

Gender inequalities in Efficiency among Cassava farmers

GENDER INEQUALITIES IN TECHNICAL EFFICIENCY AMONG SMALL-HOLDER CASSAVA FARMERS IN ENUGU STATE, NIGERIA.

IRONKWE, A.G., G. N. ASUMUGHA, K.C. EKWE AND A.C., OKOYE

National Root Crops Research Institute, Umudike, P.M.B 7006 Umuahia Abia State, Nigeria.
adanmaglory@yahoo.co.uk

ABSTRACT

This study was designed to examine the relative technical efficiency and its determinants on gender basis in cassava production in Enugu state, Nigeria. A multi-stage random sampling technique was used to select 180 cassava farmers (90 males and 90 females) from two out of three agricultural zones in the state. Interview schedules were used in data collection. Data were analysed using descriptive tools and Stochastic Frontier Production Function. The estimated farm level technical efficiency for male and female farmers were 89% and 53% respectively. Result further indicated that the estimated production function revealed that farm size 1%, labour 5%, cassava bundles 1% and quantity of fertilizer 5% significantly influenced the cassava production function for male farmers while farm size 1%, labour 1%, quantity of fertilizer 1% and capital input 1% significantly influenced that of the female. Household size, educational status, farming experience, land ownership and extension contact were found to be positively and significantly related to the technical efficiency of the male farmers while age and farm size were negatively but significantly related to their technical efficiency. For the female farmers, marital statuses, educational status, farming experience and farm size were positively significant while age and household size were negative but significantly related to their technical efficiency. The results therefore call for policies aimed at encouraging the youths who are agile and younger on experience to cultivate cassava The education is also important especially for girl-child.

KEYWORDS: Technical efficiency, Gender, inequalities and Cassava Small-holders.

INTRODUCTION

Cassava is an indispensable staple food for 500 million people in tropical Africa. It possesses special attributes, which include ability to make returns of root yield even at extreme stress condition (Ekwe *et al*, 2008). The crop is also suitable to various farming system, available all year round as well as produces efficient food energy (Beeching *et al*, 2000). Nigeria in the world's largest producer of cassava, with about 45.75 million metric tonnes annually and ranks and after yam in extent of production among the root and tuber crops of economic value in Nigeria (FAO, 2007).

Over the years, agricultural policies and programmes in Nigeria have focused on the ways of increasing the productivity of rural farmers through development and transfer of appropriate technologies. There is a wide body of literature focusing in the impacts of gender discrimination in women's access to recourses in general and to inputs into agricultural production. The most important resource is land; others one' education, credit and technical assistance (Masterson, 2007). Women's ability to obtain agricultural inputs is also directly constrained by gender discrimination. Women have limited access to improved production resources and new technologies (Aye *et al*; 2006). Also empirical studies of farm household out comes have yielded evidence of inefficient allocation of resources along gender lines, and to the detriment of women (Okoye *et al*; 2009 and Dimelu *et al*; 2009). This situation has been attributed to gender insensitivity of technology development and transfer systems (Balakrishnan, 2004). It has been reported that despite the significant roles of female farmers in the third world, their level of productivity is constrained because agricultural technologies has been designed on the assumption that farm managers are men (Saito and Spurling, 1992). Furthermore, most policies aimed at making agro-technological inputs accessible to female farmers in Nigeria were actually directed towards men (Nweke, 1994). Consequently, women have limited access to improved production resources and new technologies (Aye *et al*, 2006). Therefore, gender becomes the most

important determinant of the distribution of rights, resources and responsibilities among individuals, families and communities. All these could affect ways technologies are being transferred and adopted to increase food production in the rural areas.

Studies addressing gender inequalities in production itself include attempts to measure both differences between men and women, and the costs gender related inefficiencies in agricultural production (Masterson, 2007). Attempts to quantify differences between men and women have employed various measures of farming ability; land productivity (Lastarria-Corliel, 1988).labour productivity (Okoye *et al*; 2008) and Gender productivity (Okoye *et al*; 2009). Aye *et al* (2006) further admitted that efficiency of resource use is the key to effectively addressing the challenges of achieving food security and poverty alleviation. In the other hand, managerial efficiency, which is the ability to use farm resources (land, labour and capital) efficiently, is also relevant in the process. This is measured in terms of the way resource are converted into returns (Mbah, 2006).

