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Analysis of Gender Roles in Palm Oil Production in the Northern Agricultural Zone of Delta State, Nigeria

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Author's contribution

The sole author designed, analyzed and interpreted and prepared the manuscript.

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ABSTRACT

This study analysed gender roles in palm oil production in the Northern Agricultural Zone of Delta State. Four randomly selected Local Government Areas and 160 palm oil producers (80 males and 80 females) were used for the study. Multiple regression analysis, resource–use efficiency, percentages and t-test were employed in analysing the data. The gender responsibility profile showed that movement of fruits to processing site, sterilization, pulp pressing/milling, preservation and marketing were mainly done by women. Bunch harvesting, quartering of bunches, stripping, digesting and clarification were predominantly male activities. Results of regression analysis by gender showed that the quantity of oil palm branches, cooperative membership, the cost of processing method, and hired labour made significant contributions to quantity of palm oil produced by men and women. The result of t-test revealed that there was a significant difference between men and women in their level of palm oil production at 0.025 level of significance. There was no

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difference in resource-use efficiencies of men and women in palm oil production in the study area. On key decision-making areas of palm oil production, men dominated in three aspects, while women dominated in four out of seven aspects of decision making. Since there was no gender difference in resource-use efficiency, it was recommended that the inefficiency in the entire palm oil production system should be addressed. Men and women should strive to utilize better processing techniques that are less expensive and can save the cost of hiring labour.

Keywords: Delta State; Delta North Zone; Southern Nigeria; gender analysis.

1. INTRODUCTION

Palm oil is produced from the mesocarp of the fruit of oil palm (*Elaeis guineensis*). Oil palms are found in the hot wet tropics. They thrive in the forest regions. They can be found in fertile valleys in secondary forest. They grow wild abundantly in parts of West Africa. With the introduction of improved and quick maturing varieties of oil palm, more farmers have been growing them through a plantation system which has been so successful in southern Nigeria [1,2].

Palm oil production plays a role in the employment of labour in Delta State of Nigeria. Palm oil has traditionally been and will remain an essential diet of the people of Nigeria. It is used as a raw material for the production of soap and pomade. With a population growth rate of 2.5% [3], domestic and industrial consumption will continue to increase. Palm oil processing also produces palm kernels, palm kernel cake for livestock feed, and palm kernel oil. With increasing number of men and women in palm oil production and future prospects of expansion of plant area of oil palm in Delta State, it has become imperative to examine the gender perspective of palm oil production.

Gender is not just about women. It pertains to men and women. Gender refers to the economic, social, political and cultural attributes and opportunities associated with being male and female [4]. Gender is about the socio-cultural roles assigned to men and women and the dynamics between them. The social definitions of what it means to be male and female vary among cultures. Gender roles are not static, but change with society, time and place [5].

In the production of palm oil, the farmer or entrepreneur is concerned with efficiency in the use of inputs to achieve either cost minimization, output maximization, profit maximization or a combination of the three objectives. [6] and [7] identified two types of efficiency: technical and allocative. Technical efficiency is the ability to extract the maximum output from a given level of input. Technical efficiency exists within a firm when it is possible with given technical knowledge to produce a large output from a given set of inputs. Technical efficiency focuses on physical productivity, which is characterized by the relationship between the observed output and some ideal potential output. The measurement of a firm's specific technical efficiency is based upon deviation of the observed output from the best production frontier.

On the other hand, allocative efficiency is concerned with the choice of an optimum combination of inputs consistent with relative factor prices. Allocative efficiency has to do with using the right mix of inputs in light of the relative price of each input. [8] and [9] identified a third form of efficiency which they called economic efficiency. In order to be economically efficient, a firm must first be technically efficient. Economic efficiency occurs when a firm chooses resources and enterprises in such a way as to attain optimum or maximum profit. In economic efficiency, a given resource is efficiently utilized in production if its marginal value product is just sufficient to offset its marginal factor cost.

