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Abstract - The study was conducted in Idanre Local Government Area of Ondo State to analyze the gender and farm technical efficiency of cocoa production(Why the research? Is it to increase productivity or to correct gender issues? State it here). The data were collected from 100 respondents with the use of structured questionnaire, which involved 54 men and 46 women cocoa farmers. The maximum likelihood estimates of frontier model of male farmers showed that only family labour and pesticides were significant while for female farmers, hired labour, insecticides and family size were significant. In addition, the inefficiency model of male cocoa farmers showed that age, education and experience were significant on technical inefficiency while female inefficiency model was significant in education, experience and age of cocoa plant. The technical efficiency showed that a lot can be done to increase the production capacity of both gender in order to make them technically efficient.

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GENDER COMPARISON IN PRODUCTION AND PRODUCTIVITY OF COCOA FARMERS IN ILE OLUJI LOCAL GOVERNMENT AREA OF ONDO STATE, NIGERIA

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Abstract - The study was conducted in Idanre Local Government Area of Ondo State to analyze the gender and farm technical efficiency of cocoa production(Why the research? Is it to increase productivity or to correct gender issues? State it here). The data were collected from 100 respondents with the use of structured questionnaire, which involved 54 men and 46 women cocoa farmers. The maximum likelihood estimates of frontier model of male farmers showed that only family labour and pesticides were significant while for female farmers, hired labour, insecticides and family size were significant. In addition, the inefficiency model of male cocoa farmers showed that age, education and experience were significant on technical inefficiency while female inefficiency model was significant in education, experience and age of cocoa plant. The technical efficiency showed that a lot can be done to increase the production capacity of both gender in order to make them technically efficient.

I. Introduction

Gender is a concept used in social science analysis to look at the role and activities of man and women. Doku (1990) distinguished sex and gender with the definition that sex is a statistics and biological attribute based on natural characteristics and reproductive role while gender is a dynamic, social construction that describes feminine and masculine behavior. The word gender means more than sex. It is culturally ascribed as a role performed by either of the sexes. Aina (2002) viewed the issue of gender as a process by which individuals are born into biological categories of female and male. This could become the social categories of women and men through the acquisition of locally defined attributes of femininity and masculinity. Also, in the recent years, the topic gender especially women participating in the development has become prominent in the literature, democracy and governance. This is due to the establishment of Women In Agriculture (WIA) as a component of Agricultural Development programme (ADP), Better Life for Rural Women Programme (BLP), Family Support Programme (FSP), and Family Economic Advancement Programme (FEAP). It has been pointed out that there is no quantitative and qualitative information about female and female farming in particular (ILO, 1981). Therefore, rural women are usually excluded from development planning. The issue of gender inequality in Nigeria is rooted in the traditional and cultural practices of the society. These include the values and norms that are related to women's reproductive functions that clearly underline gender division of labour (Akanji, 1997). Socio-economic indicators of Nigerian data show that even though women account for forty-nine percent of the population, they only form thirty-nine percent of the total labour force. Most of the women, who are accounted for, in statistics, are found in the agricultural and the informal sector of the national economy.

Furthermore, majority of the population of African countries, including Nigeria, lived in rural areas before independence. This indicates that more than seventy percent of the rural population depended wholly on smallholder agriculture for food and income (Akanji, 1999). The labor force used in farming during those times are household members which comprise of men, women and their children. As a result of this, rural smallholder agriculture remains the major power house for rural growth and livelihood improvement before the emergence of petroleum. So farmers are afraid of the high labour requirements of commercialization of smallholder agriculture and uncertainty of markets from agricultural outputs. Therefore, very few farmers grow high value crops, which are marketed through lucrative marketing boards.

According to Akanji (1999), cash crop farming like cocoa and tea are major occupation of men in African countries including Nigeria. She confirmed that in Ondo women participated State and that they always involved their children in all the tasks where women labour was extremely important in small holder agriculture. Technical efficiency relates to the degree in which a farmer produces the maximum feasible output from a given bundle of inputs (an output oriented measure), or uses the minimum feasible level of inputs to produce a given level of output (an input oriented measure), (Coelli *et al*, 2002).

The level of technical efficiency of a particular farmer is characterized by the relationship between observed productions and potential production (Greene, 1993). The measurement of firm specific technical efficiency is based upon deviations from efficient production frontier. If a farmer's actual production point lies on the frontier it is perfectly efficient. If it lie below

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the frontier then it is technically inefficient, with the ratio of the actual to the potential production defining the level of efficiency of the individual farmer (Ogundele and Okoruwa, 2003).

