

GENDER DIFFERENTIALS IN TECHNICAL EFFICIENCY AMONG MAIZE FARMERS IN ESSIEN UDIM LOCAL GOVERNMENT AREA, NIGERIA.

J.B SIMONYAN, B.D UMOREN AND B.C OKOYE

Michael Okpara University of Agriculture, Department of Agricultural Economics. Umudike, Abia State.

E-mail: simonyanjudith67@yahoo.com

ABSTRACT

This study was designed to examine the relative technical efficiency and its determinants on gender basis in maize production in Essien Udim Local Government area of Akwa Ibom State of Nigeria. A multi-stage random sampling technique was used to select 100 maize farmers, (50 males and 50 females) from five out of eight clans in the Local Government Area. Data were collected using a well structured questionnaire and interview schedule administered on the respondents were analyzed using description tools and stochastic frontier production function. The estimated farm level technical efficiency for male and female farmers were 93 percent and 98 percent respectively. Results further indicated that the estimated production function revealed that farm size at 1 percent and quantity of fertilizer at 1 percent significantly influenced the maize production function for male farmers while farm size at 1 percent, labour at 5 percent, maize seeds at 10 percent and quantity of fertilizer at 10 percent significantly influenced that of the female farmers. Household size, extension contact, marital status, educational status, and credit access were found to be positively and significantly related to the technical efficiency of the male farmers while age, cooperative membership, and farm size were negatively but significantly related to their technical efficiency. For the female farmers, household size, credit access and farm size were positively significant while age and educational status were negative but significantly related to their technical efficiency. The results therefore call for policies aimed at encouraging the youths who are agile and young and experience to engage in maize production. Female farmers should be allowed access to farm land and other farm input and technologies for improved efficiency.

Keywords: *Gender Differentials, Technical Efficiency, Maize Farmers*

INTRODUCTION

The role of gender in agriculture cannot be overemphasized. The pervasiveness of gender stratification in the distribution of production resources, information and even access to appropriate technologies is an issue of great importance. According to Akanji (1991), gender of agricultural worker is significant not only to total subsistence food output in which they predominate but also to performance of cash cropland, mainly managed by men. Findings by FAO (2008) on women in Agriculture shows that women make up over half of the agriculture labour force yet they are frequently subjected to discrimination, poverty and hunger. Hjorts, 2005 also reported that compared to men, women especially those from small and marginal farming families perform over 60% of on-farm activities in sub-Saharan Africa and comprise a major driving force in the economic and social fabric of rural South Africa with major responsibilities in agricultural and non-agricultural business enterprises. The ability of women to obtain agricultural inputs is directly constrained by gender discrimination (Hughes, 2005).

According to Masterson (2007), the most important resource is land; others are education, credit and technical assistance. Recently, agricultural policies and programmes in Nigeria have focused on the ways of increasing the productivity of rural farmers through the development and transfer of appropriate technologies. However, the level of productivity of women is constraint because most agricultural technologies have being designed on the assumption that farm managers are men (Balakrishnan, 2004).

Empirical studies on farm household productivity outcomes by Okoye et al., 2009, Dimelu et al., 2009) have yielded evidence of inefficient allocation of resources and low productivity along gender lines and to the detriment of women.

Therefore, for effective transfer and adoption of technologies for increase food production in the rural areas, gender has become the most important determinant of the distribution of rights, resources and responsibilities among individuals, families and communities (Ironkwe et al., 2009).

In Ghana, it is estimated that if women and men had equal rights to land, and if women had equal access to fertilizer, profits per hectare would double (FAO, 2008).

Technical efficiency refers to the ability to produce the highest level of output with a given quantity of inputs (Onyenweaku and Nwaru, 2005). However, production system and efficiency in resources use in the farm determine the nature and amount of agricultural technologies that should be made available to the female farmers to enhance their productivity. Considering resource management at farm levels, Saito et al, 1994 reported that female farmers were equally as efficient as male farmers.

Although they argued that male farmers perform better only due to lower level of inputs use on female managing farms, and not necessarily due to any inherent superior managerial abilities in the males. Chukwuji and Oyaide 2005 also noted that there were differences in farm size, expenditure on labour and capital between men and women, with men employing more of each input than women. They admitted that the value of output net farm income per head and technical efficiency were not significantly different for men and women.