Ajah [10] argued that women experience more difficulties in securing access to farm inputs, agricultural extension services and credit. According to [11], given equal access to physical resources and human capital development, women farmers can achieve yields that are equal if not exceed those of men farmers. Most studies have shown that male and female farmers are equally efficient as farm managers [12,13]. Do the roles of men and women differ in palm oil production? Is there a significant difference between men and women in level of palm oil production? The problem centres on doing a gender analysis to ascertain the degree of dissimilarity of male and female involvement in the various palm oil production stages. The specific objectives of this study are to: (1) identify the responsibilities of men and women in the

various palm oil production stages; (2) ascertain the levels of resource utilization and palm oil production by gender; (3) determine the contribution of socio-economic characteristics of respondents to palm oil production level by gender; (4) specify the gender that takes decision in different activities of palm oil production The following three hypotheses were tested: (a) level of palm oil production for men and women do not significantly differ; (b) socioeconomic characteristics of the processors do not significantly contribute to level of palm oil production (for men and women); (c) resources in palm oil production are under utilized for men and women.

2. METHODOLOGY

Delta North Agricultural Zone is made up of nine Local Government Areas (LGAs) with a population of 1,229,371 made up of 620,517 males and 608,854 females [3]. Four out of the nine LGAs which fall within the oil palm belt, were selected by purposive sampling. Purposive sampling is when a deliberate sampling from a population becomes justifiable because some elements or local government areas are crucial to be included in the study. The selected LGAs are Aniocha South, Ika South, Ika North East and Ndokwa West. Four towns/villages were randomly selected from each of the 4 LGAs to give 16 towns/villages. The record of Delta State Agricultural Development Programme shows that there were 238 registered palm oil producers. Using simple random sampling, five males and five females were selected from each of the 16 towns/villages to give rise to 80 males and 80 females, that is 160 respondents.

Data were collected on the socioeconomic characteristics of the respondents. Data were also collected on responsibilities by gender for the different stages of palm oil production, cost of selected inputs, output of palm oil in litres, and decision-making roles by gender. Analyses of data were done using percentage, mean and mode for socioeconomic characteristics of respondents. Linear, semi-log and double log regression analyses were used to determine which socioeconomic characteristics contributed significantly to output of palm oil by gender. The implicit regression model can be stated as:

$$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}, X_{11}, e) \quad \text{Equation 1}$$

Where Y is output of palm oil (litres per annum), X_1 is gender (male = 1, female = 2), X_2 is age in years, X_3 is marital status, (married = 1, unmarried = 2), X_4 is education level (years of schooling), X_5 is years of experience, X_6 is quantity of oil palm bunches used (kg), X_7 is membership of cooperatives, X_8 is level of family labour (person-days), X_9 is cost of hired labour (₦), X_{10} is income level (₦), X_{11} is cost of processing method, and e is error term. The lead equation was selected as done by [14] which used the following criteria: (1) relative magnitude of R^2-values, (2) relative F-values, and (3) where more factors had statistically significant coefficients. Resource-use efficiency in terms of allocative efficiency for each input was computed. The first step was to determine the marginal value product (MVP) for each resource which is the product of marginal physical product (MPP) and the price of output per unit (P_y).

$$MVP = MPP.P_y \quad \text{Equation 2}$$

Depending on the functional form selected as a lead regression equation, MPP values were obtained as follows:

$$\text{For linear form, } MPP = dY/dX = b_i \quad \text{Equation 3}$$

$$\text{Semi-log, } MPP = b_i/y_i \quad \text{Equation 4}$$

$$\text{Double log, } MPP = b_i.Y_i/X_i \quad \text{Equation 5}$$

$$\text{Resource-Use Efficiency (RE)} = MVP/MFC \text{ or } MVP/P_x \quad \text{Equation 6}$$

Where

b_i = regression coefficient
Y_i = mean output of palm oil
X_i = Mean value of input
dY/dX = derivative of Y_i and X_i
P_x = Price of resource per unit
MFC = Marginal Factor Cost

Inferences were made on resource-use efficiency based on the following:

RE = 1 indicates optimal resource-use
RE > 1 indicates under utilization of resources
RE < 1 indicates over utilization of resources.

A t-test was used to determine whether men and women differed significantly in their quantity of palm oil production at 0.025 level of significance.