Therefore, this study is aimed at analyzing the effect of gender and technical efficiency on cocoa production in Idanre local government area of Ondo State. Specifically, the objectives of this study are to examine the cost and return to cocoa production, determine the technical efficiency of the cocoa farmers, and to examine the relationship between the socio-economic characteristics of gender and technical efficiency of cocoa farmers.

The following Hypotheses were tested in its null form;

- There is no significant difference between socio-economic characteristics of male and female owned farms in cocoa production.
- There is no significant difference in the levels of inputs used between male and female owned farms.
- There is no significant difference in the technical efficiencies of male and female owned farms,
- Inefficiency effects are absent from the model.

II. Materials and Methods

The study was carried out in Idanre Local Government Area of Ondo State. Primary data were collected from the respondent using a well structured questionnaire and interview schedule.

The study employed multi-stage random sampling technique for the selection of respondents. The first stage involved random selection of five out of ten wards. Second stages involved the random selection of two villages in each ward. The third stage involved random selection of ten people (male and female) from each village making a total of one hundred cocoa farmers (forty six female and fifty four male). The selection was based on the proportion of male and female registered farmers at the state Agricultural Development Programme (ADP).

The data collected were analyzed using descriptive statistics, budgetary technique and stochastic frontier production function.

The stochastic frontier model for cocoa production in Idanre Local Government Area is defined explicitly as

$$\ln Q_1 = \beta_0 + \beta_1 \ln x_1 + \beta_2 \ln x_2 + \beta_3 \ln x_3 + \beta_4 \ln x_4 + \beta_5 \ln x_5 + \beta_6 \ln x_6 + V_i - U_i$$

Where

Q is the total output in tonnes.
X_1 = family labour in man-days.
X_2 = hired labour in man-days
X_3 = pesticides used in litres
X_4 = insecticides used in litres
X_5 = amount of fertilizer used in Kg.
X_6 = area of land cultivated

The β's are unknown parameters to be estimated.
The V_i are assumed to be independent and identically distributed random error having $N(o,\sigma v^2)$ and
The U_i are non-negative random variable called technical efficiency in effect, which are assume to be independently distributed such that U_i is defined by truncation (at zero) of normal distribution with mean, u_i, variance σ^2 where u_i is defined by

$$u_i = \delta o + \delta_1(Age) + \delta_2(Edu) + \delta_3(Exp) + \delta_4(Aop) + \delta_5(ext)$$

Where
Age is the Age of the farm owners.
Edu is Year of education of the farmers
Exp represents Year of experience in cocoa production.
Aop is Age of plant
Ext represents Frequency of extension visit

The stochastic frontier production was run separately for male and female farmers.

III. Results and Discussions

a) Mean Values of Input and Yield by Sex

From table 1, the mean yield was 4.87 tonnes for all the farmers. However, further disaggregating revealed that male farmers made 5.79 tonnes while their female counterparts made 3.79 tonnes. Farm size of male was 13.17ha as against 11.78ha recorded among the female farmers. Overall average farm size for all the farmers was 12.5ha. Hence the female farmers cultivate less than the average farm size of the male farmers.

In the use of family labour, the female farmers were highly discriminated against. Thus, the female farmers committed the average of 51man-days of family labour while their male counterpart recorded an average use of 98 man-days. The average man-days of family labour was 77 man-days for all the farmers. A different situation was observed in the case of hired labour. The male farmer recorded 164 man-days while the female counterpart recorded 287 man-days. In the use of fertilizer, the average use of 92kg was recorded among the female farmers. This is less than the half of the average of 200kg recorded by all the farmers. The male farmers, however, recorded an average of 123.5kg in terms of pesticides and insecticides, male farmers use 4.47litre and 5.8litres of pesticide and insecticide respectively as against 1.74litres and 4.35litre recorded by the female farmers. The overall average was 2.69litres of pesticides and 5.13litres of insecticides.

b) Maximum Likelihood Estimate of Frontier Model

i. Maximum Likelihood Estimate of Frontier Model for Male Farmers

From Table 3, family labour and Pesticides contribute significantly to the output of cocoa in the study area. The coefficients of the variables represent their corresponding elasticities in Cobb-Douglas function. The coefficients of all the inputs is less than one indicating that cocoa production is inelastic to changes in inputs.

The analysis of the technical inefficiency effect model shows that all the variables have the expected signs and only Age, education and experience have significant effect on the level of technical inefficiency. The negative coefficient for age variable implies that the older farmers are less technically inefficient than the younger farmers. The negative coefficient for education implies that farmers with more years of education tend to be less inefficient. Years of experience also have a negative coefficient, indicating that farmers with more experience tend to be less inefficient.