Considering resource management at farm levels, Saito *et al* (1994) reported that female farmers were equally as efficient as male farmers. However, they argued that male farmers perform better only due to lower level of input use on female manage farms, and not necessarily due to any inherent superior managerial abilities in the males. Chukwuji, and Oyaide (2005) also nodded 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. Nwaru (2007) 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.

However, since production system and efficiency in resource use in the farm determine the nature and amount of agricultural technologies that should be made available to these farmer categories to enhance their productivity, this study was therefore, designed to examine the relative technical efficiency and their determinants on gender basis in cassava production in the state. Technical efficiency here refers to the ability to produce the highest level of output with a given bundle of resources (ability to produce on the production frontier) (Onyenweaku and Nwaru, 2005). It is usually derived by the ratio of total output to total input. For an efficient farmer, this ratio is unity (Nwaru, 2007).

METHODOLOGY

This study was conducted in Enugu State, Nigeria. It is one of the major cassava producing areas in South Eastern Nigeria where the role of women in food production has been conspicuous (Nwaru, 2007). Multi-stage random sampling technique was used for the study. In the first stage, two out of three agricultural zones in the state were randomly selected. In the second stage, two out of six blocks in each of the selected zones were randomly chosen. In the third stage, two out of four functional circles in each of the selected blocks were randomly selected. Finally, twenty (20) farmers (10 males and 10 females) were randomly selected from a list of men and women cassava farmers from the extension agents in charge of the circles. Thus, a total of 160 cassava farmers were chosen for detailed study.

Interview schedules were used to elicit information from the respondents on labour, farm size, agro-chemicals, planting material, other input used, output and capital. Others were farmer's socio-economic characteristics. Technical efficiency was analysed with the aid of the stochastic frontier production function developed independently by Aigner, Lovell and Schmidt (1977) and Meeusen and Van den Broeck (1977) and is defined by:

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

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 a vector of unknown parameters to be estimated, $f(\cdot)$ represents an appropriate function (eg. Cobb Douglas, Trans log, etc). V_i is a symmetric error, which accounts for random variations in output due to factors beyond the control of the farmer while U_i is a non negative random variable representing inefficiency in production relative to the

Gender inequalities in Efficiency among Cassava farmers

stochastic frontier. For this study, the production technology of farmers in Enugu state, Nigeria was specified by the Cobb Douglas frontier production function defined as follows.

$$\ln Y = \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \dots + \beta_6 \ln X_6 + V_1 U_1 \dots \dots (2)$$

Where:

- Y_i is cassava output in kilogram, X_i is farm size in hectare,
- X₂ is labour input in mandays,
- X₃ is cassava bundles in kilogram,
- X₄ is quantity of fertilizer in kilogram,
- X₅ is capital input in naira measured in term of depreciation of farm tools and

equipment, interest on borrowed capital, repairs and rent on land, b₀, b₁, b₂, b₃, b₄, b₅, b₆ are the regression parameters to be estimated while

V₁ and U₁ are as define in equation (1).

In order to determine the factors contributing to the observed technical efficiency, the following model was formulated and estimated jointly with equation (2) in a single stage maximum likelihood estimation procedure using Computer Software Frontier Version 4.1 (Coelli, 1996).

$$\begin{aligned} TE &= Y; \\ Y_i^* &= f(V; \beta) \exp(V_i - U_i) \\ &= f(X; \beta) \exp(V_i) \\ &= \exp(-U_i) \dots \dots \dots (2) \end{aligned}$$

Where Y_i is the observed output and Y_i^{*} is the frontier output. For this study, the production technology of the cassava farmers in Enugu State is assumed to be specified by the cobb-Douglas production function defined as follows.