3. RESULTS AND DISCUSSION

3.1 Socioeconomic Characteristics of Respondents

The average age of palm oil producers in this study is 40.5 years. The respondents are predominantly married persons (70.6%), have middle education level and palm oil processing experience that averaged 13.5 years. The average annual income of the respondents is ₦515,999.10 ($2,195.74). It was found that 64.4% of the palm oil producers belong to cooperative societies. These characteristics of middle education level, low annual income and affiliation with cooperative society are in conformity with the findings of [15]. Details of the socioeconomic characteristics of the respondents are shown in Table 1.

3.2 Responsibilities by Gender in the Production Stages

Table 2 shows the responsibilities held by men and women during the various production stages of palm oil. The results show that men are predominantly responsible for bunch harvesting, quartering of bunches, stripping of fruits, digestion/pounding of fruits and oil clarification. Women are mainly involved in movement of fruits to processing site, fruit boiling or sterilization, milling/pulp pressing, preservation and marketing of palm oil.

Table 1. Distribution of respondents by socioeconomic characteristics

	Parameters	Frequency n = 160	Percentage (%)	Cummulative percent	Mean/mode
i.	**Gender**				-
	Male	80	50	50	
	Female	80	50	100	
ii.	**Age distribution**				40.5 years
	21-30 years	13	8.2	8.2	
	31-40 years	67	41.8	50	
	41-50 years	52	32.5	82.5	
	51-60 years	20	12.5	95	
	61-70 years	8	5.0	100	
iii.	**Marital status**				(Married)
	Single	10	6.2	6.2	
	Married	113	70.6	76.8	
	Separated	13	8.2	85	
	Widowed	24	15.0	100	
iv.	**Educational level**				(Completed
	No formal education	18	11.3	11.3	Sec. School)
	Attended primary school	26	16.2	27.5	
	Completed primary school	22	13.7	41.2	
	Attended Secondary school	32	20.0	61.2	
	Completed secondary school	49	30.7	91.9	
	Have tertiary education	13	8.1	100	
v.	**Processing experience**				13.5 years
	1-8 years	53	33.1	33.1	
	9-16 years	67	41.9	75	
	17-24 years	24	15	90	
	25-32 years	16	10	100	
vi.	**Cooperative membership**				(Member)
	Member of a cooperative	103	64.4	66.4	
	Not member of a cooperative	57	35.6	100	
vii.	**Income per annum (₦)**				₦515,999.10
	₦120,000 – 359,999	17	10.6	10.6	
	₦360,000 – 599,999	70	43.8	54.4	
	₦600,000 – 839,999	62	38.8	93.2	
	₦840,000 – 1,079,999	11	6.8	100	

Note: $1 = ₦235

3.3 Palm Oil Production Level by Gender

The difference between the means of palm oil production levels for men and women was tested by use of t-test. The mean output for 80 males and 80 females were 4,366.75 litres/annum and 3,441.87 litres/annum respectively. The result of the t-test shows that t_{cal} is 21.02, while t_{tab} is 1.96 for two-tailed test with df = 158 at 0.025 level of significance as shown in Table 3. This result shows that men and women are significantly different in their levels of palm oil production. This significant difference could be attributed to differential quantities of oil palm bunches used for processing annually by men and women, owing to differential opportunities for accessing farm inputs and credit. The differential opportunities cited here were alluded to by [10] who stated that women have more difficulty in securing farm inputs and credit.

3.4 Contribution of Socioeconomic Variables to Production Level by Gender

The contributions of ten independent variables to palm oil production level were determined by multiple regression for men and women. The results of the regression analyses are presented in Tables 4 and 5 for men and women respectively. Using a linear regression function as lead equation, the quantity of oil palm bunches used, cooperative membership and the cost of processing method made significant contributions to volume of palm oil produced by men. On the other hand, using a double - log function as lead equation, the quantity of oil palm branches, hired labour and cost of processing method determined women's level of palm oil production. All the variables combined explained 89.1% and 61.1% of the total variation in palm oil production level for men and women respectively. This study has shown that quantity of oil palm bunches available for processing determined to a large extent the output of palm oil derived. This finding is in consonance with the finding of [2].