The estimate for the gamma- parameter is 0.70, which means that the inefficiency effects are highly significant in the analysis of the output of the farmers.

ii. *Frequency Distribution of Technical Efficiency of Male Farmers*

The frequency distribution of technical efficiency presented in Table 5 Shows that about 48% of the male farmers had their technical efficiency below 0.5 or 50%, which indicates that there is much opportunity to increase technical efficiency of these farmers. The average technical efficiency of 0.52 shows that, given the level of technology of male farmers, a lot can be done to increase their productivity.

iii. *Maximum likelihood estimate of frontier model for female farmers*

The result of the maximum likelihood estimates of female farmers in Table 5 shows that hired labour, insecticide and farm size were significant and all carried appropriate signs except insecticides. In terms of elasticity, output was found to be inelastic with respect to all the inputs.

The result of the inefficiency effects model shows that only three of the variables are correctly signed and three variables are statistically significant (education, experience and Age of plant). The coefficient of education is negative implying that this factor led to decrease in technical inefficiency of female cocoa farmers. The coefficient of experience is positive indicating that farmers with more experience tend to be more inefficient. The coefficient of age of plant is positive indicating that the older the cocoa plantation is, the more the level of technical inefficiency.

The estimated value of gamma parameter is 0.99 indicating that 99% of total variation in cocoa output is due to differences in technical inefficiency.

iv. *Frequency distribution of technical efficiency of female cocoa farmers.*

The frequency distribution of female cocoa farmers based on their technical efficiency from the Stochastic Frontier Model (Table6) reveals that the predicted farm specific technical efficiencies ranged between 0.03 and 1.00 with a mean of 0.21. Thus in the short run, there is a scope for increasing cocoa production by about 79% by adopting the technology and techniques used by the best practiced farmers. The table also shows that 97.8% of the female cocoa farmers have technical efficiency less than 0.5 and just 2.2% had technical efficiency of 1. This implies that only 1 female cocoa farmer was technically efficient.

c) Test of Hypotheses

In this section the four hypotheses stated is tested and inference made on the basis of the result. Two samples T-test for equality of means were used to test the entire stated hypotheses.

i. *t-test for input used between male and female cocoa farmers*

The test for equality of means for the various inputs between male and female cocoa farmers in Table 7 shows that there was no significant difference in the estimated means for farm size, fertilizer, pesticide and insecticide while there is a significant difference in the estimated mean for family labour and hired labour. Thus, while the null hypothesis 1 hold true for farm size, fertilizers, pesticides and insecticide and should be accepted, it does not for the use of other inputs such as family labour and hired labour and therefore should be rejected.

ii. *t-test for socio-economic variable between male and female cocoa farmers*

The test for equality of means in Table 8 reveals that while there was no significant difference in the estimated mean for age, education, experience and extension visit between male and female cocoa farmers, the equalities of mean for family size was highly significant. Analysis of the socio-economic variables between male and female farmers indicated that there were no significant differences in the estimated mean age, education, experience and extension visit. Hence, hypothesis 2 holds true for them and should be accepted. The hypothesis is however rejected for family size as the result indicates a high level of significant difference for this variable between male and female farmers.

iii. *test for technical efficiency.*

The result of the T- test for equality of mean between Male and female farmers'(Table9) shows that there was significant difference between the means of technical efficiency of male and female farmers. Thus hypothesis 3, which says there is no significant difference in technical efficiency between male and female farmers, should be rejected.

iv. *Generalized livelihood- ratio tests of hypothesis for parameters of stochastic frontier production function for Cocoa Farm*

The null hypothesis, that the technical inefficiency effects are not present in the model is expressed by H0: $\infty = 0$.

This hypothesis is rejected for male and female cocoa farmers, while it is accepted for all the farmers. Hence, the average response function is not an adequate representation of the data for male and female farmers while it is for all the cocoa farmers (Table 10).

IV. Conclusion

The study reveals that most of the cocoa producers are not technically efficient which implies a lot can be done to increase their productivity. It is also discovered that most of the cocoa producers are old people which means young ones are not encouraged and adequately trained into cocoa production. Also, most of the producers were not educated which not only make interaction difficult between extension agent and farmer but also makes them receptive to taking risk. It also makes it easy for fake chemicals to be sold to the farmers.

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Table 1 : an Values of Input and Yield by Sex.

	Male-Owned Farm			Female-Owned farm		
Farm Variable	Mean	SD	CV	Mean	SD	CV
Output (tonnes)	5.78	4.625	0.799	3.79	4.325	1.141
Farm size	13.17	8.17	0.620	11.78	7.37	0.626
Family Labour	98.06	62.659	0.639	50.67	41.42	0.817
Hired Labour	164.19	53.80	0.327	287.01	134.30	0.468
Fertilizer	123.50	90.00	0.729	92.00	56.50	0.614
Pesticide	4.47	3.43	0.767	1.74	1.29	0.741
Insecticide	5.80	5.18	0.893	4.35	3.23	0.743

Source : Computed from Field Data, 2005.

