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Determinants of Level of Engagement in Oil Palm Processing among Rural Households in Southeast Nigeria

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Abstract
The study provided empirical evidence of the determinants of level of engagement in oil palm processing among rural households in Southeast Nigeria. The specific objectives were to; describe the socioeconomic characteristics of the respondents, ascertain the level of household's engagement in processing of oil palm produce, and estimate the costs and returns from processing oil palm produce. The study made use of multi-stage random sampling procedure in selecting 540 respondents. Data for the study were collected with the use of structured questionnaire and analyzed with the use of both descriptive (frequency, percentage, mean and gross margin) and inferential statistics (regression model). Results show evidence of high level engagement in the processing of oil palm (3.67). F–statistics was significant at 1% indicating goodness of fit of the model used. The coefficients of household size (5%), level of education (5%), processing experience (5%), income (1%) and labour cost (1%) significantly influenced level of engagement in the processing of oil palm in Southeast Nigeria. The study concludes that rural households in the study area were highly engaged in the processing of oil palm processing as a profitable livelihood activity. It was therefore recommended that young and educated youths should be encouraged by government at all levels to engage in oil palm processing since the enterprise was dominated by rural households who were relatively young, active, experienced and educated.

Keywords: Determinants, oil palm, processing, level of engagement

Introduction

Oil palm (*Elaeis guineensis*) is one of the most important economic oil crops in Nigeria, and indigenous to the Nigerian coastal plain, though it has migrated inland as a staple crop (Alabi *et al*., 2020; Nwalieji and Ojike 2018 and Udo and Essien, 2018). The global growing demand for palm oil is making oil palm cultivation becoming a means of livelihood for many rural families, and indeed the farming culture of millions of people in Nigeria, especially South-East region. The oil palm tree is a useful crop that is relevant in all aspects of live with socioeconomic and socio-cultural values. The reference to oil palm as a crop of multiple value underscores its economic importance. Oil palm is made of essential components, namely; the fronds, the leaves, the bunch, fruit, the trunk and the roots etc. Oil palm provides a lot of resources ranging from palm oil, palm kernel oil, palm wine, broom, and palm kernel cake (Nwalieji and Ojike 2018). Oil palm processing and its value addition have the potential to strengthen national food security and reduce rural poverty. The extra value like vegetable oil, palm kernel oil, native soap, can be used for commercial purposes, which serve as a source of income. Also, processing of palm kernel by small scale producers has the ability to increase income, reduce rural unemployment, rural poverty and wastage in oil palm processing (Sarku, 2014).

Bassey (2016) reported that Nigeria was the leading producer and distributor of palm oil until the petroleum (oil) boom of the late 1970's. Data from Gourichon (2013), Statista (2017), Palm Oil Analytics (2017), amongst many, shows that Nigeria and other West Africa countries have generally been stagnated or subjected to critical fluctuation of palm oil production, which is a major source of income and employment to a substantial proportion of the rural populace in the southern part of the country. However, the decline in agricultural output and export, particularly with regards to oil palm processing and value addition is not conducive for the economic development of the nation. More so, that high labour costs in oil palm processing, non-availability of good roads in prospective high producing areas and dearth in the sources of credit facilities and infrastructure needed in the processing of oil palm, have also contributed immensely in a negative

manner to affect value addition processes (Edem, 2012 and Gourichon, 2013).

Furthermore, Nwalieji and Ojike (2018) asserted that other fundamental problems such as tenure-right which is mostly tenancy-right through leasing and rent, lack of land for planting of oil palm trees, inefficient methods of harvesting and conveying oil palm fruits, poor market price also pose serious challenges to oil palm processing among rural dwellers in the study area. It is equally reported by the operators that the business has been facing series of challenges ranging from lack of mechanized processing, poor produce pricing by middlemen, lack of storage facilities, lack of capital for large-scale production and expansion, lack of credit facilities by micro-finance banks, and long period of maturity. The situation thus appears in Nigeria that neither large-scale monocultures nor small-scale holdings seem able to provide answers to problem of the scarcity of palm oil in one of the countries, which the oil palm is native.