$$\ln Y = \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln V_2 + \dots + \beta_6 \ln V_6 + V_i U_i \dots \dots (2)$$

$$TE = a_0 + a_1 Z_1 + a_2 Z_2 + a_3 Z_3 + \dots + a_{10} Z_{10} \dots \dots (3)$$

Where TE_i is the technical efficiency of the i-th farmer, Z_i is land ownership a dummy variable which take 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 unity for member and zero non-member, Z₄ is extension visits a ln number, Z₅ is age in years, Z₆ is marital status, a dummy variable which takes the value of unity for married and zero otherwise Z₇ is educational status in years, Z₈ is credit access a dummy variable which takes value of unity for access and zero for non-access, Z₉ is farming experience in years and Z₁₀ is farm size in hectare, a₀ is intercept and a₁ a₁₀ are parameters estimated.

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

RESULTS AND DISCUSSION

The results of the estimated production function for cassava of the sampled farmers by gender are presented in Table 1. The table shows that the constants were significant at 1% for both male and female farmers. The estimated variance (σ²) was also significant at 1% for both farmer groups indicating goodness of fit and correctness of the specified distribution assumption of the composite error terms. The estimated values of the gamma (γ) were highly significant at 1% for females but at 10% for male farmers. The coefficients for gamma were 0.498 and 0.984 for the male and female farmers respectively, implying that 49.8%, and 98.4% of the total variation in cassava output for male and female farmers respectively was due to technical inefficiency.

The table also shows that for the male farmers, the coefficient for farm size (p = 1.0%), labour (p = 5%), cassava bundles (p = 1%) and quantity of fertilizer (p = 5%) were significant and positive according to a priori

expectations while capital input and other inputs were not significant even at $p = 10\%$. For the female farmers, farm size ($p = 01\%$), quantity of fertilizer ($p = 01\%$) and capital input ($p = 10\%$) were positive and significant whereas cassava bundled was not significant even at $p = 10\%$. However, the coefficient for labour was significant but negative for the female farmers, implying that this input was used beyond the point where its marginal value product equated its unit price. This result agrees with the report of Nwaru, (2007) who reported negative coefficient for labour for female farmers in arable crops production in Abia State, Nigeria.

The significant and positive coefficient for land and fertilizer for both the male and female farmers are expected and agree with Ohajianya and Onyenweaku (2001), Nwaru (2003 and 2004) and Nwaru (2007). The use of more land and fertilizer is expected to lead to greater output of cassava

Table 1: Estimated production function for cassava production by gender in Enugu state

Variables	Parameter	Estimate Male	Estimate Female
Constant X_0	β_0	7.776 (2.706***)	10.853 (21.119***)
Farm size X_1	β_1	0.213 (2.998***)	0.3804 (4.165***)
Labour X_2	β_2	0.081 (2.206**)	-0.89 (-1.895*)
Cassava bundle X_3	β_3	0.615 (2.967***)	0.023 (0.298)
Quantity of fertilizer X_4	β_4	0.041 (2.615**)	0.133 (3.273***)
Capital input X_5	β_5	-0.037 (-0.037)	0.154 (1.689*)
Other input X_6	β_6	-0.054 (-0.983)	-0.083 (-1.501)
Sigma	$\frac{\sigma^2}{6}$	0.445 (4.516***)	15.348 (5.304***)
Gamma	γ		

Source: Field Survey 2006

Figures in parentheses are t-ratios; ***, **, and * are significant levels at 1%, 5% and 10% respectively.

The results of estimated determinants of technical efficiency in cassava production by gender in Enugu state, Nigeria are presented in Table 2. The coefficient for land ownership for the male farmers is positive and significant at 1% level while that of the females though positive but not significant. The coefficients for household size for the two farmer groups presented mixed results. For the male farmers it is positive and significant at 1%, which is consistent with *a priori* expectations because according to Onyenweaku and Nwaru (2005), large household size eased labour constraints thereby leading to increases in productivity and income of the farm household. For the female farmers, the coefficient of household size is negative and significant at 1%, which is contrary to *a priori* expectations and suggesting that larger households might have utilized household labour beyond the point where the marginal value product of labour was equal to the wage rate (Nwaru, 2007).

