Economic Analysis of Oil Palm Fruit Processing in Dekina Local Government Area of kogi State, Nigeria.

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Abtract: This study investigated the economic analysis of oil palm fruit processing in Dekina Local Government Area of Kogi State, Nigeria. A total of 100 oil palm fruit processors were selected through purposivesampling procedure comprising 25 processors from each of the four districts. Data collected through structured questionnaire were analyzed using descriptive statistics, multiple regression analysis, gross margin and mean score. The results revealed that the oil palm fruit processing in the study area is generally practiced by females with the mean age of 33 years. Majority (71%) were married with average family size of 8 persons per household. Multiple regression analysis showed age, family size and labour cost to be positively and significantly associated with output of palm oil. The result also showed that the average gross margin was N4, 309, 750, indicating that oil palm fruit processing is profitable in the study area. Manual processing method was the predominantly used method of processing. This study recommends that government should construct roads, in the area where they do not exist and maintain thealready existing ones for easy access to oil palm fruit. It will also reduce transportation cost in order to boost the revenue of the processors.

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1. Introduction

The oil palm (Elaeis guineensis) is a single stemmed plant which may attain the height of 10 – 18 meters tall with different varieties. The leaves are called fronds and they are spirally arranged on a short trunk. Oil palm is the most important species in the genus Elaeis which belongs to family palmae and sub-family cocoideae. It contains about 225 genera with over 2600 species, (Onuchenyo, 2003). The simple classification of the oil palm is based on its shell and the fruit form.

Oil palm is an erect monocot plant that produces separate male and female inflorescences. Each tree produces compact bunches of fruitlets, weighing about 10 to 25kg with 100 to 3000 fruit lets per bunch. Each fruit let is spherical or elongated in shape. Generally, the fruit is dark purple (almost black) and the colour turns to orange red when ripe. There are two distract oil types; the palm oil (mesocarp oil) and kernel oil (the seal oil) obtainable from the oil palm tree (Opeke, 2005). Palm oil is edible plant oil and is derived from the mesocarp of the fruit of the palm. It is naturally reddish in colour because of high beta-carotene content (Opeke, 2005). In Nigeria, 80 percent of production of oil palm comes from dispersed small holders who harvest semi-wild plants and use manual processing techniques (Carrere, 2005). He further maintained that several million small holders are spread over an estimated area of 1.6 million hectares of the country.

According to FAO report (2005), processing of fresh palm bunds (FPB) for edible oil has been practiced in Africa for thousands of years and the oil produced is highly coloured and flavoured which form an essential ingredient in much of the traditional African cuisine. The report also stated that the traditional method of processing is simple but tedious and inefficient. The fruit may be processed by the farmer using the traditional method of oil extraction or sold to other processors. Among the small scale producers palm oil is principally processed by traditional or semi-mechanized methods (Omereji, 2005).

Poku (2002) asserted that operations involved in processing of palm fruit to obtain palm oil can briefly be summarized as follows: Sterilization, threshing or strippings, digestion, pressing, Clarification, and Drying.

Oil palm is one of the most important economic crops in Nigeria.According to World Rainforest Movement (2001). Oil palm is indigenous to the Nigeria coastal palm having migrated inland as a staple crop. It is found both in the wild grooves and plantation in Nigeria. Its cultivation serves as a means of livelihood for many rural families. Indeed it is in the farming culture of millions of people in the

country. The often mention of oil palm as a crop of multiple value underscores its economics importance. All its essential components namely, the frond, the leaves, the trunk, and the roots are used for several purposes ranging from palm oil, palm kernel oil, palm wine, broom and palm kernel cake. (Daramola et al, 2009).