Table 2 : Maximum likelihood estimates of frontier model for male farmers.

Variables	Coefficient	Standard Error	t-ratio
General Model Constant	0.37	0.71	0.52
Family labour	0.26	0.12	2.12*
Hired labour	0.09	0.11	0.86
Pesticides	0.37	0.12	3.11*
Insecticides	0.03	0.08	0.39
Fertilizer	0.02	0.02	1.06
Farm size	0.03	0.11	0.30
Inefficiency Model Constant	4.54	1.19	3.82*
Age	-0.04	0.01	-2.82*
Education	-0.49	0.14	-3.52*
Experience	-0.02	0.007	-2.30*
Age of plant	-0.009	0.04	-0.26
Extension visit	-0.02	0.28	-0.09
Variance Parameter			
Sigma-squared	0.22	0.06	3.68*
Gamma	0.70	0.36	1.96*

Source: Computed from Field Data, 2005
**Significant*

Table 3 : Frequency Distribution of Technical Efficiency among Male farmers

Range of Technical Efficiency	Frequency	Percentage
<5.0	26	48
5.0-5.9	8	14.8
6.0-6.9	6	11.1
7.0-7.9	7	13.0
8.0-8.9	6	11.1
9.0-9.9	1	1.9
Total	54	100

Source : Computed from Field Data, 2005

Table 4 : Maximum Likelihood Estimates of Frontier Model for Female Farmers.

Variable	Coefficient	Standard error	t-ratio
General Model			
Constant	0.90	0.99	0.91
Family labour	0.07	0.22	-0.30
Hired labour	0.96	0.24	3.96*
Pesticide	0.14	0.42	0.34
Insecticide	-0.49	0.23	-2.14*
Fertilizer	0.46	0.49	0.95
Farm size	0.42	0.12	3.47*
Inefficiency Model			
Constant	1.94	0.42	4.65
Age	-0.006	0.009	-0.59
Education	-0.09	0.04	-2.19
Experience	0.02	0.008	2.58*
Age of plant	0.09	0.05	2.50*
Extension visit	-0.25	0.28	-0.89
Variance Parameter			
Sigma-squared	0.45	0.09	5.20*
Gamma	0.99	0.0000	2.62*

Source: Computed from Field Data, 2005
**- Significant*

Table 5 : Frequency Distribution of Technical Efficiency of female Cocoa farmers

Range of T E	Frequency	Percentages
<50	45	97.8
5.0-5.9	0	
6.0-6.9	0	
7.0-7.9	0	
8.0-8.9	0	
9.0-9.9	0	
1.00	1	2.2
Total	46	100

Source : Computed from Field Data, 2005

Table 6 : t-test for input use between male and female Cocoa farmers

Input Used	T	Degree of Freedom	Mean of Difference	Standard Error Difference	Decision
Family labour	3.724	98	37.056	34.262	Reject HO
Hired labour	3.453	98	4.031	5.509	Reject HO
Farm size	0.888	98	3.326	6.696	Accept HO
Fertilizer	0.724	98	3.32	2.059	Accept HO
Pesticides	1.551	98	1.22	1.907	Accept HO
Insecticide	1.641	98	1.449	4.058	Accept HO

Source ; Computed from the Field Survey Data, 2005
Significant level = 5%

Table 7 : t-test for socio-economic variable between male and female cocoa farmers

Socio-economics Variable	T	Degree of Freedom	Mean Difference	Standard Error Difference	Decision
Age	1.395	98	3.720	2.270	Accept Ho
Education	1.395	98	3.720	2.270	Accept Ho
Experience	1.102	98	3.252	8.008	Accept Ho
Extension visit	1.421	98	0.100	0.266	Accept Ho
Family Size	4.197	98	5.569	8.134	Reject Ho

Source ; Computed from the Field Survey Data, 2005
Significant level = 5%

Table 8 : t-test for technical efficiency between male and female cocoa farmers.

Technical Efficiency	T	Degree of Freedom	Mean Difference	Standard error Difference	Decision
Male& female	7.00	98	0.292	0.13	Reject

Source ; Computed from the Field Survey Data, 2005
Significant level = 5%

Table 9 : Generalized Likelihood–Ratio Test of Hypothesis for Parameters of the Stochastic Frontier Production Function for Cocoa Farms.

Null Hypothesis	λ	Critical Value	Decision
Male	30.107	14.067	Reject Ho
Female	18.206	14.067	Reject Ho
All farmers	2.810	14.067	Accept Ho

Source ; Computed from the Field Survey Data, 2005
Significant level = 5%

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