The coefficient for extension visit is positive and significant at 1% level for male farmers these agrees with *a priori* expectations that those who have more contact with extension agents have more access to agricultural information, credit and other production inputs as well as more enhanced ability to increase their productivities. However, for the females, the extension contact though not significant but is positive.

The coefficients of age for both farmer groups are negative and significant at 1% implying that age is inversely related to technical efficiency. This result is consistent with *a priori* expectations that the older farmers are less technically efficient than the younger ones. This is because the older farmers are less likely to have contacts with extension agents and are less willing to adopt new technologies to improve their productivities (Hussain, 1989). The result agrees with those of Okike (2000) for crop and livestock farmers in the savannah zones of Nigeria, Onu *et al* (2000) for cotton farmers in Nigeria, Nwaru (2004) for arable crop farmers in Imo State of

Gender inequalities in Efficiency among Cassava farmers

Nigeria and Onyenweaku and Nwaru (2005) for food crop farmers in Imo State of Nigeria; Nwaru (2004). However, it was not consistent with Nwaru (2007); Onyenweaku and Nwaru (2005).

The coefficient of marital status for male farmers is not significant but positive and significant at 1% level for female farmers. The coefficients of farming experience are positive and significant at 1% for both male and female farmers indicating that these variables are directly related to technical efficiency and are in consonance with *a priori* expectation that farmers with more farming experience are more technically efficient. This result agrees with those of Onyenweaku and Nwaru (2005); Nwaru (2007); Nwaru (2004); Onyenweaku *et al*, (2004); Onyenweaku and Ohajianya (2005). However, the result differs from that of Onu *et al* (2000) who reported negative relationship between technically efficiency and farming experience.

The coefficients for farm size for both farm groups have mixed results. For the male farmers, it was negative and significant at 1% indicating inverse relationship with technical efficiency. For female farmers, the coefficient for farm size was positive and significant at 1% level indicating direct relationship with technical efficiency; this result is in consonance with *a priori* expectations that larger farmers are more technically efficient than small ones and agrees with Onyenweaku and Nwaru (2005).

Table 2: Estimated Determinants of Technical Efficiency by gender in cassava production.

Variables	Parameter	Estimate male	Estimate female
Constant (Z_0)	a_0	3.004 (4.738***)	9.027 (2.135***)
Landownership (Z_1)	a_1	0.005 (2.744***)	0.092 (0.089)
Household size (Z_2)	a_2	0.011 (2.409***)	-2.328 (-3.000***)
Membership of corporative (Z_3)	a_3	-0.036 (-1.339)	-5.368 (-1.567)
Extension contact (Z_4)	a_4	0.072 (2.513***)	1.372 (0.947)
Age (Z_5)	a_5	-0.218 (-2.160***)	-0.665 (-4478***)
Marital status (Z_6)	a_6	0.173 (0.421)	8.954 (3.006***)
Educational status (Z_7)	a_7	0.811 (1.927)	0.526 (2.77***)
Credit access (Z_8)	a_8	-0.316 (-0.432)	-0.904 (-1.299)
Farming exp (Z_9)	a_9	0.316 (4.319***)	0.414 (2.541***)
Farm size (Z_{10})	a_{10}	-0.025 (-2.350*)	0.039 (2.583**)

Sources: field Survey 2006

Figures in parameter are t-ratios; ***, **, and * are significant levels at 1%, 5% and 10% respectively.

Table 3 shows the results of the elasticity and returns to scale for cassava production of farmers by gender. The regression coefficients in the Cobb-Douglas production function are the production elasticities and their sums indicate the returns to scale (Hazarika and Subramanian, 1999). The Table shows that cassava bundle and farm size has the highest elasticity of production for the males and females farm respectively. This implies that they contributed the most to farm returns when compared with the other inputs in each case. The sum of output elasticity (returns to scale) on male and female farms were 0.86 and 0.52 respectively. This indicates decreasing returns to scale in both cases.

