of organic fertilization is a dummy variable, if the household is engaged in the use of animal dung's and/or poultry droppings on the farm to raise soil productivity the score is 1point and 0 if otherwise.

A Cobb–Douglas stochastic production frontier approach was used to estimate the production function and the determinants of technical efficiency among smallholder maize-based farming household. Given the potential estimation biases of the two-step procedure for estimating technical efficiency scores and analysing their determinants, the one-stage procedure is adopted following Battese and Coelli (1995). Although this approach has its own limitations, it remains one of the popular production functions in production frontier studies. The following model is estimated on the basis of the Battese and Coelli (1995) procedure:

$$Y_i = X_i\beta + (V_i - U_i), i = 1, N, \text{-----}(2)$$

Where  $Y_i$  is the output of maize crop in grain equivalent.  $X_i$  is a  $k \times 1$  vector of input quantities of the  $i$ th household (land is measured as the total plot area cultivated in hectares; and labour is estimated as man-days worked; fertilizer is the amount of fertilizer used on the plot in kilogram; seed is the quantity of seed in kilograms, regardless of the type of maize and

agrochemicals is the quantity of chemicals used in liters).  $\beta$  is a vector of unknown parameters to be estimated: Where  $V_i$  are random variables, two-sided ( $-\infty < v_i < \infty$ ) normally distributed random error  $N \sim (0, \delta v^2)$ , which are assumed to be independent of the  $U_i$  that captures the stochastic effects outside the farmer's control (e.g., weather, natural disasters, and luck, measurement errors in production, and other statistical noise).

The two components  $v$  and  $u$  are also assumed to be independent of each other. Thus, to estimate a Cobb-Douglas production functions, all the input and output data must be logged before the data is analyzed (Coelli 1995). The estimating equation for the stochastic function is given as:

$$\ln Y = \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + V_i - U_i \text{-----}(3)$$

The maximum likelihood estimation of equation yields consistent estimators for  $\beta$ , the variance parameters; gamma ( $\gamma$ ), lambda ( $\lambda$ ) and Sigma squared ( $\delta^2$ ).

#### Determinants of Technical Inefficiency

$U_i$  =Inefficiency component of error term. It is assumed that the inefficiency effects are independently distributed and  $U_i$  truncation (at zero) of the normal distribution with means 0 and variance  $\sigma^2 u$  where  $U_i$  is specified as:

$$U_i = \delta_0 + \delta_1 Z_{1i} + \delta_2 Z_{2i} + \delta_3 Z_{3i} + \delta_4 Z_{4i} + \delta_5 Z_{5i} + \delta_6 Z_{6i} + \delta_7 Z_{7i} \text{-----}(4)$$

Where

$U_i$  = Technical inefficiency of maize-based farming household.

$Z_1$  = Farm size (in hectares)

$Z_2$  = Farming Experience in years

$Z_3$  = Household size (number of direct and dependants of the household adjusted to adult equivalent).

$Z_4$  = Extension contact (number of visits by the extension agent).

$Z_5$  = Crop Production Intensification which was measured using Shriar (2005) index.

$Z_6$  = Credit Access (1 if the household head has access and 0 if otherwise).

## RESULTS AND DISCUSSION

### Socioeconomic characteristics of farming households

The age of the farming households' heads ranged between 30 and 75 years with an average of 48.3 years as shown in Table 2.

**Table 2: Socioeconomic characteristics of maize-based enterprise household heads**

Variables	Frequency	Percentage
Age		
21-40 years	62	24.6
41-60 years	161	63.9
61-80 years	29	11.5

Total	252	100
<b>Sex</b>		
Male	216	85.7
Female	36	14.3
Total	252	100
<b>Marital Status</b>		
Married	198	78.6
Single	44	17.5
Widower/Separated	10	03.9
Total	252	100
<b>Household Size</b>		
1- 5	26	10.3
6- 10	117	46.4
11-15	99	39.3
16-20	10	03.9
Total	252	100
<b>Education Status</b>		
No formal Education	46	18.3
Quranic Education	77	30.6
Primary Education	81	32.1
Secondary Education	30	11.9
Tertiary Education	07	02.8
Adult Education	11	04.4
Total	252	100
<b>Primary Occupation</b>		
Farming	192	76.2
Agricultural Trading	19	07.5
Non-Agricultural Trading	24	09.5
Business	15	05.9
Civil Service	06	02.4
Total	252	100
<b>Farming Experience (Yrs)</b>		
1- 10	13	5.20
11-20	55	21.8
21-30	76	30.2
31-40	56	22.2
41-50	52	20.6
Total	252	100
<b>Introduction to Farming</b>		
Inherited	214	84.9
Farm Friends	22	08.7
Relations	16	06.4
Total	252	100

