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GENDER AND RESOURCE USE EFFICIENCY AMONG SMALL-HOLDER CASSAVA FARMERS IN EBONYI STATE, NIGERIA

G. Ironkwe, J. E. Ewuziem and N. C. Ezebuiro
National Root Crops Research Institute, Umudike P.M.B 7006 Umuahia, Abia State, Nigeria.
(adanmaglory@ yahoo.co.uk)

ABSTRACT
The study was conducted to examine the gender-related factors influencing resource use efficiency of smallholder cassava farmers in Ebony state, Nigeria. Multi-stage sampling technique was employed in selecting 80 respondents from two agricultural zones in the State for the study. Interview schedule was used to obtain information from respondents. Data were analysed using frequency, percentage and stochastic frontier production function. The results revealed that more of the younger female farmers than the males were in cassava production while land ownership was still in the hands of the male farmers in the State. However, both gender groups had similar production constraints. The results further indicated that household size, membership of cooperative society, number of extension contacts, age, farming experience, farm size and land ownership significantly affected the technical efficiency of the farmer categories but educational status only affected that of the females in cassava production in the State. The males and females had mean technical efficiency of 0.77 and 0.74 respectively. Although the farmer groups were not technically efficient enough, the males were observed to be more efficient than the females in cassava production in the State. Therefore, policies to enhance efficiency and productivity of the farmers in the State should critically consider those variables that are significant on gender basis

Key words: *Gender, resource use efficiency, cassava farmers*
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INTRODUCTION
The aim of research and extension agencies in Nigeria is to help the farmers of all categories and gender to increase their productivity through the use of the improved available technologies. This is with a view to increase their food production and income and consequently improve the general standard of living in the country. However, reports have shown that there is low productivity among the farmers in the country in the recent times. For instance, Idiong *et al.*, (2000); Abang and Agom (2004), observed that food crop farmers in developing countries, including Nigeria, have low productivity. They attributed this low productivity to inefficiency in the management of scarce resources by the farmers. Productivity of farmers could be improved by increasing their technical and allocative efficiency in response to better information and education. Efficiency is an important factor of productivity growth as well as stability of production especially in developing agricultural economies (Hazhrika and Subramanian 1990). Productive efficiency means the attainment of a production goal without waste (Ajibefun and Daramola 2003). Technical efficiency is the measure of a firm's success in producing maximum output from a given set of inputs (including such undisputed gains obtainable by gingering up the management). Consequently,

a firm is technically inefficient if too little output is being produced from a given quantity of inputs. Therefore technical efficiency refers to the degree, which firms are producing on the production frontier as opposed to or below it. That is for the same amount of inputs some firms obtain higher output levels than others due to both management and labour differences and perhaps other reasons (Norton and Alwang 1993; Olayide and Heady 1982). The failure on the part of the firms to produce on the frontier level of output given the level of input and available technology is therefore attributed to inefficiency (Kumbhakar 1994). Efficiency therefore becomes a very significant factor in increasing productivity through technology adoption in view of the difficulties encountered by farmers in adopting improved technologies due to shortage of farm resources.

Njoku (1995) stated that it is when resources are allocated to their best uses and in the right proportion that productivity and output rise to their highest possible level. Hence, productivity has been defined as the ratio between output and input and is a measure of production efficiency. Efficiency in resource management has also been defined by Kebede (2001) as how effectively a production unit or firm uses variable resources for the purpose of profit maximization given the best production technology available. Improved efficiency then means getting more from the same inputs by allocating them in a better way (Nwaru, 2003). It then means that increase in productivity of a farmer does not only require the use of appropriate technology and production inputs but also his/her ability or capability in effectively allocating his/her available resources to increase production. These conditions depend on personal characteristics of the farmer, exposure, education and the environment in which he/she operates. Gender invariably plays a great role in the resource management and productivity of the farmers.

Resource is any good or service which is capable of satisfying human wants. It carries the qualities of scarcity and economic values. Resource use refers to the allocation of all resources between competing alternatives with the aim of deriving maximum returns. Since these production resources are scarce, choice must be made about the use to which a resource will be put and how best it will be used to produce maximum output (technical efficiency). However, since the production of agricultural commodities or goods involves numerous relations between resource input and products, Nwaru (1993) pointed out that knowledge of the relationship between resources and products is very important as it provides the tools by means of which the problems of production and resource use could be analysed. This is also important in considering the fact that there are gender differences in resource acquisition, access to, control and ownership of resources (Ironkwe *et al 2007).* Furthermore, there are gender differences in levels of efficiency in resource management in agricultural production (Nwaru, 2003). Invariably, this could affect technology adoption, utilization and outputs of various farmers groups.