However, the elasticity for the males was higher than the females. The mean technical efficiencies of both the male and female farmers, the table shows that the males (89%) counterparts were more technically efficient than the females (53%).

Table 3: Elasticity and Returns to Scale for Cassava Production of Farmers by Gender in Enugu State.

Variables	Elasticity Male	Elasticity Female
Farm size	0.213	0.380
Labour	0.081	-0.089
Cassava bundles	0.615	0.023
Quantity of fertilizer	0.041	0.133
Capital input	-0.037	0.154
Other input	-0.054	-0.083
Sum elasticities	0.859	0.518
Mean Technical Efficiency	0.89	0.53

CONCLUSION

The results of this study reveal that technical efficiency in cassava production Enugu state across gender is relatively low for the female farmers. Although the average male farmer is technically more efficient than his female counterpart, maximum technical efficiency was not achieved by both farmer categories. Thus suggests that opportunities still exist for increasing productivity of cassava farmers in the State by increasing the efficiency with which resources are used at the farm level.

Important factors directly related to technical efficiency were age and farming experience for both sexes. However, land ownership, household size and extension contacts are directly related to technical efficiency of the male farmers while farm size is directly related to the technical efficiency of the females. Therefore, policies aimed at improving the women farmers' access to land, extension contact and education will be useful in increasing their technical efficiency. 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 cassava production, will help to increase technical efficiency and productivity. Those who are experienced should also be encouraged to remain in the production process. Policies also call for education especially to the girl-child while women's access to production input and relevant technologies should be increased to enhance their technical efficiency and productivity in the study area.

REFERENCE

- Aiger, D; C.A.K. Lovell and P. Schmitt (1977). Formulation and estimation of stochastic production models. *Journal of Econometrics* 6 (1): 21-37.
- Aye, G.C., V.U. Oboh and C.K. Biam (2006). Resource use efficiency in cassava production among women farmers in Makurdi Local Government Area of Benue State. *Proceeding of the 40th Annual Conference of the Agricultural Society of Nigeria (ASN) held at NRCRI, Umudike, Abia State, Nigeria October 16th 20th. Pp 137 140*
- Balakhirshman, R. (2004). Widening gaps in technology development and technology transfer to support rural women. Hills Lease held Forestry and for age Development Project Nepal (GCP MEP / 052 NET).
- Beeching, J.R.T. Niger and J.Tohmen. (2000). Post harvest physiological deterioration of cassava. *Proceedings of 12th Symposium of International Society of Tropical Root Crops* held in Tsukuba, Japan, September 10th to 16th.