Source: Field Survey, 2011/2012

Sex distribution varies appreciably, 14.3% and 85.7% of the household heads were females and males respectively. The average household size is 11 persons in the zone. Most (69.3%) households are polygamous in nature. Majority (76.2%) of the household heads were predominantly farmers, while others were involved in both agricultural and non-agricultural trading, business and civil service as their secondary sources of livelihood. The farming households head's years of experience ranged between 5 and 45 years with an average of the

average of 29.1 years. This indicates that most of the household' heads have been practicing farming for long. Majority of the household heads (72.6 percent) have inherited farming business as an occupation, while the remaining was introduced to it by either friends or relations. Eighty-two percent (82%) of the household heads are literate with most of them having primary education (32.1%) and this is closely followed by Quranic education (30.6%) Those who had tertiary education (2.8%) probably constituted the civil servant who engaged in part-time farming in the area.

### Crop production intensification strategies in maize-based production systems

The crop production intensification strategies in the study area are capital-intensive, labour-intensive and land-intensive, or a combination of these. The capital-intensive strategies commonly used in the study area are the application of inorganic fertilizer, use of improved hybrid maize seed and agro-chemicals. The application rate  $\text{ha}^{-1}$  of inorganic fertilizer in the area was low (87.5kg) compared to the recommended rates of 300kg (Kwara Agricultural Development Programmes, 2000). Given the low inorganic fertilizer application rate, the farming households were unable to maintain or improve the maize production levels and yield. Most households (89%) used fertilizer mainly for the purpose of direct and immediate supply of needed plant nutrient to growing crops in the study area on an average farm size of 1.89 hectares and a Standard Deviation of 0.42832 This result revealed that fertilizer use was the most prevalent practice among the sampled farming households. The major herbicides used were atrazine, karate and Paraquate. The herbicide application rates was low (1.24litres) compared to recommended rate The mean level of application of the insecticides per hectare was 1.03 liters which is lower than the ADP recommended rate of between 3.0litres  $\text{ha}^{-1}$ . About 26% of the households used improved hybrid maize seed as a capital-intensive strategy on an average farm size of 0.87 hectares. The use of hybrid maize was more pronounced among households with requisite resources. The improved hybrid seed is a crop production intensification strategy used to improve the yields only when all agronomic aspects of planting, weeding and fertilizer application are strictly followed. The improved hybrid maize seed was not accompanied with the appropriate agronomic management practices that raise the yields by households in the study area (Table 3).

**Table 3: Land management practice, percentage use and farm size in maize production**

Input Use or Management Practice	Percentage of household use in maize-based production	Average Farm Size (ha)	Standard Deviation
Hybrid Maize	26.0	0.87	0.11045
Tractor Usage	09.0	2.31	0.19428
Minimum Tillage	87.0	1.05	0.45114
Cover Cropping	50.0	1.20	0.35071
Crop Rotation	23.4	0.65	0.38559
Organic Fertilization	22.0	1.29	0.44965
Mulching	05.0	0.57	
Intercropping	73.0	0.89	

Source: field survey 2011/2012

The labour-intensive strategies are most common since households in the study area were cash constrained. The household merely added labour in crop production, allowing more dense cropping, weeding and harvesting more intensively. Also due to land constraints, labour/land ratios are rising, and therefore households choose production methods that are as labour-intensive as possible to raise productivity. The households used two or more of the integrated soil management practices on their respective fields. Labour-intensive strategies were mainly soil management practices. These included uses of minimum tillage, crop rotation, cover cropping, animal manure application and mulching.

Minimum tillage was the second most prevalent land management practice after fertilizer use. About 87% of the sampled households practiced minimum tillage on an average farm size of 1.05 hectares. Other households that did not practice minimum tillage used animal traction and tractors to till the soil. Minimum tillage in the study area involved the

use of hoes to disturb the soil in the process of constructing mounds or heaps.