Maize is one of the cereal grain crops extensively cultivated in all the agro-ecological zone of South-Southern Nigeria. It is becoming an important grain crop worldwide not only in the wet savanna but also in the drier Sudan and Sahel savanna areas of tropical Africa (Mani et al, 2009). This is possible due to the development of early maturing varieties, which are resistant to pests and diseases in addition to being drought tolerant. Maize ranked third after wheat and rice in the world production of cereal crops (Onwueme and Sinha, 1991).

Rahman and Lawal (2003) reported a significant increase in maize production in Nigeria, mainly due to rapid increase in population, feed for livestock and poultry and industrial raw materials.

The dearth of disaggregated data on actual gender responsibility and efficiency in agricultural production is a big challenge to meaningful agricultural and development planning in most developing countries. The records in the agricultural extension usually works with the whole farm families since every member of the family is engaged in one way or the other in food production activities without necessarily comparing the contributions of each member. There is therefore need to identify the areas of gender involvement and role of each member of the farm family in order to plan holistic agricultural programme that will address the problem of gender differentials in agricultural production for food sufficiency. The study therefore determined the level of technical efficiency of maize farmers in the study area as it relates with their gender. It also determined factors that influenced production efficiency of maize farmers in the study area.

Research Hypotheses

1. Household size, educational status, farming experience, land ownership and extension contact are positively related to the technical efficiency of male farmers while age and farm size are negatively related to their technical efficiency.
2. Marital status, educational status, farming experience and farm size is positively related to the technical efficiency of female farmers while age and household size are negatively related to their technical efficiency.

METHODOLOGY

The study was conducted in Essien Udim Local Government Area of Akwa Ibom State of Nigeria. Farming is the major occupation of the majority of the people in the locality. The study employed multi-stage sampling technique involving a purposive selection of five out of the eight clans that constituted the study area because majority of people in these selected clans are particularly engaged in maize production as their livelihood activity. Thus a total of one hundred maize farmers were utilized for detailed study.

Data was collected using a well structured questionnaire and interview schedule administered on the respondents. Data collections covered one production cycle and include input-output data as labour, farm size, planting material, capital, maize output as well as socio-economic characteristics of respondent.

Data collected were analyzed with the aid of the stochastic frontier production function developed independently by Aigner Lovell and Broeck 1977 and Meeusen and Vanden Broeck 1977 which is implicitly defined as

$$Y_i = f(X_i, B_i) \exp(V_i - U_i), i=1, 2, n \dots\dots\dots 1$$

Where

Y_i is the output of the i th farmer,

X_i is the vector of input quantities used by the i th farmer;

B_i is the vector of unknown parameters to be estimated,

$f(.)$ represents an appropriate function

V_i is a symmetric error, which accounts for random variations in output due to factors beyond the control of the farmer,

U_i is a non negative random variable representing inefficiency in production relative to the stochastic frontier.

Specifically, the production technology (Technical efficiency) of maize farmers in Essien Udim was estimated using the Cobb Douglas functional form of the stochastic frontier production function model defined as follows:-

$$\ln Y_i = B_0 + B_1 \ln X_1 + B_2 \ln X_2 + B_3 \ln X_3 \dots B_6 \ln X_6 + V_i - U_i \dots\dots\dots$$

Where

Y_i = maize output in kilogram,

X_1 = farm size in hectare

X_2 = labour input in mandays

X_3 = maize seeds in kilogram,

X_4 = quantity of fertilizer in kilogram,

X_5 = capital input in naira measured in terms of depreciation of farm tools and equipment, interest on borrowed capital, repairs and rent on land;

$B_0, B_1, B_2, B_3, B_4, B_5, B_6$ are the regression parameters to be estimated.

V_i and U_i are as defined in equation (1)

The determinants of technical efficiency of maize farmers were estimated jointly with equation (2) in a single stage maximum likelihood estimation procedure using computer software frontier version 4.1 (coelli, 1996).

$$TE = Y^*$$

$$Y^* = f(V, B) \exp(V_i - U_i) \dots\dots\dots 3$$

$$\text{But } f(X, B) \exp(V_i) = \exp(-U_i) \dots\dots\dots 4$$

Where

Y_i is the observed output

Y^* is the frontier output

$$TE = a_0 + a_1 Z_1 + a_2 Z_2 + a_3 Z_3 \dots\dots\dots a_{10} Z_{10} \dots\dots\dots 5$$