In Africa, all part of the oil palm is useful. The residue after oil has been extracted (palm kernel cake) is useful in feeding livestock. The leaves of oil palm are used for making brooms, roofing and thatching, basket and mats, the thicker leaf stalks are used for walls of village huts. The bark of the palm frond is pealed and woven into baskets. The tree itself can be split and used as supporting frames in building. The sap tapped from the flower is processed into drink called palm wine which is a rich source of yeast. The palm wine can be allowed to ferment and then distilled into gin known as "Ogogoro" in Nigeria and "Akpetesin" in Ghana (Opeke, 2005). The empty fruit bunch, the shell and fiber that remain after oil extraction are used for mulching, manure and as fuel (Soyebo et al, 2005).

According to Hyman (1990) since independence in 1960, Nigeria Agricultural sector has experience low productivity which has not kept pace with the population growth and has resulted in declining agricultural exports and growing reliance onimported food. In the early 1960's, Nigeria's oil palm production accounted for 43 percent of the world production, and later only accounts for merely 7 percent of total global output (Daramola et al, 2009). Presently, Nigeria is a net importer of palm oil and since 1974 ceased to contribute in the export trade of the commodity (palm oil) largely due to increased domestic demand in palm production. Nigeria has lost her place to Malaysia, which is now the largest oil palm producer in the world. (Daramola et al,2009). This steady decline in the nation's domestic supply of palm oil has been attributed partly to the crude palm oil extraction methods employed by palm fruit processors, which resulted into low quality of the oil and also the drudgery involved in the processing of palm fruits are some of the important reasons responsible for the recurrent short fall in domestic palm oil supply in the country.

FAO (2004) gave the world oil palm production level at 153,578,600Mt or 385 billion pounds. This is about twice the level of production of any other fruit crop, making oil palm by far the world number one fruit crop. Oil palm is produced in 42 countries worldwide on about 27 million acres with an average yield of 10,001bs per acre (Soyebo et al, 2005).

Omoti, (2001) stated that Nigeria has enormous potential to increase her production of palm oil and palm kernel oil through application of improved processing techniques. This oil palm fruit processing enterprise is mainly dominated by rural farmers who are confronted with low returns from palm oil due to involvement in traditional processing which seriously limit the quatity of oil that can be processed. Modern small scale oil palm fruit processing machines that can be more efficient and effective are now available. However not many of the small scale oil palm processor have adopted it in the study area, despite the fact that oil palm processing is a major farming activity in the area. It is in view of this that this study seek to carry out the analysis of oil palm fruit processing in Dekina Local Government Area of kogi State, Nigeria.

2. Materials And Method

This study is carried out in Dekina Local Government Area of kogi state, Nigeria. Dekina Local Government Area is located in the Eastern part of the state. It has boundaries with Omala to the North, Ofu to the South, Ankpa to the East and Bassa to the West. It's headquarter is in the town of Dekina. It has a total land area of 2,461km^2 and a population of 260,312 (NPC, 2006). Geographically, it is located between longitude $7^0$00'E and $8^0$00'E and latitude $6^0$30'N and $7^0$30'N. The inhabitants of the area are predominantly Igalas with few migrant like Bassa-komo, Bassa-nge, Hausa, Yoruba and the Igbo. (KADP, 2006)

Crops grown are mainly cassava, sorghum, maize, oil palm, kolanut and cashew. Mixed cropping is the common farming system. The people of this area are involved in economic activities like trading-selling of livestock, fishing hunting, basket weaving as well as blacksmith. Small holder employee uses cutlass and hoes for cultivation.

The study area has two main seasons, the dry season (November to March) and the raining season (April to October). The local government is within the southern gunea savannah zone. The rainfall is well distributed during the raining season with an average rainfall level of over 1000mm per annum and so majority of the farmers practice rain fed agriculture (KADP, 2006).

The oil palm processors in Dekina Local Government Area of kogi State were from three districts areas of the Local Government viz Okura, Dekina and Biraidu. The main criteria used for the selection is the availability of oil palm.

A purposive random sampling procedure was used in selecting hundred processor from the three districts for the study. Both primary and secondary data were used for the study. The primary data was directly collected from oil palm processors

using structured questionnaire backed with personal interview. The questionnaire was administered to farmers to generate relevant data for the study. The data collected include information on socio-economic variables of the rural farmers engaged in oil palm processing, effect of socio-economic variables on the output of palm oil, method of oil palm processing, profitability obtained from oil palm processing and constraints against oil palm fruit processing in the area. The secondary data was obtained from journals, Kogi State Agricultural Development Project (KADP), libraries and textbooks.