Cover cropping; the third most prevalent land management practices in the area was practiced by about 50% of the households on an average farm size of 1.20 hectares. The practice was more common among high than low intensity households. The major problem with cover cropping practice is the opportunity cost which the households consider to be very high. Crop rotation was the fourth most common land management practices among the sampled farming households. About 23.4 percent of the sampled respondents practiced crop rotation on an average farm size of 0.65 hectares. Organic fertilization was another land management practice used by 22 percent of the sampled households on an average farm size of 1.29 hectares. Animal manure was commonly used in the southern part of Niger State, although most households complained of its bulkiness and high cost of application. A few households left plant residue in the furrows to rot and strengthen the soil after their initial land cleaning operations. In most cases, households who planted cowpeas ploughed the vegetation part into the soil after harvest with the aim of improving soil fertility. Mulching was the least prevalent land management practice among the sampled households. The land-intensive strategies are commonly practiced on increasingly small land sizes in the area. Intercropping was practiced by about 73% of the households on an average farm size of 0.89 hectares. Intercropping has long been recognized as a common practice among subsistence farmers due to the flexibility of labour used and less risk. Mixed cropping has been shown to lead to better utilization of land, labour and capital. It also results in less variability in annual returns compared with mono cropping (Eneh et al. 1997).

**Levels of Crop Production Intensification of Maize-Based Farming Households.**

The crop production intensity scores among the farming households in the zone is presented in Table 4.

**Table 4: Levels of crop production intensification of farming households**

Category	No of household	Range	Min	Max	Mean	Variance	Kurtosis
High Intensity	064	24.00	14.50	38.50	27.47	16.51	0.461
Low Intensity	188	26.50	5.50	32.00	19.57	26.66	-0.296
All Households	252	33.00	5.50	38.50	23.13	37.36	-0.217

Source: Field Survey, 2011/2012

It ranged between 5.5 and 38.50 with a mean score of 23.13. This study therefore used the mean crop production intensity scores as the threshold value and as a basis for classifying the farming households into high and low intensity categories. The high intensity farming households had the maximum and mean crop intensity scores of 38.50 and 27.47 respectively, which were higher than those of the low intensity households.

The number of households that fall within each of the intensity category provides additional data with which to compare the farming households. Majority (74.6%) of the households belong to the low intensity category while the remaining 25.4% are high intensity households.

The kurtosis value for a normally distributed households equals three. The Kurtosis value of -0.296 and 0.461 suggests that the variability in crop intensity from one farming household to the next is higher among low intensity households than those of high intensity households. The negative Kurtosis value (-0.296) implies greater level of inter-household variation among low intensity households in terms of the land size and cropping strategy. In contrast, high intensity households are much more homogenous from a socio-economic and farming systems stand point.

### Maximum Likelihood Estimates (MLE) of Maize-Based Farming Households in SGS

#### Diagnostic Statistics

The estimate of the sigma-square ( $\delta^2$ ) is 0.3287. This is large and statistically significant at 1 percent (Table 5).

**Table 5: Maximum Likelihood Estimates of the Stochastic Frontier Production Function**

Variables	Parameters	Coefficients	t-values
<b>Physical inputs</b>			
Constant	$\beta_0$	0.4196	0.4669
Land (ha) ( $X_1$ )	$\beta_1$	-0.4183*	-1.9521
Labour (man-days) ( $X_2$ )	$\beta_2$	0.2126	0.1127
Seeds (Kg) ( $X_3$ )	$\beta_3$	-0.0840	-0.1006
Fertilizer (kg) ( $X_4$ )	$\beta_4$	0.8492** *	12.025
Agrochemical (litres) ( $X_5$ )	$\beta_5$	-0.1235**	-2.3236
<b>Inefficiency model</b>			
Constant term	$\delta_0$	0.1791	0.4246
Farm size ( $Z_1$ )	$\delta_2$	0.0492	0.4380
Farming	$\delta_2$	-0.0213**	-2.2706

Experience ( $Z_2$ )			
Household size ( $Z_3$ ) --	$\delta_3$	0.0535*	1.6754
Extension contact ( $Z_4$ )	$\delta_4$	-0.3592	-0.5524
Crop intensification ( $Z_5$ )	$\delta_5$	- 0.6277** *	-3.3689
Credit Access ( $Z_6$ )	$\delta_6$	-0.5295	-0.1489