However, previous studies on gender issues in resource management and output such as Nwaru and Iheke (2002) in rice production in Abia state and Nwaru (2003) on food crop

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farming in Abia state reported low resource productivity and efficiency of women farmers in comparison with their men counterparts. On the other hand, some studies have reported differently. For instance, Saito *et al.*, (1994) reported that female farmers were equally as efficient as male farmers, Chukwuji and Oyaide (2005) reported that income per head and technical efficiency were not significantly different for men and women, Ohajianya and Onyenweaku (2001) reported from their profit function analysis that there were no significant differences in economic efficiencies of male and female rice farmers in Ebonyi State of Nigeria. None of these reports considered cassava production which is a major root crop of great importance in the State. The beauty of empirical studies using the stochastic frontier model to estimate production efficiency in both crops and livestock farming in Nigeria in particular and sub-Saharan Africa in general gives further justification to this attempt.

Cassava (*Manihot esculenta* Crantz) is one of the important root crops grown in Nigeria. It is a major source of energy with high food security value similar to most cereal crops (Achinewhu and Owuamanam, 2001). The crop is used in manufacturing industrial starch, alcohol and confectionaries (Oguntona, 1999). Nigeria is the world largest producer of cassava with annual production of about 38.17 million metric tones (FAO, 2005). This record was made possible through the successful efforts of the farmers (males and females) and needs to be enhanced and sustained in view of the recent global food crisis. The attendant increase in cassava production arising from this will increase the output of the households, and improve their standard of living (Onyemauwa, *et al*, 2007). This study therefore examined the gender-related factors influencing the resource use efficiency in smallholder cassava farms in Ebonyi state, Nigeria.

METHODOLOGY

This study was conducted in Ebonyi state, in South east agro-ecological zone of Nigeria. Two agricultural zones (Ebonyi North and Ebonyi South) out of the three zones in the state were purposively selected. Multi-stage sampling technique was used in selecting the respondents for the study. In the first stage, two agricultural zones in the state were purposively selected. In the second stage, two blocks in each of the selected zones, were randomly selected. Similarly, in the third stage, two circles in each of the selected blocks were randomly chosen. Finally, ten cassava farmers (5 males and 5 females) were randomly selected from a list of cassava farmers obtained from the extension agent in charge of each of the selected circles. A total of 80 respondents (40 males and 40 females) were interviewed with the aid of structured questionnaire. Data were collected from the respondents on their personal characteristics, activities carried out in cassava production, cost of production, out-put and income from cassava per hectare, production resources used, constraints faced etc. Data were analyzed using frequency, percentages and Cobb-Douglas production functional form of the stochastic frontier production function. Several studies from both developing and developed countries have used the Cobb Douglas functional form to analyze farm efficiency (Battese and Coelli 1995,; Bravo Ureta and Pinheiro, 1997).The model is represented as

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$Y = f(X_1, X_2, X_3, X_4 \ldots X_6 + Vi - Ui) \ldots. (1)$

This is defined as follows:

$InY_1 = bo + b_1InX_1 + b_2InX_2 + b_3InX_3 + b_4InX_4 + b_5InX_5 + b_6InX_6 + Vi - Ui \ldots(2)$

Where;

In = Logarithm to base e

Yi = output of cassava (Kg)

$\mathbf{X_1}$ = farm size (Ha)

$\mathbf{X_2}$ = cassava stems (Kg)

$\mathbf{X_3}$ = labour (Man days)

$\mathbf{X_4}$ = fertilizer (Kg)

$\mathbf{X_5}$ = capital (Naira)

$\mathbf{X_6}$ = other inputs (Kg)

Vi = a symmetric error term which accounts for random variations in output due to factors beyond the control of the farmer.

bo, $\mathbf{b_1, b_2, b_3, b_4, b_5}$ and $\mathbf{b_6}$ are regression parameters estimated

Ui = a non negative random variable representing inefficiency in production relative to the stochastic frontier. 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 by the methods of maximum likelihood using the computer program FRONTIER 4.1 (Coelli, 1994):

$TE_i = {}_0 + {}_1Z_1 + {}_2Z_2 + {}_3Z_3 + {}_4Z_4 + \ldots + {}_{10}Z_{10}$

Where;