Methodology

The South-East Agro-ecological Zone of Nigeria was the main focus of the study. The Zone lies between latitude 6° and 9°E and 4° and 7°N longitude, and has a total land mass of 952,400 hectares. The zone has a projected population estimate of 21,955,414 and is made up of five states viz: Abia, Anambra, Ebonyi, Enugu and Imo (NPC, 2019). The population density is 173 persons per square kilometer (Umeh, 2018). About 60-70% of the inhabitants engage in agriculture; mainly crop farming and animal rearing (Umeh, *ibid).* The study population comprise of all rural households who engage in oil palm production in South–East Nigeria. Multi-stage sampling procedure was used in the selection of the 540 respondents for the study. The 1st stage involved the selection of three States from the zone using Simple Random Sampling (SRS) technique. The 2nd stage involved the selection of 6 (six) Local Government Areas (LGAs) from the States selected using SRS. This gave a total of 18 (eighteen) LGAs. The 3rd stage involved the use of SRS in selecting 3 Communities each from the selected LGAs bringing the total to 54 Communities. The 4th and final stage involved the selection of ten (10) respondents each from the communities' selected using SRS technique. A total of 540 (five hundred and forty) respondents constitute the sample size for the study. The study made use of primary data collected using structured questionnaire. Data for the study were analyzed using both descriptive (frequency, mean, gross margin model) and inferential statistics (multiple regression). To describe the socioeconomic characteristics of the respondents; this was measured using frequency and percentage. To ascertain the level of household's engagement in processing of oil palm fruit, this was measured using mean count. Engagement of respondents in oil palm produce processing was operationalized by using frequency or level of engagement. Extent of engagement was captured with 5-point Likert type measurement scale of very high, high, moderate, low and very low. Furthermore, 'very high' was assigned the highest scale of 5 graded downwards to 'very low' with lowest scale of 1. Mean scores were computed for each respondent by adding 5+4+3+2+1 and divided by 5 which gave a mean of 3.0. The maximum weighted score of 5 was further divided by 3 to obtain the class interval of 1.33. Thus the class interval (1.33) was successively deducted from the maximum mean scores to obtain the three categories of household's engagement levels as employed by Ekwe (2019). As a result, class ranges for the three categories of household's engagement levels emerged as follows 0.00-2.33 = low engagement; 2.34 -3.66 = moderate engagement and 3.67-5.00 = high engagement. Gross margin model was employed in estimating the cost and returns in oil palm processing, while multiple regression model was used in estimate the determinants of level of engagement in oil palm processing. The OLS/Multiple regression expressed implicitly as follows;

$$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}, X_{11}) + e$$

Where;

Y = extent of engagement oil palm processing (mean score)

X_1 = Age (years)

X_2 = Sex (dummy variable; 1=male, 0=female)

X_3 = Marital status (dummy variable; 1 = married, 0 = single)

X_4 = Household size (number of persons)

X_5 = Level of Education level (Number of years spent in school)

X_6 = Processing experience (years)

X_7 = Monthly income (Naira)

X_8 = Major occupation (dummy variable; farming =1, others =0)

X_9 = Distance to processing centre (km)

X_{10} = Labour cost (Naira)

X_{11} = Transport cost (Naira)

e = error term

Results and Discussion

Socioeconomic characteristics of the respondents

Age

The result on Table 1 showed that the mean age of the respondents in the study area as 43 years. Across the states, the mean age of the respondents were 47, 42, and 40 years in Anambra, Imo and Abia States respectively. The result implies they were relatively young, active, productive and should be able to undertake the strenuous tasks of oil palm processing. This further highlights the importance of youths in oil palm enterprise. This result conforms to the findings of Nzeakor (2014) also found that most of oil palm farmers were still in their active working years and argued that oil palm processing as with other agricultural production or processing activities is very exhausting and maybe too strenuous for an elderly person.

