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COMPARATIVE ANALYSIS OF USE OF TRADITIONAL AND MODERN METHODS OF PALM OIL PROCESSING AMONG RURAL FARMERS IN ABIA STATE, NIGERIA

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ABSTRACT
This study investigated the comparative analysis of the use of modern and traditional method of palm oil processing among rural farmers in Abia State, Nigeria. The study estimated the cost and returns of palm oil processing, determined factors influencing output of palm oil processing and identified the constraints to use of traditional and modern processing methods. Multistage sampling techniques was used in selecting 120 palm oil processors in the study area. Data were collected with use of structured questionnaire and analyzed with both descriptive and inferential statistics. The major findings showed that modern method of palm oil processing was more profitable than the traditional method with a BCR of 11.8 as against that of 1.30. The study also found that age (10%), education (1%), household size (1%), farming experience (1%), income (1%) and access to credit (5%) were the factors influencing output of palm oil in the study area. Inadequate land, lack of credit, lack of electricity, high cost of transportation among others were some of the constraints in processing of palm oil. There was a significant difference at 1% alpha level in the income from traditional modern processing method. The study therefore concluded that using modern processing method was more profitable than the traditional method. It was recommended that farmers should be aided in the use of modern techniques of processing through relevant and regular extension contact because most times underutilization is due to lack of experience.

Keywords: Palm Oil, Modern and Traditional, Processing Methods

INTRODUCTION

Nigeria has a long history of palm oil production. It was its primary export in late part of the 19th century and the early part of the 20th century (Abdullahi, 2004). Like other countries in the region, Nigeria has failed to take palm oil production beyond mere potential. This is due to the use of traditional methods of production coupled with the low quality of palm oil produced which could not make Nigeria to meet up with the rising global and domestic demand. Its current annual production is put at 120,000MT down from 128,000 in 2018 (PIND, 2019). The domestic consumption level is estimated to be around 230,000MT per annum. The shortfall is being filled by import at great cost to the country.

According to Adegeye, and Adegeye (2000), the palm oil industry in Nigeria since independence has been geared towards meeting domestic demand and thus reducing import bills, (i.e. it has largely been an import substitution industry). The growth in oil palm cultivation from the 1970s was in response to the increase in domestic demand as a result of growth in population, urbanization and industrialization. The structure of the palm oil industry in Nigeria has been shaped by the presence of two different markets: home consumption and industrial use in domestic manufacturing (Afoakwa and Sakyi-Dawson, (2013). As a result, Nigeria's industry has two sub-sectors which are largely separated. The industrial use sub-sector consists of medium and large scale oil palm plantations and mills. Processing mills under large scale sub-sector process more than 10 tonnes fresh fruit bunches (FFB) per hour while installations that process between three and eight tonnes FFB per hour are termed medium scale (Poku, 2013). Large sub-sector is characterized by more efficient technology, economies of scale, higher productivity on farms (in terms of yields of oil palm bunches) and in mills (in terms of quantity of oil extracted). It also produces better quality of crude palm oil and further refined palm oil products, which are sold to companies for use in manufacturing. The small scale sub-sector, however, consists of household processors (who process manually and private smallholder oil palm cultivators, who largely sell their fruit bunches to small scale mechanized mills (Processing units handling up to 2 tonnes of fresh fruit bunches (FFB) per hour) (Poku, 2013). The small scale sub-sector is characterized by low-yielding oil palm variety, low productivity of farm and mill, and low quality crude palm oil which is sold in the village or at small town markets ((Afoakwa and Sakyi-Dawson, (2013).

Basically, there are two methods of processing palm oil, the traditional and the industrial. Within these two major methods, there are widespread variations. They all apply physical means in processing to obtain crude oil. Chemicals are used if they have to go through the refining, bleaching and deodorizing (RBD) stages. Sokoudjou (2004), has detailed the various stages of processing fats and oils, which generally applies to palm oil as well. These processes may alter significantly the quality of the palm oil; each may be determined by the quality indices which are basically chemical or physical in nature. For example RBD reduces the level of carotenes in palm oil.

The local method is a very laborious process. The palm bunches are quartered and left overnight for easy separation of nuts from the spikelet. The fruits are boiled for 1.0 to 1.5 hours, pounded in a mortar or macerated with feet in a canoe-like container. Water is added and well-shoveled up. All nuts are carefully removed out by hand. The fibres are well-shaken over in the sludge until oily foam floats to the surface of the sludge. The foams continue to collect in a container until the operation is completed. This is later boiled in pot for about 30-40 minutes. The clean edible oil then collects on the surface leaving the dirty oil at the bottom of the pot.