The statistical tools used to attain the objective of the study were descriptive statistics such as mean, standard deviation, frequency distribution and percentages. Multiple regression analysis was used to determine the effect of socio-economic variables on the output of palm oil. Different functional forms were tried on the data that was collected based on some economic criterion and the one with the best fit was selected. Explicitly the model is specified as follows:

$Y = a+b_1x_1+b_2x_2+b_3x_3+b_4x_4+b_5x_5+b_6x_6+b_7x_7+ei$
Where;
Y = Palm oil output (litre)
X_1= Age of the farmer (years)
X_2= family size (number)
X_3= Level of education (years)
X_4= Years of experience (years)
X_5= Labouur cost (naira)
X_6= Transportation cost (naira)
X_7= Processing method (modern =1, traditional = 0)
ei = Error term (which is assumed to have zero mean and constant).
a = constant term
b_1.....b_7 = coefficients of the variables

Gross margin analysis was used to determine the profit obtained from oil palm fruit processing in the study area. Gross margin is the difference between the total revenue and the total variable cost. The model is specified as follows:

Gross margin
GM = TR-TVC
TR = Total Revenue
TVC= Total Variable Cost

Likert type of scale was used to identify the constrained facing oil palm processing in the study area. Likert scale was developed by Rensis likert in the 1930s.The five points type of scale was specified as follows:

Opinion	point
Strongly Agreed (SA)	5
Agreed (A)	4
Undecided (U)	3
Disagreed (D)	2
Strongly Disagreed (SD)	1

The mean respond to each item was calculated using the following formula:

$$X = \frac{\sum FX}{N}$$

Where x = means response
$\sum$ = Summation
F = Number of respondents choosing a particular scale point
X = Numerical value of the scale point and
N = Total number of the respondents to the item.
The mean response to each item was interpreted using the concept of real limit of numbers. The numerical value of the scale points (response models) and their respective real limits are as follows:
Strongly Disagreed (SD) = 1point with real limits of 0.5-1.49
Disagreed (D) = 2 points with real limits of 1.50-2.49
Undecided (U) = 3 points with real limits of 2.50-3.49
Agreed (A) =4 points with real limits of 3.50-4.49
Strongly Agreed (SA)= 5 points with real limits of 4.50-5.49
Decision rule: Any mean up to 3 is considereda major problem.

3. Results and Discussion

The socio-economic characteristic in table I were discussed under the following variables: age of the processors, sex, marital status, family size, educational status and processors experience in oil palm processing. Other characteristics studied include; major occupation of Respondents, labour force used, mode of transportation and respondents' status of land ownership.

Results of socio-economic characteristics of the respondents in table I revealed that the major age groups (46%) of the respondents were in the age range of 31-40 years. The mean age was 33 years. This implies that most of the respondents involved in the processing of oil palmfruit are energetic enough to carry out the vigorous oilpalm processes. Ogundele and Okoruwa (2006) asserted that only those farmers within the productive age group of 20-45 years are likely to posses the necessary strength to carry out farming operations.

Majority of the Respondents (88%) were females while the rest (12%) were males. This is in contrast with Adeoti (2006), who reported that, more men were found in farming than women. Bachman and Earles (2000) stressed that women were deeply involved in food processing, preservation and storage of agricultural products. Not only that, it has been widely reported that males are more actively involved in arable farming than cash crops as a result of land tenure system that does not favour land ownership by female in developing countries (Ogbonna and Okoroafor, 2004).

Seventy-one percent of the respondents were married and sixteen percent were single while 11 percent and 2 percent of the respondents were divorced and widow respectively. This shows that majority of oil palm fruit processor are married and this implies that more hands from their spouse and children may support them in carrying out the processing activities.