Marital status

The result on marital status of the respondents showed that a large proportion (70.0%) of the respondents was

married. The result across the States equally revealed that about 77.2% in Anambra, 67.8% in Abia and 65.0% in Imo were married. The result implied that married people in most rural households engage in oil palm processing in-order to ensure both food security and increased income to improve the standard of living of their households. This also shows that oil palm processing in the area is an enterprise of married individuals, who were seen to be responsible according to societal standards. Onumadu *et al*. (2014) agreed with the result and asserted that marriage is an important factor in the livelihood of individuals in our society as it is perceived to confer responsibility on individuals.

Household size

The result of the household size of the respondents showed that the mean household size of the respondents in the study area was 8 persons. The result further shows that the mean household sizes across the states were 7.8, 7.5 and 6.4 for Imo, Anambra and Abia respectively. The result implies that the respondents had a relatively small household size in the study area. In agreement with result, Nwaobiala (2013) in their studies found a relatively small household size among their respondents, but argued that more family labour would be readily available since household size is an obvious advantage in terms of farm labour supply, where wage rate is relatively costly.

Level of Education

The distribution of the respondents based on their educational level was also presented. The result showed that about 43.7% of the respondents in the study area had secondary education, 28.5% had primary education, 26.5% had tertiary education, while 3.1% had no formal education. The result implies that most of the rural dwellers in the Southeast had formal education. This result equally agrees with the findings of Nzeakor (2014) and Odoemelam (2019) who found that majority of the farmers in Southern Nigeria had formal education.

Processing experience

The result on the processing experience of the respondents was presented on Table 1. The result showed that the mean processing experience of the respondents was 27.0 years in the study area. Across the States the result revealed that the mean processing experience of the respondents as 31.6 years in Imo, 27.5 years in Anambra and 22.0 years in Abia. The result implies that the respondents had good experience in the processing of oil palm produce in the study area.

Extent of household's engagement in processing of oil palm

Data on the mean rating of the respondents on level of household's engagement in processing in the study area were analyzed and presented on Table 2. The result revealed a grand mean of 3.67; affirming that the respondents in the study area were highly engaged in the processing of oil palm produce. The results across the States equally showed that the level of engagement of rural households in oil palm processing in Imo was high as affirmed with the grand mean of 4.03, while those in Anambra and Abia were moderately engaged with grand mean of 3.58 and 3.35 respectively. The result implies that rural households in Southeast Nigerian engage in the processing of oil palm produce as a profitable livelihood activity. Alabi *et al.* (2020) asserted that oil palm fruits postharvest activities were not only providing employment opportunities for the owners alone, but also serve as a means of employing others who could have been jobless. This implies that these activities have entrepreneurial capabilities that could enhance the socio- economic status of rural households if well exploited. The active involvement of respondents observed in almost all the processing activities could be an indication that they were smallholder operators using manual labour for the majority of the activities.

Estimate of the costs and returns from processing of oil palm produce

The result on Table 3 showed that the total returns from oil palm produce in the study area was ₦910,946.0 only. The total cost for oil palm processing among rural households in the study area was ₦348,544.3. The estimated gross margin from the oil palm produce processing was ₦562,401.7, while the benefit cost ratio was 2.40. The result of the gross margin implies that oil palm processing is a profitable in the study area. The benefit cost ratio implies that that for every one naira invested in oil palm processing, it will earn two naira forty kobo (₦2.40) in return. Where there is adequate and efficient management, of the field, the gross margin could be higher as well as the benefit cost ratio. The result across the States followed the same trend. The gross margin and benefit cost ratio for oil palm produce processing were ₦247,076.3 and 3.17 respectively for Imo, ₦161,755.5 and 2.05 for Anambra and ₦160,248.3 and 2.19 for Abia in that order. These results indicate gross margin across the States revealed that processing of oil palm produce were profitable, while the benefit cost ratio indicated that for every one naira (₦1) in the marketing of oil palm produce, will earn three naira seventeen kobo (₦3.17) in Imo, two naira five kobo (₦2.05) in Anambra and two naira nineteen kobo in Abia (₦2.19). This agrees with Nwalieji and Ojike (2018) that oil palm processing is profitable.