The modern method uses such simple machines as presses to more sophisticated palm oil mill in processing fresh fruit bunch (FFB) into palm oil and other products (CTA, 2000). Palm oil mill consists of a series of operations designed to separate the harvested bunch into distinctive fractions – stalk, fruit, fibre, oil, sludge, nut, and kernel and so on. These operations are: sterilization, stripping, digestion, crude oil extraction clarification, kernel extraction.

According to Lawal (2010), processing method affects the quality and quantity of palm oil produced. There is still a confusion about the method of palm oil processing that will be viable that is efficient and effective. Many studies have concluded that modern method of palm oil processing is more efficient and effective in producing both quality and quantitative palm oil (Ohimain, Oyedeji, and Izah, 2012).), still others have opposed such view as Okiy, Nwawe and Ikheloa (2006), says that the traditional method of processing produces quality palm oil than the modern method in a study that analyzed the farmers perception of the advantage of the various processing techniques. More so, the cost and return of the two processing techniques have been in debate as some studies claim that traditional method of processing is cost effective, while some studies say that the modern method although not cost effective but rake in more returns than the traditional method. Based on this confusion, this study did a comparative analysis of the two methods of processing, namely traditional and modern so as

to ascertain their extent of use as well as cost and return among rural households in Abia State, Nigeria.

i. estimated the cost and returns of traditional and modern method of palm oil processing;
ii. determined the factors influencing the output of the oil palm processing techniques used; and
iii. identified the constraints to use of traditional and modern methods of oil palm processing

METHODOLOGY

A total of 120 oil palm producing farm households were selected from the three agricultural zones of Abia State. A multi-stage stratified random sampling technique was adopted in selecting respondents. First, all the 17 LGA's were listed to form a separate sampling frame from the three zones. Two Local Government Areas (LGA's) with high concentration of oil processors was purposively selected from each of the zones making a total of 6 LGA's, from the state. Secondly, from each of the 6 LGA's, four farming communities with high palm oil processing capacity were purposively selected. The essence of the purposive selection is to ensure that rural communities whose major occupation is farming and that has high concentration of palm processing farmers were selected. Thirdly, in each of the 24 communities/villages, respondents were randomly selected for the study. This made a total of 120 palm oil processors in the study area. The study made use of primary data through the use of questionnaire. Both descriptive and inferential statistics were employed in analyzing the data for the study.

Objective 2 was analyzed using OLS/Multiple regression expressed implicitly as follows.

$Y = f(X_1\ X_2\ X_3\ X_4\ X_5\ X_6\ X_7, X_8 X_9 X_{10} X_{11} X_{12,}\ X_{13}, ei)$

The four functional forms of OLS in explicit form is specified as;

Linear Function

$Y = ß + ß_1 + x_1 + ß_2 x_2 + \ldots\ldots\ldots\ldots\ldots\ldots\ldots ß_n x_{n+} ei$

Exponential function

$LogY = ß + ß_1 + x_1 + ß_2 x_2 + \ldots\ldots\ldots\ldots\ldots\ldots\ldots ß_n x_{n+} ei$

Semi-log function

$ß_0 + ß_1 lnx_1 + ß_2 lnx_2 \ldots\ldots\ldots ß_n lnx_{n+} ei$

Cobb Douglas function

$Log\ Y = ß_0 + ß_1 lnx_1 + ß_2 lnx_2 \ldots\ldots\ldots ß_n lnx_{n+} ei$

Where,

Y = level of access to maternal healthcare services (mean score)

X_1 = Age (years)

X_2 = Education level (Number of years spent in school)

X_3 = Marital status (1 = married, 0 = single)

X_4 = farm size (ha)

X_5 = farmers experience (years)

X_6 = household size (number of persons)

X_7 = farm output (km)

X_8 = cost of labour (₦)

X_9 = farm income (₦)

X_{10}= access credit (₦)

e = error term

3.0 RESULTS AND DISCUSSON

3.1 Average cost and returns of palm fruit processing

From the cost analysis as presented in Table 1, returns per naira invested in palm oil production were evaluated by dividing their net revenue by the total cost. For traditional method, the total variable cost was computed by taking a sum of the following costs: labour cost, transport cost, storage cost and other cost. The total fixed cost included cost of processing equipment and depreciated cost. For modern method, the total variable cost includes cost of labour/man-day, threshing cost, par boiling cost, cost of water, firewood, extraction, clarification and transportation.

From the result, the total variable cost stood at ₦138,650.00 and ₦ 61,978.60 for traditional and modern methods respectively, the total cost stood at ₦ 148,970.00 and ₦ 113,207.80 for traditional and modern methods respectively. The total revenue were 193,500.00 and 1,330,924.60 for traditional and modern methods of processing respectively, while the gross margin were at 54,850.00 and 1,268,946.00 for the traditional and modern method of

processing respectively. The profitability for traditional method of processing was 1.30, which implies that for every ₦1.00 invested in palm oil production using traditional methods will yield ₦0.30 in revenue in the area. The profitability for the modern method of processing shows a B/C ratio of 11.8, which implies that for every ₦1.00 invested in palm oil production using the modern method will yield ₦10.8 in revenue in the area.