Where

TE is the technical efficiency of the *i*th farmer

Z₁ is land ownership, a dummy variable which takes the value of unity for market based (inheritance, mortgaged) and zero for non market based (lease, communal),

Z₂ is household size,

Z₃ is membership of cooperative, a dummy variable which takes the value of unity for member and zero for non member,

Z₄ is extension visit, in number,

Z₅ is age in years,

Z₆ is marital status, a dummy variable which takes the value of unity for married and zero for unmarried,

Z₇ is educational status in years

Z₈ is credit access, a dummy variable which takes the value of unity for access and zero for non access,

Z₉ is farming experience in years,

Z₁₀ is farm size in hectare,

a₀ is intercept

a₁a₁₀ are parameters to be estimated.

The coefficient of age was expected to be negative and those for the other variables positive.

RESULT AND DISCUSSION

Estimated Production Function for Maize Farmers

The results in Table 4.1 show the Maximum Likelihood Estimates (MLE) of the stochastic frontier for male and female maize farmers in the study area. As indicated in the Table, the estimated variance (σ^2) was significant at 1 percent level of probability for both male and female farmers indicating goodness of fit and correctness of the specified distribution assumption of the composite error terms.

Table 1: Maximum Likelihood Estimate of Production Efficiency between Male and Female Maize Farmers.

Variables	Parameters	Estimate male	Estimate female
Constant X ₀	b ₀	3.4674(94.7174***)	3.2850(47.6085***)
Farm size X ₁	B ₁	2.0127(159.3358***)	1.9525(92.3151***)
Labour X ₂	B ₂	-0.00132(-0.1181)	0.0616(2.5182**)
Maize seeds X ₃	B ₃	-0.0013(-0.1437)	-0.0179(-0.0187*)
Quantity of fertilizer X ₄	B ₄	2.1259(3.2490***)	0.0192(2.2919*)
Capital input X ₅ Elasticity	B ₅	14.2895(0.5674)	0.0048(-1.3944)

Source: field survey, 2010 ***, **, * significant at 1%, 5% and 10% respectively

The estimated values of the gamma (γ) were significant at 1 percent for male farmers and the coefficients for gamma were 0.99 and 0.14 for male and female farmers respectively implying that 99 percent and 14 percent variability in maize output for the male and female farmers respectively was due to technical inefficiency.

The coefficients for farm size have the desired positive signs and were highly significant at 1 percent level of probability for male and female farmers. The coefficients for quantity of fertilizer were also positive and significant at 1 percent and 5 percent levels of probability for the male and female farmers respectively. This follows the findings of Onyenweaku and Okoye (2007) in their study on cocoyam in Anambra State, Nigeria. The coefficient for labour was positively and significantly related to maize output at 5 percent level of

probability for female farmers and quantity of fertilizer was also positive and significant at 10 percent level of probability while capital input was not significant even at 10 percent level of probability.

Determinants of Technical Efficiency

The result of estimated determinants of technical efficiency in maize production by gender is shown in Table 2. As shown in the Table, the coefficients of household size were positively and significantly related to technical efficiency at 1 percent and 10 percent level of probability for the male and female farmers respectively. This implies that large household size is a source of labour for most farm operations (Dimelu *et al.*, 2009). The coefficient for cooperative membership was negative and significant at 1 percent level of probability for the male farmers. This is contrary to a priori expectation probably because the male farmers regard membership as a “public good” and not a “social good” where they fraternize not necessarily for production motives.

Table 2: Estimated Determinants of Technical Efficiency by Gender in Maize Production

Variables	Parameters	Estimate male	Estimate female
Constant Z_0	a_0	-0.8404(-2.6762**)	0.0106(0.4584)
Land ownership Z_1	a_1	0.1456(1.4620)	-0.0097(-1.2918)
Household size Z_2	a_2	0.1052(8.6917***)	0.0052(2.4834*)
Cooperative membership Z_3	a_3	-0.7743(-0.0017***)	-0.0155(1.6178)
Extension contact Z_4	a_4	0.1544(9.0076***)	0.0005(-0.1071)
Age Z_5	a_5	-0.0077(-0.0347***)	00.0020(-4.2652***)
Marital status Z_6	a_6	0.0758(2.1030**)	-0.0036(-0.4679)
Educational status Z_7	a_7	0.0131(4.2851***)	-0.0413(-3.954***)
Credit access Z_8	a_8	0.3776(7.7232***)	0.0073(8.7874***)
Farming experience Z_9	a_9	-0.0004(-0.1042)	0.0004(0.5965)
Farm size Z_{10}	a_{10}	-0.0136(-0.0597***)	0.0009(2.7844***)
Sigma squared	σ^2	0.1821(5.2756***)	0.2708(4.1087***)
Gamma	γ	0.9980(826.3508***)	0.1410(9.3125)
LR	LR	176.8739	11.0818