Socioeconomic determinants of level of engagement in oil palm processing

Table 4 show the multiple regression analysis of the relationship between the selected socioeconomic characteristics of the respondents and their level of engagement in the processing of oil palm produce in Southeast Nigeria. The four functional forms of multiple regression were tried and semi-log function was chosen as the lead equation. The lead equation was chosen based on the magnitude of R^2 value and number of significant variables and their conformity to *a prior* expectation. The R^2 (coefficient of multiple determination) value was 0.708 which indicates that about 70.8% of the total observed variations in the dependent variable (Y) were accounted for, while, other variations were due to error. F–statistics was significant

at 1%, indicating the fitness of the model used. The coefficients of household size (5%), level of education (5%), processing experience (5%), income (1%) and labour cost (1%) significantly influenced level of engagement the processing of oil palm in Southeast Nigeria. The coefficient of coefficient of household size was positive and significant at 5% level of probability. This result implies that an increase in household size will result to a corresponding increase in the level of engagement in the processing of oil palm in the study area. The result agreed with Odoemlam (2019) that the increase in household size suggests that more family labour would be readily available since relatively large household size is an obvious advantage in terms of labour supply, where wage rate is relatively costly. The coefficient of education was positive and significant at 5% level of probability. The result implies that an increase in the level of education of the respondents in the study area will lead to a corresponding increase in the level of engagement the processing of oil palm produce in the study area. The result conforms to the researchers *a prior* expectation that education enhances farmer's technical and managerial competence in oil palm production and production efficiency. The coefficient of production experience was statistically significant at 5% and positively related to level of engagement in oil palm processing in the study area. The result implied that a unit increase in the years of processing experience will lead to an increase in the level of engagement in the processing of oil palm produce. Okoronkwo *et al*. (2020) and Odoemlam (2019) found that farming experience has been shown to enhance the participation and adoption of improved farming techniques by farmers thereby increasing agricultural output. The coefficient of income was significant at 1% and it is positively related. This implies that a unit increase in income will lead to an increase in level of engagement in oil palm processing in the study area. This may be attributed to the fact that an increase in income will enable the farmer to adopt improved farm technologies, secure farm inputs and relevant agricultural information. Nzeakor (2014) in agreement with the findings asserted that more household income will boast the ability of farmers to invest more in agricultural enterprises. The coefficient of labour cost was statistically significant and negatively related to level of engagement in oil palm processing in the study area. This result implies that any increase in the labour cost of the farmers will lead to a corresponding decrease in the level of engagement in oil palm processing in the study area. This explains why most farmers instead of patronizing palm oil mills resort to using traditional methods in the processing of oil palm produce in the study area.

Conclusion

The study concludes that rural households in the study area highly engage in the processing of oil palm produce as a profitable livelihood activity. The oil palm industry remains a source of livelihood to a large proportion of households in the rural areas of Southeast Nigeria. It was very evident that oil palm production is an essential livelihood activity which is not only profitable but employs and feed several rural households in the study area. Based on the findings of the study some recommendations were made. Young and educated youths should be encouraged by government at all level to engage in oil palm processing since the enterprise was dominated by rural households who were relatively young, active, processing, experienced and educated. Campaigns, publication and awareness creation is needed to re-emphasize the need for rural households to engage in oil palm processing as a panacea to unemployment among rural households in Southeast Nigeria. If government at all levels is sincere in reducing unemployment in Nigeria, then youth engagement in oil palm industry is a viable solution.