Household size of the respondents ranged from 4-9 (9%)to more than 9 members (28%). The mean household size of 7 members for this study was lower when compared with what is obtainable in the northern part of this country, Salisu (2007) recorded an average household size of 13 members per household. This may be attributed to socio-cultural factors outside the scope of this study.

Forty three percent of the respondents had no formal education followed by 32 percent who had primary education, 18 percent had secondary education, while three percent attended tertiary institution. It is thus obvious that the educational standard of the respondents are generally low, but not as low as other region in Nigeria, especially south eastern Nigeria and northern part, (Akinsanmi and Doppler, 2005). This relatively higher educational status may encourage acceptance of new innovation which may raise farm productivity and income.

The study revealed that, 5 percent of the respondents had been in processing for between 1-4 years, 43 percent had 5-9 years processing experience, while 27 percent had been in processing for over 20 years. The mean processing experience is 12 years. According to Omoti (2001), the primary determinants of a potential processor's capabilities are experience in the business and the quality of the information provided as far as extension workers are concerned.

Table I further showed that majority (89%) are full time farmers. This implies that, agriculture still remains an important employment sector to the rural communities. This is consistent with Adeoti (2006), forces are engaged in farming.

Findings on land ownership status revealed that 51 percent of the respondents acquired land through inheritance. About 20 percent own personal plantation, 15 percent acquired their farmlands by rent and 10 percent buys from open market. This system of land ownership, is the major source of access to land in Nigeria (Mathew, 2007).

In estimating the relationship between socio-economic characteristics and the output of palm oil, various functional forms of multiple regressions were tried. The exponential production function was chosen as the lead equation on the basis of its R^2 value, F-value, and the number of significant variables as well as their compliance with the apriori expectation.

Table I: Distribution of Respondents According to Socio-economic Variables

Socio-economic characteristics	Frequency (No.)	Percentage (%)
A. Age Category (years)		
Less than 21	3	3
21-30	38	38
31-40	46	46
Above 40	13	13
Total	**100**	**100**
B. Sex		
Male	12	12
Female	88	88
Total	**100**	**100**
C. Marital Status		
Single	16	16
Married	71	71
Divorced	11	11
Widow	2	2
Total	**100**	**100**
D. Household Size		
Less than 4	3	3
4-9	69	69
Above 9	28	28
Total	**100**	**100**
E. Education Status		
Informal Education (0 year)	43	43
Primary Education (1-6 years)	36	36
Secondary Education (7-12 years)	18	18
Tertiary Education (above 12)	3	3
Total	**100**	**100**
F. Experience		
Less than 10	5	5
10 – 20	68	68
Above 20	27	27
Total	**100**	**100**
G. Occupation	**No. of Respondents**	**Percentage (%)**
Farming/Oil palm Processors	89	89
Trading	11	11
Artisan	66	66
Civil Servant	44	44
Total	**100**	**100**
H. Source of Labour	**No. of Respondents**	**Percentage (%)**
Family Labour	44	44
Hired Labour	40	40
Communal Labour	16	16
Total	**100**	**100**
I. Land Ownerships Status	**No. of Res pondents**	**Percentage (%)**
Personal Plantation	20	20
Open Market	10	10
Rented Plantation	15	15
Inheritance	55	55
Total	**100**	**100**

Source; Field Survey, 2012

Table II: Regression Result for the effect of Socio-economic variables on the output of Palm Oil.

Variable	Linear	Exponential	Semi-log	Double-log
Constant	0.01(.006)	-1.54(-1.242)	-3.186(-143.968)	-1.772(-2.458)
Age (X_1)	3.64(1.336)***	3.454(0.0042)***	3.76(45.725)	3.876(1.446)
Family Size (X_2)	-2.529(-2.346)**	-2.008(-0.60)**	-2.009(-14.123)	-1.702(-0.367)
Educational Status (X_3)	-0.200(-0.95)	0.18(0.002)	-1.613(-4.007)	-1.390(-0.249)*
Farming Experience (X_4)	0.058(0.023)	0.232(0.003)	1.526(-6.707)	-1.843(-0.249)
Labour Cost (X_5)	1.116(4.479)	4.382(1.303)***	2.654(60.915)***	2.931(2.076)***
Transportation Cost (X_6)	-0.407(-2.117)	-0-101(-0.018)	0.7303(4.082)	0.472(0.084)
Processing Method (X_7)	-0.113(-.353)	-0.24(-0.024)	0.577(3.7799)**	0.514(0.14)***
R^2	0.435	0.444	0.283	0.290
Adjust R^2	0.382	0.398	0.224	0.231
F-value	10.131	9.590	.7646	4.901