$\mathbf{TE}_i$ = the technical efficiency of the farmer

$\mathbf{Z_1}$ = ownership of land (Ha)

$\mathbf{Z_2}$ = household size (number)

$\mathbf{Z_3}$ = membership of cooperative/farmers' associations (number)

$\mathbf{Z_4}$ = contact with extension agent (number)

$\mathbf{Z_5}$ = age (years)

$\mathbf{Z_6}$ = marital status (dummy variable; 1 for married, 0 otherwise)

$\mathbf{Z_7}$ = educational status (number of years spent in school)

$\mathbf{Z_8}$ = access to credit (dummy variable; 1 for access, 0 otherwise)

$\mathbf{Z_9}$ = farming experience (years)

$\mathbf{Z_{10}}$ = farm size (Ha)

${}_0$ = the intercept

${}_{1, 2, 3, 4, 5, \ldots 10}$ are parameters estimated.

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Results and Discussion

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

Age range (yrs)	Male (n = 40)	Female (n = 40)	Total(n = 80)
21-30	0(0.00)	6 (15.00)	6 (7.50)
31-40	7(17.5)	19 (47.50)	26 (20.00)
41-50	18 (45.00)	13 (32.25)	31 (35.75)
>50	15 (37.50)	2 (5.00)	17 (21.25)
Mean	**46**	**37**	**42**
Educational Status			
No formal education	1 (2.50)	18 (45.00)	19 (36.25)
1-6 years	16(40.00)	12 (30)	28 (23.75)
7-12 years	17 (17.40)	6 (15.00)	23 (16.25)
13- 18	4 (4)	3 (7.50)	7 (8.75)
□ 18 years	2 (5)	1 (2.5)	3(3.75)
Mean	**8**	**5**	**6**
Household Size			
1-5 members	4 (10.00)	11 (27.5)0	15 (18.75)
6-10 "	19 (47.50)	19 (47.50)	38 (47.50)
11-15 "	12 (30.00)	5 (12.50)	17 (21.25)
> 15	5 (12.50)	5 (12.50)	10 (12.50)
Mean	**9**	**6**	**8**
Farming experience			
<10	3 (7.50)	5 (12.50)	8 (8.75)
10 -20	12 (30.00)	20 (50.00)	32 (40.00)
21-30	18 (45.00)	10 (25.00)	28 (35.00)
> 10	7 (17.5)	5 (12.50)	12 (15.00)
Mean	**23**	**19**	**21**
Farm size (ha)			
< 1	0 (0.00)	20 (60.00)	20 (25.00)
1-3	5 (12.50)	11 (27.50)	16 (20.00)
4-6	25 (62.50)	7 (17.50)	32 (40.00)
> 6	10 (25.00)	2 (5.00)	12 (15.00)
Mean	**5**	**3**	**4.5**
Land Ownership			
Yes	34 (85.00)	3 (7.50)	37 (46.25)
No	6 (15.00)	37 (92.50)	43 (53.75)
Contact with Extension			
Yes	25 (62.50)	13 (32.50)	38 (47.50)
No	15 (37.50)	27 (67.50)	42 (52.50)

Source: Field survey, 2007 * Figures in parentheses are in percentages.

Table I revealed that more of the younger female farmers than males were in cassava production in this state. This implies that female farmers were in their productive and economic ages (mean age of 37 years). Since the farmer's age is an important factor in determining the productivity and adoption of an innovation (Kebede, 2001; and Nwaru, 2004), this result implies that there is great prospect for increased and sustainable cassava production among the female farmers. The result is in consistent with the findings of Ironkwe, *et al* (2009). Greater proportion (45%) of these women had no formal education while more than half (57.4%) of the males had both primary and secondary education. Since education increases productivity, improves access to agricultural information and as well as enhances farmers' ability to understand and evaluate new production techniques (Onyenweaku ans Nwaru, 2005), it implies that the female farmers will be more disadvantaged more than their male counterparts in the process of production. Majority (47.5%) of both the male and female farmers had the same household size (6-10 with a mean of 8). However, greater proportion (45%) of the male farmers had more years of farming experience (21-30 years with a mean of 21years) than their female counterparts. This means that the males are more experienced than the females. The more experienced a farmer is the more efficient his decision making processes and the more he will be willing to take risks associated with the adoption of innovation (Okoye et al 2009). In addition, greater percentage (62.5%) of the male than the female (47.5%) farmers had contact with extension. Farm land in the study area was mostly owned by men as indicated by majority (85%) of the male and (7.5%) of females respondents.