3.5 Resource-Use Efficiency by Gender

Resource-use efficiency of palm oil processors in terms of allocative efficiency for men and women were determined. The results are shown in Tables 6 and 7. For both men and women, quantity of oil palm bunches used in terms of Kg weight is under utilized. Family labours, hired labour and cost of processing method are over utilized by men and women. The over utilization of family and hired labour found in this study are in conformity with the findings of [16] on the utilization of family labour and hired labour. This study has shown that there is no difference in resource-use efficiencies of men and women in palm oil production. This similarity in efficiency level for males and females is in agreement with the positions of [13] and [12]. For both gender to reach an optimum level, the resources which were over utilized should be reduced and a little more of palm oil bunches should be used.

Table 2. Responsibility profile of palm oil production stages by gender, n = 160

	Palm oil production stages	Male freq.	%	Female freq.	%
1	Bunch harvesting	158	98.7	2	1.3
2	Movement of fruits to processing site	53	33.1	107	66.9
3	Quartering of bunches	157	98.1	3	1.9
4	Bunch sterilization or boiling	30	18.8	130	81.2
5	Stripping of fruits	99	61.9	61	38.1
6	Digestion/Pounding of fruits	101	63.1	59	36.9
7	Pulp pressing/milling	48	30.0	112	70.0
8	Oil clarification	142	88.8	18	11.2
9	Preservation of palm oil	16	10.0	144	90.0
10	Marketing of palm oil	15	9.4	145	90.0

Table 3. Result of t-test for palm oil output by gender

Parameter	Males	Females	t_{cal}	t_{tab}
Mean output	4,366.75	3,441.87		
Variance	1,780.46	1,604.82	21.02*	1.96

** Significant at 0.05 under a two-tailed test (p = 0.025)*

Table 4. Summary of regression results for palm oil output by men

Predictors	Linear	Semi-log	Double log
Constant	602.389 (0.870)	1212.70 (0.835)	3.325 (19.546)
Age, X_1	0.015 (0.320)	0.090 (1.700)	0.041 (0.747)
Marital Status, X_2	0.005 (0.126)	0.014 (0.283)	-0.015 (-0.307)
Educational level, X_3	0.021 (0.494)	0.015 (0.303)	-0.012 (-0.249)
Processing Experience, X_4	-0.012 (-0.257)	-0.010 (-0.204)	-0.028 (-0.540)
Quantity of bunches, X_5	0.812 (21.250)*	0.793 (20.321)*	0.746 (17.994)*
Cooperative membership, X_6	0.083 (2.508)*	0.028 (0.589)	0.043 (0.904)
Family Labour, X_7	0.010 (0.263)	-0.001 (-0.031)	0.009 (0.194)
Hired labour, X_8	-0.018 (-0.442)	0.017 (0.366)	-0.019(-0.408)
Income level, X_9	0.013 (0.344)	0.0303 (0.667)	-0.016(-0.35)
Cost of processing, X_{10}	-0.521 (-3.861)*	-0.498 (-2.976)*	0.514 (-3.383)*
R^2	0.891	0.866	0.837
F	63.106	51.642	46.258

** Significant at 0.05. values in parentheses are t-values*

Table 5. Summary of regression results for women's palm oil output

Predictors	Linear	Semi-log	Double log
Constant	-0.353 (-0.221)	4244.97 (-1.463)	3.323 (8.980)
Age, D_1	-0.078 (-0.564)	-0.015 (-0.119)	-0.056 (-0.969)
Marital Status, D_2	0.195 (1.731)	0.151 (1.473)	0.213 (1.818)
Educational level,DX_3	0.007 (0.061)	0.019 (0.187)	0.091 (0.949)
Processing Experience, D_4	0.058 (0.494)	0.026 (0.255)	0.035 (0.358)
Quantity of bunches, D_5	0.587 (5.186)*	0.605 (5.765)*	0.621 (6.041)*
Cooperative membership, D_6	0.072 (0.659)	0.900 (0.881)	0.097 (0.997)
Family Labour, D_7	0.095 (0.974)	0.059 (0.635)	0.058 (0.658)
Hired labour, D_8	0.078 (0.772)	0.077 (0.813)	0.105 (2.612)*
Income level, D_9	0.039 (0.389)	0.065 (0.673)	0.079 (0.865)
Cost of processing, D_{10}	-0.484 (-3.891)*	-0.532 (-4.510)*	-0.579 (-4.966)*
R^2	0.482	0.538	0.611
F	4.897	6.028	7.153