Source: Computed from field survey data, 2012.
*** = coefficient significant at one percent (1%) level of significance.
** = Coefficient significant at five percent (5%) level of significance.
Values in brackets are the coefficients of each production variables. The regression line of the estimated lead equation (Exponential production function) is presented as

$Logy = a+b_1X_1+b_2X_{2+}b_3X_3+b_4X_4+b_5X_5+b_6X_6+b_7X_7$

Logy = -1.242(-1.540) + -0.081(-0.101) +0.042(3.454) – 0.024(-0.240) – 0.060(-2.008) + 1.303(4.382) + 0-02(0.1088) + 0.003(2.232)

From the regression result, the coefficient of multiple determinations (R^2) was 0.444. This implies that 44 percent variability in the output of palm oil was explained by the model, while the remaining 54 percent could be attributed to error and omitted variables. The F-value of 9.590 was significant at one percent level, which also confirms the significance of the entire model.

The result indicates that age is positively related to the output of palm oil. It was also significant at one percent level. It is a known fact that the older a farmer, the more experienced and skilful he becomes in the application of farming techniques. Omaruaye (1987) in Agbamu (2006) found out that older farmers have built up some ideals and practices over times which make it difficult for them to change.

Processing method was found to be negatively related to the output of palm oil but was however not significant. Number of persons per household revealed a negative relationship with the output of palm oil. The regression was significant at 5 percent level of probability. The labour cost of the respondents was found to be positively related to the quantity of palm oil produced and also significant at 5%.This implies that, family labour will continue to serve as an important component of labour in oil palm fruit processing.

Number of years spent in school revealed a positive relationship however the relationship was not significant. The positive relationship implies that education plays an important role in oil palm fruit processing operations since it will facilities the adoption of innovations that will improve oil pal fruit processing. By implication, formal education enables the processors to obtain information from bulletins, agricultural newsletters and other sources. Formal educational aid processors and lead them to accept new processing technology.Number of years spent in oil palm fruit processing shows a positive relationship with the output of palm oil that the produced. By implication, the more experienced as processor in processing, the more he/she is expected to produce palm oil.

Investigation into method of oil palm fruit processing revealed that 33.3 percent of the

respondents usedmanual processing method, 28 percent and 37 percent used modern and combination of traditional and modern methods respectively. The high usage of manual processing method tends to reduce the output of palm oil produced. According to FAO (2005), the traditional technique is the oldest method used before the advent of machinery and it used by rural dwellers for palm fruit processing.

Table III: Gross Margin of Oil Palm Fruit Processing per 20,000litres of Palm oil

S/N	Items	Total Quantity	Unit Cost (₦)	Total Cost
A	**Return**			
	Palm Oil Palm	1000 jerry can	**300**	3,000,000
	Total Returns	(20,000 its)		3,000,000
B	**Variable Cost**			
	Cost of Palm Bunches	**LS**		330,000
	Labour Cost			
	Threshing	**6MD**	**1000**	60,000
	Striping	**5MD**	**1000**	250,000
	Digesting	**12MD**	**1000**	12,000
	Pressing	**8MD**	**1000**	8,000
	Clarification	**6MD**	**1000**	6,000
	Drying	**4MD**	**1000**	4,000
	Other Costs (water, transportation)	**LS**	**1000**	25,000
	Total Variable Cost			621,000
C	**Fixed Cost**			
	Depreciation on fixed assets (tools and equipment)			100,000
	Total Fixed Cost			100,000
	Total Costs (TC) =TFC+TVC			721,000
	Gross Margin = TR-TVC			2,279,000
	Benefit-Cost Ratio (TR/TC)			4.16

Source: computed from Field Survey Data, 2011.