Gender inequalities in Efficiency among Cassava farmers

- Chukwuji, C.O and W.J. Oyaide (2005). Gender analysis of crop production in Delta State Nigeria. In: Ogisi, O.D., Okuneye, P.B. and Oyaide, W.J. (eds.). Economic Reforms and Management of Nigerian Agriculture. *Proceedings of the 19th Annual Conference of the farm Management Association of Nigeria* held at Delta State University, Asaba Campus, Delta State, Nigeria, 18-20 October, pp. 227-236.
- Coeli, T.J. (1996). A guide to Frontier Version 4.1: A Computer Programme for Stochastic Frontier Production and Cost Function Estimation. Department of Economics. University of New England, Armidale, Australia.
- Dimelu, M.U., Okoye, A.C., Okoye, B.C., Agwu, A.E., Aniedu, O.C. and Akinpelu, A.O (2009). Determinants of Gender Efficiency of Small-Holder Cocoyam Farmers in Nsukka Agriculture Zone of Enugu State. Scientific Research and Essay. *Academic Journals*. 4 (1): 28-32.
- Ekop, M.O. (2001). Gender Implication for Sustainable Technology Adoption. In: Akoroda, M.O. and Ngeve, J.M. (eds). Root Crop in the 21st Century. *Proceedings of the 7th Triennial Symposium of International Society for Tropical Root Crops Africa Branch (ISTRC-AB)* 11th - 17th October, 1998.
- Ekwe, K.C., I. Nwachukwu and C.C., Ekwe (2008). Determinants of Improved garri processing technologies utilization and marketing profile among rural household in Southeastern Nigeria. *Nigerian Journal of Rural Sociology* 8 (1) 1-8.
- FAO, (2007) Food and Agricultural Organization Statistics Division, <http://Faostat.Org>.
- Hazarika, C. and S.R. Subramanian (1999). Estimation of Technical Efficiency in the Stochastic Frontier production Function Model. An Application to the Tea Industry in Assam.
- Hussain, S.S. (1989). Analysis of economic efficiency in Northern Pakistan. Ph. D. Dissertation, University of Illinois, U.S.A.
- Mbah, S.O. (2006). Resource management for rice production in Ishiagu, Local Government Area of Ebonyi State. Repositioning Agriculture for sustainable Millennium Development Goals in Nigeria. *Proceeding of the 40th Annual Conference of the Agricultural Society of Nigeria (ASN)* held at NRCRI, Umudike Abia State Nigeria October 16th - 20th 2006. Pp. 141-144.
- Masterson, T.(2007). "Productivity, Technical Efficiency and Farm Size in Parapuayan Agriculture". The Levy Economics Institute of Bard College. Working Paper No. 490.
- Nwaru, J.C. (2003). Gender and relative production efficiency in food crop farming in Abia State Nigeria. *The Nigeria Agricultural Journal* 34: 1-10.
- Nwaru, J.C. (2004). Rural credit market and resource use in arable crop production in Imo State of Nigeria. Ph.D. Dissertation. Department of Agricultural Economics Michael Okpara University of Agriculture, Umudike, Umuahia.
- Nwaru, J.C. (2007). Gender and Relative technical Efficiency in Small holder Arable Crop Production in Abia State of Nigeria. *International journal of Agriculture and Rural Development*, 10 (2): 25-34.

Ironkwe, A.G., G. N. Asumugha, K.C. Ekwe and A.C., Okoye

- Nweke, A.N. (1994). Role of Women in Agricultural Production Awka Education Zone of Anambra State. Implication for Adult Education in Agriculture. University of Nigeria. Nsukka, Nigeria. M.Ed. Dissertation.
- Onyenweaku, C.E. and Nwaru, J.C. (2005). Application of a stochastic frontier production function to the measurement of technical efficiency in food crop production in Imo State of Nigeria. *The Nigerian Agricultural Journal* 36: 1 - 12.
- Onyenweaku, C.E. and Ohajianya, D.O. (2005). Technical efficiency of swamp and upland rice farmers in South Eastern Nigeria. *Journal of Sustainable Tropical Agricultural Research* 14: 64-70.
- Okoye, B.C., Okoye, A.C., Asumugha, G.N, Dimelu, M.U, and Agbaeze, C.C. (2009). Determinants of Gender Productivity Among Small-Holder Cocoyam Farmers in Nsukka Agricultural Zone of Enugu State, Nigeria. *Nigerian Journal of Rural Sociology* (In Press) Vol. 9 (1).
- Ohajianya, D.O. and C.E. Onyenweaku (2001). Gender and relative efficiency in rice production in Ebonyi State of Nigeria. *Nigerian Journal of Agriculture and Sustainable Environment*. 3 (2): 384-392.
- Okike I. (2000). Crop livestock interactions and economic efficiency in the savannah zones of Nigeria. Ph.D. Dissertation. Department of Agricultural Economics, University of Ibadan, Ibadan, Nigeria, 155pp.
- Onu, J.K., Amaza P.S., and Okunmadewa, F.Y. (2000). Determinants of cotton production and economic efficiency. *African Journal of Business and Economic Research* 1 (1): 234-240.
- Saito, K.A. and D. Spurling (1992). Developing Agricultural Extension for Women Farmer *World Bank Discussion Paper* No. 156. Washington, D.C. USA.
- Saito, K.A., H. Mekonnen and D. Spurling (1994). Raising the productivity of women farmers in Sub-Saharan Africa. *World Bank Discussion Paper* No. 230. Africa technical Department Series. Pp. 20-28.