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Table 1: Socioeconomic characteristics of the respondents in the study area

Variables	Abia (n = 180)		Anambra (n = 180)		Imo (n = 180)		Southeast (n = 540)	
Age (years)	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**
18-28	19	10.6	4	2.2	5	2.9	28	5.2
29-38	46	25.6	40	22.4	24	13.4	110	20.4
39-48	75	41.7	74	41.3	63	34.1	212	39.3
49-58	23	12.8	52	29.0	60	33.2	135	25.0
59-68	17	9.4	10	5.1	28	15.7	55	10.2
Mean		**39.8**		**47.2 years**		**41.7 years**		**42.9**
Marital status								
Single	41	22.8	17	9.4	20	11.1	78	14.4
Married	122	67.8	139	77.2	117	65.0	378	70.0
Widowed	7	3.9	20	11.1	16	8.9	43	8.0
Separated	10	5.6	4	2.2	27	15.0	41	7.6
Household size								
1 – 3	21	11.7	18	10.0	25	13.9	64	11.9
4 – 7	106	58.9	84	46.6	108	60.1	298	55.2
8 – 11	37	20.5	53	29.4	44	24.5	134	24.8
12 – 15	16	8.9	25	13.8	3	1.7	44	8.1
Mean		**6.4**		**7.5**		**7.8**		**7.2**
Level of education								
No formal education	4	2.2	11	11.7	2	1.1	17	3.1
Primary education	61	33.9	58	32.2	35	19.4	154	28.5
Secondary education	65	36.1	82	45.6	89	49.4	236	43.7
Tertiary education	50	27.8	39	21.7	54	30.0	143	26.5
Processing experience								
1-10	77	42.8	54	30.0	50	27.8	181	33.3
11-20	24	13.3	65	36.1	88	48.9	177	32.8
21-30	21	11.7	46	25.6	35	19.4	102	18.9
31-40	58	32.2	15	8.3	7	3.9	80	14.8
Mean		**22years**		**27.5years**		**31.6years**		**27.0**
Monthly income (₦)								
10,000 --100,000	79	43.9	64	35.6	58	32.2	201	37.2
101,000 - 200,000	86	47.8	97	53.9	118	65.6	301	55.7
201,000 - 300,000	15	8.3	16	8.9	4	2.2	35	6.5
301,000 – 400,000	-	-	3	1.7	-	-	3	0.6
Mean		**103,438.5**		**113,871.8**		**132,609.5**		**116,639.9**

Source: Field Survey, 2020

Table 2: Mean rating of the respondent's level of household's engagement in processing in the study area

Processing of oil palm produce	Abia (n = 180)		Anambra (n = 180)		Imo (n = 180)		Southeast (n = 540)	
	$\sum f(x)$	$\bar{x}$	$\sum f(x)$	$\bar{x}$	$\sum f(x)$	$\bar{x}$	$\sum f(x)$	Pooled $\bar{x}$
Threshing or bunch quartering	641	3.56	773	4.32	654	3.63	2074	3.84
Fruit loosening	747	4.15	617	3.45	759	4.22	2128	3.94
Boiling,	794	4.41	648	3.64	773	4.32	2225	4.12
Digestion,	445	2.47	539	3.00	783	4.35	1767	3.27
Pressing/oil extraction,	468	2.60	584	3.24	666	3.70	1118	3.18
Clarification and	457	2.54	628	3.49	630	3.52	1715	3.18
Packaging	639	3.55	693	3.85	728	4.07	2060	3.82
Storage	626	3.48	652	3.62	800	4.46	2078	3.85
Grand mean		**3.35**		**3.58**		**4.03**		**3.67**

Source: Field Survey, 2020

Table 3: Gross Margin estimate of the quantity processed and income generated from oil palm processing in the study area