Source: field survey, 2010 ***, **, * significant at 1%, 5% and 10% respectively

The coefficient for extension contact was positive and significant at 1 percent level of probability for the male farmers. This implies that increase in extension contact is expected to increase technical efficiency. This is an indication that knowledge and orientation on maize technologies from extension contact have strong influence on technical efficiency, following Dimelu *et al.*, 2009. The coefficients for farmers' age were negatively related to technical efficiency and significant at 1 percent level of probability for the male and female farmers. This implies that younger farmers are technically efficient than their aged counterparts. This follows Okoye *et al.*, 2007 who found out that ageing farmers would be less energetic to work.

The coefficient for marital status was positive and significant at 5 percent level of probability for the male farmers. This implies that male farmers who were married were more efficient than those who were single. The coefficients for educational status were positive and negative for the male and female farmers respectively and significant at 1 percent levels of probability. This implies that increased education led to increased technical efficiency for the male farmers but a decrease for female farmers. Education might be regarded as a factor for increased efficiency among the male farmers (Dimelu *et al.* 2009, Simonyan, 2010). While for the females, it suggests the strong competing effect of diverting skills to other off-farm employment opportunities as the level of education increases. The coefficients for credit access were positive and significant at 1 percent level of

probability for the male and female farmers. This implies that credit access leads to increased technical efficiency. This is in agreement with a priori expectation.

The coefficients for farm size were negative and positive for the male and female farmers respectively and were significant at 1 percent. This agrees with Hazarika and Subramanien (1999) for the female farmers who found out that if the farm size is small, they are able to combine their resources better.

Distribution of Technical Efficiency According to Gender

The frequency distribution of technical efficiency in maize production by gender are shown in Table 3

Table 3: Frequency Distribution of Technical Efficiency Estimate According To Gender

Efficiency	Male freq	Percentage	Female freq	Percentage
<0.80	1	2.0	-	-
0.81-0.85	-	-	-	-
0.86-0.90	4.0	8.0	-	-
0.91-0.95	2	4.0	2	4.0
>0.95	43	86.0	49	96.0
Total	50	100	50	100
Maximum		99		99
Minimum		44		95
Mean		93		98

Source: Field survey, 2010

The technical efficiency estimates presented indicate that 10 percent of the male farmers operated below 91 percent while about 4 percent of male and female farmers operated within 91 – 95 percent efficiency.

A large percentage of 86 and 96 percent of the male and female farmers respectively operated above 95 percent efficiency. The individual technical efficiency index is 93% for male and 98% for female. The high level of technical efficiency obtained with respect to female in the study area is consistent with low variance of farm effect. This finding is consistent with that of Nwaru (2003) who reported that mean technical efficiency for the female farmers was significantly higher than the male farmers in arable crop production in Abia State of Nigeria.

CONCLUSION

The results of this study reveal that technical efficiency in maize production in Essien Udim L.G.A of Akwa Ibom State, Nigeria across gender is relatively low for male farmers. Although the average female farmer is technically more efficient than her male counterpart, maximum technical efficiency was not achieved by both farmers' categories. This suggests that opportunities still exist for increasing productivity of maize farmers in the study area by increasing the efficiency with which resources are used at the farm level.

However, household size, extension contact, educational status and credit access are directly related to the technical efficiency of the male farmers while farm size is directly related to the technical efficiency of the female farmers. Age is an important factor and it is significant to the technical efficiency of both sexes. The mean technical efficiency for the female farmers is significantly higher than males.

RECOMMENDATION

- 1) Since the study revealed that an increase in the age of the farmer groups would lead to decline in their technical efficiency, policies that would focus on ways of attracting and encouraging the youths who are agile and stronger to embark on maize production will help to increase technical efficiency and productivity.
- 2) Policies aimed at improving the female farmers' access to land and other farm input will be useful in increasing the efficiency which in turn will increase the level of food sufficiency among Nigerians
- 3) Those who are experienced should also be encouraged to remain on the production process.

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