Table 1: Average Cost and Returns estimate of Palm fruit processing in the study area

Traditional method	**Item value/month**
Returns	
Total Revenue (TR)	193,500.00
Fixed cost	
Cost of processing equipment	103,200.00
Depreciated cost	10320.00
Variable cost	
Labour cost	12,540.00
Transport cost	17,500.00
Storage cost	3200.00
Other costs	2210.00
Total Variable cost (TVC)	138,650.00
Total Cost	148,970.00
Gross Margin (TR – TVC)	54850.00
Profitability (Pr = TR/TC x 100)	1.30
Modern method	
Total Revenue	1,330,924.6
Depreciation on Fixed Cost	51,229.2
Variable Cost (TC)	
Labour/man-day	13077.8
Threshing cost	5233.8
Par boiling cost	4079.3
Cost of water in litre	17513
Cost of firewood	2313.0
Extraction	441.2

Clarification	17262.2
Transportation cost	2058.3
Total variable cost (TVC)	61978.6
Total Cost (TC= TFC + TVC)	113,207.8
Gross Margin (TR – TVC)	1,268,946
BCR (TR/TC)	11.8

Source: *Field Survey, 2020*

The gross margin analysis above shows that the modern method of palm oil processing in the area is more profitable than the traditional method, which is line with what was expected. Modern method of processing palm oil required less expenses to run than requires less than the traditional method and is more efficient which explains why the profitability of the modern method was way higher than the traditional method of processing. When modern method of processing are used, the only major expenses will be the cost of purchasing the equipment *ab initio* after which the cost of processing drastically reduces because apart from harvesting the fruits, the modern technique takes care of every other step. And in the end produces more oil per kilogram of palm than the traditional method (Saliu, Ukwuteno and Ekpa 2016)

3.2 Factors influencing palm oil processing

Table 2 shows the factors affecting palm oil processing in the study area. From the table, double log has been chosen as the lead equation. The choice was based on the high value of R^2 (0.765), which is in conformity with a priori expectations in respect of the signs of the estimated coefficients of the explanatory variables in the model. The R^2 of 0.765 implies that 76.5% of the total variations in palm processing method (Y) were accounted for by the dependent variables (Xt).

Table 2: Regression result of the factors influencing palm fruit processing in the study area.

Variables	Parameter	Linear	Exponential	Semi-Log	+ Double Log
(Constant)	B_0	-2338.142	8.980	103387.027	11.173
		(-0.032)	(9.566)***	(4.714)***	(4.507)***
Sex	X_1	39594.605	0.659	29725.679	.637
		(0.651)	(0.473)	(1.363)	(0.588)
Age	X_2	-194.886	0.007	-37351.323	-.773
		(-0.255)	(0.681)	(-0.972)	(-1.779)*
Marital status	X_3	-26405.1	-0.303	-28338.511	-0.417
		(-3.097)***	(-2.794)**	(1.236)	(1.361)
Educations	X_4	3244.229	0.064	-34888.386	1.149
		(1.805)*	(2.501)**	(1.151)	(3.355)***
Household size	X_5	-302.356	0.005	1376.132	.068
		(-0.122)	(0.172)	(0.106)	(3.461)***
Farming experience	X_6	1950.902	0.010	14972.501	.089
		(1.983)**	(0.832)	(4.160)***	(3.767)***
Monthly income	X_8	0.422	1.823E-6	474.305	.113
		(2.071)	(0.705)	(2.037)**	(5.768)***
Access to credit	X_9	-0.057	1.967E-6	4482.591	.288
		(-0.637)	(1.740)*	(4.112)***	(2.60)**
R-Square		0.685	0.655	0.616	0.765
R Adjusted		0.618	0.609	0.597	0.733
F – ratio		14.710***	11.711***	12.27***	16.144***

Field Survey, 2020

Key: * Significance at 10%, ** Significance at 5%, * Significance at 1% ***, + = Lead Equation and the values in bracket are the t-value**

The results shows that sex is positively related to the method of processing used by the farmers, with a coefficient of 0.637 which implies that a 1 unit increase in sex will bring about a 63.7% increase in farmers choice of processing method, however sex has a significant effect on the choice of processing method used by farmers.

Any unit increase in education will bring about a 1.149 units increase in choice of processing method, this means that an increase in education will lead to possible adoption of modern processing method by farmers.