Variables	Abia Average amount (₦)	Anambra Average amount (₦)	Imo Average amount (₦)	Southeast Average amount (₦)
Returns (R)				
Palm oil (litres)	186305.0	237405.0	281855.0	705565.0
Palm wine (litres)	68000	39420.0	9000	116420
Palm kernel (kg)	14400.0	12182.0	27433.8	54015.8
Palm kernel shell	7440.4	5300.5	12050.2	18094.7
Baskets	-	-	16850.5	16850.5
Total Returns (TR)	276,145.4	294,307.5	347,189.5	910946.0
Fixed Costs (FC)				
Machete	3300.5	1550.5	1300.5	6151.5
Spade/shovel	4250.0	1500.0	4250.0	10000.0
Basin/head pan/basket/drums	7283.4	10500.0	7283.4	25066.8
Wheel barrow	19650.0	36566.0	29650.0	85866.0
Weighing scale	15050.2	10200.5	8550.0	33800.5
Pressing machine	39508.3	42450.9	27800.0	109759.2
Wooden/cemented mortar	11540.5	7488.5	14830.8	33859.8
Total Fixed Cost (TFC)	100582.9	110256.4	93664.7	304503.8
Depreciated Fixed Cost (DFC)	10,058.3	11,025.6	9.366.5	30450.4
Variable Cost (VC)				
Harvesting cost	13077.8	18,542.0	21448.5	53068.3
Processing cost (service charge)	25233.8	17,500.0	9912.5	52646.3
Cost of firewood	4079.3	3200.0	2476.8	9755.8
Cost of water used for processing	513.5	210.0	149.3	872.8
Labour cost	12313.0	38,650.0	30924.6	81887.6
Transport cost	4041.2	5480.0	10848.8	20370.0
Storage cost	27262.2	48,970.0	16911.1	93143.3
Other costs	2058.3	-	7441.6	9499.9
TVC	115,879.1	132,552.0	100,113.2	348,544.3
TC (TFC + TVC)	125,937.4	143,577.6	109479.7	378,994.7
GM (TR – TVC)	160,248.3	161,755.5	247,076.3	562401.7
BCR (TR/TC)	2.19	2.05	3.17	2.40

Source: Field Survey, 2020

Table 4: Multiple regression analysis of the relationship between the selected socioeconomic characteristics of the respondents and their level of engagement in the processing of oil palm produce in the study area

Variables Parameters	Abia Cobb Douglas+	Ebonyi Cobb Douglas+	Enugu Linear +	S/E Semi-Log +
Constant	24.578 (4.238)**	8.150 (6.913)***	6151.804 (10.334)***	1.324 (10.545)***
Age	-447.06 (-1.310)	-0.511 (-0.44)	-891.993 (-1.400)	-0.743 (-1.551)
Sex	4.123 (1.090)	0.009 (0.907)	648.511 (1. 348)	0.370 (1.672)
Marital status	18.923 (0.950)	0.004 (1.132)	309.629 (1.050)	0.071 (0.830)
Household size	82.300 (2.596)**	0.077 (3.907)***	35.354 (7.101)***	0.117 (2.685)**
Level of education	9.592 (8.690)***	0.002 (3.570)***	420.526 (1.962)**	2.003 (2.033)**
Processing experience	28.923 (5.950)***	0.004 (0.132)	399.629 (5.050)***	0.071 (1.930)**
Monthly income	11.125 (13.307)***	5.368E-5 (5.044)***	164878.706 (9.803)***	.844 (4.788)***
Major occupation	33.500 (0.743)	0.014 (0.390)	320.904 (0.613)	0.045 (0.255)
Distance to processing center	0.001 (0.860)	2.301 (0.988)	52.349 (7.330)***	0.107 (0.716)
Labour cost	3324.578 (2.228)**	8.150 (8.913)***	6651.804 (11.334)***	1.324 (3.545)***
Transport cost	18136.906 (0.768)	.037 (0.121)	31148.830 (1.998)*	.150 (0.198)
R^2	0.887	0.617	0.890	0.708
R Adjusted	0.861	0.538	0.866	0.508
F – Ratio	34.833***	7.157***	18.966***	26.038***

Field Survey, 2020

Key: ** and *** Significance at 5% level of probability, + = Lead Equation and the values in bracket are the t-values