** Significant at 0.05. values in parentheses are t-values*

Table 6. Resource-use efficiency for men using linear function

Resources	MPP (b_i)	P_y (₦)	MVP (MPP. P_y)	MFC (₦)	Efficiency (MVP/MFC)	Decision
Quantity of oil palm bunches	0.812	125/litre	101.5	100/bunch	1.02	Under utilization
Family labour	0.010	125/litre	1.25	1200/md	0.001	Over utilization
Hired labour	-0.018	125/litre	-2.25	1200/md	-0.002	Over utilization
Cost of processing method	-0.521	125/litre	-65.125	40/litre	-1.63	Over utilization

3.6 Decision Making Roles of Men and Women

Results in Table 8 show that on key decision making areas of palm oil production, men dominated in two aspects. They are type and cost of labour and time to do harvesting of fruits. What to do with income from palm oil is the prerogative of both men and women. Women dominated four out of seven aspects of decision making. They are processing methods, where to sell, quantity to sell and price at which to sell. It was found that sometimes both men and women jointly take a decision in the performance of their roles.

Table 7. Resource-use efficiency for women using double-log function

Resources	Regression coefft. (b_i)	MPP ($b_i . Y_i/X_i$)	P_y (₦)	MVP (MPP. P_y)	MFC (₦)	Efficiency (MVP/MFC)	Decision
Quantity of oil palm bunches	0.621	0.919	125/litre	114.9	100/bunch	1.15	Under utilization
Family labour	0.058	0.080	125/litre	10	1200/md	0.008	Over utilization
Hired labour	0.105	0.145	125/litre	18.13	1200/md	0.015	Over utilization
Cost of processing method	-4.966	-1.259	125/litre	-157.4	40/litre	-3.94	Over utilization

Table 8. Distribution of decision making roles by gender in palm oil production

Decision making roles	Gender distribution		
	Male (%) n = 80	Female (%) n = 80	Both (%) n = 160
1. Type & Cost of farm labour	60.6	26.9	12.5
2. Harvesting time	63.8	21.8	14.4
3. Processing methods	18.8	59.4	21.8
4.Where to sell	14.4	70.0	15.6
5. Quantity to sell	36.9	40.6	22.5
5.Price at which to sell	22.5	43.1	34.4
6. What to do with income	22.5	20.0	35.0

4. CONCLUSION AND RECOMMENDATIONS

This study found that the profile of the palm oil producer in Delta State is a man or a woman with an average age of 40.5 years, generally married with a low education level and average income of ₦515,999.10 ($2,195.74) per annum. On responsibilities held by men and women, it was found that the men featured more in oil palm bunch harvesting and quartering of bunches, while women were more involved in bunch sterilization and preservation of palm oil.

It can also be concluded that men differed significantly from women in palm oil production level in Delta State. The socioeconomic variables that contributed significantly to palm oil production by men were: The quantity of oil palm bunches used, cooperative membership and the cost of processing method. For women, the quantity of bunches used, hired labour and cost of processing made significant contributions to palm oil production level. It was also found that there was no difference in resource-use efficiencies of men and women in palm oil production. On decision making roles, more men took decisions on the type and cost of labour as well as time of harvesting, while women mostly took decisions on processing methods and where to sell the palm oil. The roles performed by men and women differ in palm oil production. The gender roles depended on the stage of production of palm oil and the kind of decision desired.

Given that men and women differed significantly in palm oil output, it is recommended that women be provided more opportunities for accessing farm inputs, land area and credit. In this way, the output of women will increase beyond what this study found. Given that there was no difference in resource-use efficiencies of men and women, it is recommended that the inefficiency in the entire palm oil production system should be addressed without specificity for gender. Since the cost of processing affected output of both genders, men and women should utilize better palm oil processing techniques that are less expensive and can save the cost of hired labour.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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