Table 2: Distribution of respondents according to activities carried out in cassava production.

Activities	**Male (n = 40)**	**Female (n = 40)**	**Both (n = 80)**
Land Clearing	32 (40.00)	10 (12.50)	38 (47.50)
Mounding/ridging	68 (85.00)	2 (2.50)	10 (12.50)
Cutting of planting materials	6 (7.50)	56 (70.00)	18 (22.50)
Planting	10 (12.50)	55 (68.75)	15 (18.75)
Weeding	0 (0.00)	68 (85.00)	12 (15.00)
Fertilizer application	20 (25.00)	12 (15.00)	48 (60.00)
Harvesting	10 (12.50)	30 (37.50)	40 (50.00)
Haulage/transportation	6 (7.50)	6 (20.00)	58 (2.50)

Source: Field survey, 2007 *Multiple responses recorded. *The figures in parentheses are in percentages.

However, Table 2 revealed that the female farmers dominated mostly in four major production activities such as cutting of planting materials, panting, weeding and harvesting while the males dominated in land clearing, mounding/ridging and fertilizer application. This result implies that female farmers are greatly involved in cassava production in the State and agrees with the findings of Ironkwe (2005).

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Table 3: Distribution according to production constraints faced by the respondents

Activities	Males (n=40)	Females (n=40)	Both (n=80)
Scarcity/high cost of fertilizer	36 (90.00)	22 (55.00)	58 (72.50)
Scarcity/high cost of labour	34 (85.00)	18 (45.00)	52 (65.00)
Lack of capital/credit	30 (75.0)	20 (50.00)	50 (62.50)
Land tenure system	18 (45.0)	10 (25.00)	28 (35.00)
Lack of improved varieties	16 (40.0)	14 (35.00)	30 (37.50)
Diseases and pests	12 (30.00)	10 (25.00)	22 (27.50)
Lack of markets	8 (20.00)	10 (25.00)	18 (22.50)

Source: Field survey, 2007 *Multiple responses recorded *Figures in parentheses are in percentages

Both the male and female farmers faced the same constraints in cassava production as shown in Table 3. Among these constraints were scarcity/high cost of fertilizer, scarcity/high cost labour, lack of capital and land tenure problem. This result agrees with that of Ironkwe *et al.,* (2009)

Table 4: Distribution according to outputs and costs of production

Cassava output in kg.	Male	Female	Total
1,000 – 6000	2 (5.00)	8 (20.00)	12 (15.00)
6,001 – 8,000	10 (25.00)	16 (40.00)	26 (32.50)
8,001 – 12,000	18 (45.00)	10 (25.00)	28 (35.00)
12,001 – 16,000	6 (15.00)	6 (15.00)	12 (25.00)
> 16,000	2 (5.00)	0 (0.00)	2 (2.50)
Cost of production in Naira			
<60,00	6 (15.00)	2 (5.00)	8 (10.00)
60,000 – 120,000	22 (55.00)	20 (50.00)	42 (52.50)
121,000 – 180,000	8 (20.00)	10 (25.00)	18 (22.50)
181,000 – 240,000	3 (7. 50)	6 (15.00)	9 (11.25)
> 240,000	1 (2.50)	2 (5.00)	3 (3.75)

Source: Field survey, 2007 *Figures in parentheses are in percentages.

Table 4 showed that greater proportion (60%) of the male folks had between 8000kg to 16000kg of cassava tubers per hectare while 65% of the females had between 6,000kg to 12,000kg of cassava tubers per hectare. This implies that the male farmers are producing more than their female counterparts in cassava production in the State.

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Table 5: Estimated Cobb-Douglas frontier Production Function for Male and Female Cassava Farmers in Ebonyi State, Nigeria.