Gross margin analysis of oil palm fruit processing is presented in table III. The variable cost is made up of the cost of palm bunches and the labour costs. The labour cost were made up of threshing, stripping, digesting, pressing, clarification, drying and other labour cost (water, transportation). The total variable cost was ₦621, 000. The fixed cost of production were obtained from the depreciation of fixed assets used in production-screw press, pioneer mill, hydraulic press , cutlass, axe, basin, drum, and jerry cans. The fixed cost amounted to ₦100.000. Total cost incurred in oil palm fruit processing was obtained from the addition of total variable cost and total fixed cost. This was found to be ₦721.000. The yield per metric ton of palm oil bunches in the study area was found to be 1.0000 jerry can (20,000litres). The average price per jerry can was ₦3,000. Therefore, the total return from oil palm fruit processing was found to be ₦3, 000,000.

The gross margin was ₦2, 279,000. A positive gross margin revealed that oil palm fruit processing in the study area is profitable, since it is believed that if a business can recover its variables cost, then, it is capable of continuing in the short run.

Benefit cost ratio of 4.16 implies that every N1 invested in oil palm fruit processing generate revenue of ₦4.16. This is an indication that oil palm fruit processing in the study area is economically advisable.

The result of this finding agreed with Ekine and Onuh (2008), who obtained a gross margin of ₦38917.50 and also reported that an investment of N1 in palm oil processing yields returns of N 2.21.

Table IV: Distribution of Respondents According to Problems affecting oil Palm Fruit Processing

S/N	Problem Items	Relative Frequency					Total	Mean Score
		SA	A	U	D	SD		
		5	4	3	2	1		
01	High cost of bunches							
02	High cost of labour	6	5	29	52	8	100	2.49
03	Lack of fund	0	12	16	64	8	100	2.32
04	Transportation problem	1	2	33	56	8	100	2.32
05	Lack of storage facilities	1	17	36	38	8	100	2.69
06	Unavailability of thee technology	8	14	20	3	12	100	2.44
		10	4	18	60	8	100	2.48
07	Inappropriate method of processing	8	58	16	13	4	100	3.5

Source: Field Survey, 2012.

Table IV seek to find the opinion of respondents on the constraints affectingoil Palm fruit processing in the study area. The study revealed that transportation problem and inappropriate methods of processing had means scores of 2.69 and 3.5 respectively. This result implies that problems of transportation and inappropriate methods of processing according to the farmers in the study area were the major constraints to oil palm fruit processing. The research also indicate that the following problems; high cost of labour, high of bunches, lack of fund, unavailability of the technology and lack of storage facilities have mean scores of 2.49, 2.32, 2.32, 2.44, 2.48 respectively. This implies that these constraints are not serious problems affecting oil palm fruit processing in the area. The farmer in the study area rated inappropriate method of processing as the major constraints affecting oil palm processing.

4. Conclusion

From this study it can be concluded that most oil palm fruit processing in the study area still depend largely on traditional method of processing. It can also be concluded from the profitability analysis that oil palm fruit processing is highly profitable in the area. Therefore, the business of oil palm fruit processing will continue to thrive well in Dekina local government area of Kogi State, Nigeria.

5. Recommendations

The following recommendations were made based on the research findings;

1. In order to accelerate the net output in oil palm fruit processing in the study area, government should construct roads in the area where they do not exist and maintained already existing ones for easy access to raw materials and reduce transportation cost in order to boost the revenue of the processors.
2. Processors should be encouraged to form co-operatives so as to pool their resources together in order to acquire modern equipment for the processing of their oil palm fruit. Processors revenue base can be more enhanced if multi-purpose automatic machine could be supplied to farmers by government at subsidize price.

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