Household size can have 6.8% effect on processing technique used by farmers, when the family has larger household which portends more hands to do the work, then the use of traditional method may be likely, but smaller household may lead to the use of modern method.

Farming experience when increased by 1 unit can cause an 8.9% change in choice of processing, monthly income had a positive relationship with processing technique as any unit increase in monthly income will increase choice of processing technique by 11.3% which implies that the higher the income, the higher the chances of choosing modern methods of processing.

Access to credit also showed a positive relationship processing technique used, increase access to credit will lead to 28.8% increase in the opportunity to use modern method of processing. The findings is in tandem with the works of (Saliu, Ukwuteno and Ekpa 2016) who all found the above characteristics to be positively related to processing technique used.

On the other hand, age was negatively related to processing method as an increase in age will lead to a 73.3% decrease in the choice of modern method, while marital status when it tends to 1 (married) leads to 41.7% decrease in choice of modern technique for processing. This result implies that increased age reduces the ability of farmer to use more sophisticated techniques such as modern method of processing and such they continue with what they have been using all their lives which support the proverb that "old monkeys don't learn new tricks". Also when they are married, they tend to choose traditional method because of large household number, thereby reducing their choice of the modern method.

The f-ratio of 16.144 shows that the explanatory variables put together have can have a significant effect on the dependent variable at 1% level of significance.

3.3 Constraints to palm oil processing

The result shows that for the modern method of processing, 100% indicated lack of electricity, 93.3% of the respondents indicated non-availability of palm fruit as a problem, and lack of government support, 86.7% indicated lack of credit facilities, while 85% said inadequate land. For the traditional method, some of the problems indicated as constraints include inadequate land and poor quality of processed oil 93.3%, shortage of firewood 85%, poor access to market 70% and high cost of labour 68.3%.

Table 3: Distribution of respondents according to their perceived constraints to palm oil in the study

Constraints	Frequency	Percentages
Modern method		
Non availability of palm fruits	112	93.3
Inadequate land	102	85.0
Non availability of labour	82	68.3
Lack of credit facilities	104	86.7
Lack of government support	112	93.3
High cost of modern processing facilities	84	70.0
Lack of electricity	120	100.0
Shortage of firewood	44	36.7
Scarcity of water	34	28.3
Traditional method		
Inadequate land	112	93.3
Shortage of firewood	102	85.0
High cost of labour	82	68.3
Poor access to credit	104	86.7
Poor quality of processed oil	112	93.3
Poor access to market	84	70.0
High cost of transportation	120	100.0

Source: Field Survey, 2020

**Multiple responses recorded*

The factors mentioned are not far from apriori expectations, lack of infrastructural facilities in many areas has led to farmers underutilization of modern techniques of farming and processing, lack of access to land to engage in lager farm operations has also been a serious impediment to farmers use of technology, lack of support in the forms of extension services, lack of credit are also factors that has affected farmers use of modern techniques which is in line with the findings of Wakker, (2004)

Hypothesis Testing

The result presented in Table 4 shows the Z-test for the comparative analysis of the difference in the income from modern and traditional palm fruit processing in the study area and the result shows a Z-calc. of 6.214 which is greater the z-tab. (1.96).

Table 4: Z-test Comparative analysis of the difference in the income from modern and traditional palm fruit processing in the study area

Methods	Mean	Std. Deviation	Z-Calc.	Df	Z-Tab.
Modern method [a]	198,920	10975.8			
Traditional method [b]	153,600	9,889.8			
A – B	453,128	1086.0	6.214***	118	1.96

*key: There is significant difference.

*** = significant at 1%.

The result implies that there is a significant difference in the mean income from the traditional and modern method of processing palm oil. The study therefore rejected the null hypothesis and concluded otherwise.

CONCLUSION AND RECOMMENDATIONS

Based on the findings of this study, the study concludes that traditional method of processing was the major processing technique used in the study area, as a result of various factors such as age, educational qualifications, farming experience, household size, income and access to credit. The study concludes that modern method of processing is more profitable than its traditional counterpart and encourages farmers to utilize such.

Based on the findings of this study, the following recommendations have been made:

1. Government should introduce policies that will entice the youth into joining agriculture as the findings shows that less youth are involved in palm oil processing, for when they bring their

youthfulness into agriculture, the future of food security in the country will be bright hence age is a determinant of the method of processing used.

1. Farmers should be aided in the use of modern techniques of processing through relevant and regular extension contact because most times underutilization is due to lack of experience.
2. The high profitability recorded by the use of modern method underscores the need to introduce modern methods of processing in rural communities by helping farmers get the needed materials in forms of subsidy.
3. The constraints to use of modern processing techniques can be curbed if government funds are properly utilized to provide the necessary social infrastructure for farmers in the rural areas.

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