Production Variables	Parameters	Estimates	t-ratio	Estimates	t-ratio
		Males		Females	
Constant term	b_o	3.4186	2.4073*	5.2596	2.3310**
Farm Size (In X_1)	b_1	0.3326	2.0613	0.5289	1.7032**
Cassava Stems (In X_2)	b_2	0.0242	0.2461	0.2484	2.2134**
Labour Input (In X_3)	b_3	0.3593	1.9430*	0.1050	0.8917
Fertilizer (In X_4)	b_4	0.2346	2.1194**	0.2743	1.9823*
Capital Input (In X_5)	b_5	0.6485	6.4172***	0.5585	11.2745***
Other Inputs (In X_o)	b_6	0.01232	0.1007	0.1778	2.5321**
Efficiency Variables					
Constant term	Z_o	3.7000	2.2772**	1.8480	1.3149
Land 0wnership	Z_1	0.0542	1.6797*	0.0413	1.9503*
Household Size	Z_2	0.1622	2.2374**	0.3056	2.9593***
Membership of Crop	Z_3	0.8480	2.4778**	0.2817	2.0259
Extension Contacts	Z_4	0.0190	2.0825**	0.0710	0.9144
Age	Z_5	2.3606	2.0671**	0.9111	5.8198***
Marital Status	Z_6	0.0089	0.2724	0.0049	0.2289
Educational Status	Z_7	0.2153	0.4777	0.3183	2.4311**
Credit Access	Z_8	0.5681	0.6122	0.1190	0.2345
Farmer Experience	Z_9	2.2543	2.2324**	0.3334	3.0349***
Farm Size	Z_{10}	2.5140	2.0446**	0.3050	2.5203***
Log likelihood function	32.0945			14.9079	
Sigma Squared	$ó^2$	0.6665	6.5929***	0.4472	2.5412***
Gamma	y	0.9204	3.0861***	0.9613	27.1957***
Mean Efficiency		0.77		0.74	

Source: Field survey, 2008 *, **, and *** are significant levels at 10%, 5% and 1% respectively.

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The Cobb-Douglas production function for the male and female cassava farmers were estimated as presented in Table 5. The estimated variance (**ó**^{2}) for both genders was statistically significant at 1% level of probability indicating a good fit and the correctness of the specified distribution assumptions of the composite error term. The gamma was statistically significant at 1% level of probability. The coefficients for gamma (&) for both male and female farmers were 0.9204 and 0.9613 respectively. This implies that 92.04% and 96.13% of total variations in cassava output for male and female farmers respectively was due to technical inefficiency.

SOURCES OF TECHNICAL EFFICIENCY

Table 5 also shows the results of the factors influencing technical efficiency of male and female farmers in Ebonyi State. All the coefficients for the male farmers had a direct or positive relationship with technical efficiency. The coefficients for household size, membership of cooperatives, number of extension contacts, age, farmer experience and farm size were all positive and significant at 5% level showing a direct relationship with technical efficiency. This result is in consistent with that of Onyenweaku and Nwaru (2005), Nwaru (2009) and Ironkwe *et al.,* (2009). Thus implies that any increase in any of these variables would increase the technical efficiency of the male farmers in cassava production in the state. Land ownership was also significant at 10% level. The coefficients for marital status, educational status and credit access though positive were not significant.

The coefficients for the female farmers were all positive related to their technical efficiency in cassava production. Household sizes, age, farming experience and farm size were significant at 1% level. Membership of cooperative societies and educational status were significant at 5% level while land ownership was significant at 10% level. This implies that an increase in any of these variables would increase the technical efficiency of the female farmers in cassava production in the State. However, the coefficients for extension contact, marital status and access to credit though positive were not significant.

The mean technical efficiency for males was 0.77 and that for females was 0.74. However, the technical efficiency of each farmer group was less than unity but greater than zero in conformity with theory. This indicated that all farmers in each group were producing below the maximum efficiency frontier. Although the male farmers achieved a higher mean farm level technical efficiency than their female counterparts in cassava production in the State, maximum technical efficiency was not achieved in either case. These show that there are opportunities for increasing productivity and income of both male and female cassava farmers through increased technical efficiency given the existing technology.

CONCLUSION

The study revealed that more of the younger female farmers than the males were into cassava production in the study area. However, more of the males had larger farm land, more education and more farming experience than the female folks. Even though both the male and

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female farmers had similar production constraints, the males had higher output and were more technically efficient than the females in cassava production. The results further revealed that both male and female farmers were not technically efficient enough in cassava production in the State. This suggests that there are substantial opportunities to increase productivity of the cassava farmers in the study area through efficient utilization of production resources. The important factors directly related to technical efficiency of the farmer categories were the same except educational status that was directly related to the technical efficiency of the female farmers only. Therefore, policies geared towards enhancement of their access to those variables will be useful in increasing their technical efficiency in cassava production in the State.

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