#### Diagnostic statistics

Sigma square ( $\delta^2$ )	( $\delta u^2 + \delta v^2$ )	0.3287** *	3.9528
Gamma ( $\gamma$ )	( $\delta u^2 / \delta^2$ )	0.7789** *	7.9756
Lambda	( $\delta u / \delta v$ )	1.8767	
Log-likelihood function			-0.6356
$\delta u^2$	0.2560		
$\delta v^2$	0.0727		
$\Delta u$	0.5059		
$\Delta v$	0.2696		

Sample size **252**  
(n)

Source: Data analysis, 2011/2012

\*\*\* significant at 1%,

\*\* significant at 5%,

\* significant at 10%.

Lambda ( $\lambda$ ) estimated at 1.8767, which is greater than 1 indicates a good fit and the correctness of the specified distributional assumption of the composite error term (Tradesse and Krishnamoorthy (1997).

The variance ratio represented by gamma ( $\gamma$ ) is estimated as 77.89%. This suggests that systematic influences that are unexplained by the production function are the dominant sources of random error. That implies that the presence of technical inefficiency among the sampled maize based farming households heads explains about 80 percent variation

in error observed in the estimated stochastic production frontier. The generalized likelihood ratio is significant at 1 percent level suggesting the presence of the one sided error component. This implies that technical inefficiency is significant and a classical regression model of production function based on Ordinary Least Square (OLS) estimation techniques would be inadequate representation of the data. Thus, the results of the diagnostic stochastic confirm the relevance of the stochastic parametric production frontier and maximum likelihood estimator for the study.

The coefficient of fertilizer was positive and statistically significant at 1% level of probability. This implied that as the respondents increase the use of fertilizer, ceteris paribus, maize- based output increases. This implies that availability of fertilizer at affordable price generally determines the increase in land under maize production in any particular year in the zone. Thus areas cultivated to maize decrease as fertilizer subsidies are withdrawn. Similar results were obtained by Oluwatayo et al. (2008) and Oyewo et al. (2009); among Ekiti and Oyo states maize-based farming households respectively. Also, the coefficient of agro-chemical and land though negative, are statistically significant at 5% and 10% level of probability respectively. This suggests a situation of inappropriate (and hence, inefficient) use of these inputs in maize- based production systems in the study area.

#### **Determinants of Technical inefficiency of Maize-based Farming Households**

The coefficient of farming experience is negative and statistically significant at 5% level of probability (Table 5). This is expected because as household heads gain more experience in maize production, it is expected that their efficiency level will increase. Oyekale and Idesa (2009) reported similar findings among maize-based farming households in Rivers state, Nigeria. On the other hand, Oyewo et al. (2009) reported a positive and significant relationship between farming experience and technical inefficiency. This implies that maize farmers in Ogbomosho having more years of experience are relatively less technically efficient or more inefficient. The coefficient of crop production intensification is negative and statistically significant 1% level of confidence. This implies that household's level of technical inefficiency tends to decrease with increased maize production intensification. This is expected because with increased maize intensification households are expected to use more of fertilizers, hybrid seeds and land management practices which in turn enhance their technical efficiency.

The coefficient of household size is positive on the other hand but significant at 10% level of probability. This indicates that household's level of technical efficiency increases with reduced household sizes. This finding agrees with the work of Ebong et al. (2009) but is inconsistent with the findings of Ebong (2005) and Onyenweaku et al. (2005), which identified a positive relationship between household size and technical efficiency among crop farmers.

#### **CONCLUSION**

Within the limitation of the data availability, the study has been able to measure crop production intensification, estimate technical inefficiencies as well as identify the factors determining technical efficiencies among maize-based farming households in the SGS ecological zone of Nigeria. Technical efficiency index computed showed that sampled households under study were highly technically inefficient, with a mean efficiency ratio of 0.48. Therefore, our result indicated that great potential exists for the maize-based farming households to further increase output using the available inputs and technology. Among those factors that have significant impacts on technical efficiencies are household size, crop production intensification and farming experience. This outcome thus suggests that household size, farming experience and cropping intensification of households are vital variables to be considered when policy-makers deliberate on ways to reduce in-inefficiencies among maize-based farming households in the zone.

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