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PROFITABILITY OF PALM FRUITS PROCESSING IN OHAJI- EGBEMA LOCAL GOVERNMENT AREA OF IMO STATE, NIGERIA

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Abstract
The study analyzed the profitability of palm fruit processing in Ohaji-Egbema Local Government Area of Imo State. Simple random sampling was used in selecting eight (8) communities in the Local Government Area. Two (2) villages were randomly selected from the eight communities making it sixteen (16) villages. From each village, five (5) palm oil processors was randomly selected, this gave a total of eighty (80) palm oil processors which constitutes the sample size for the study. Results showed that the mean age of respondents was 54.5 years, 60% of the respondents were males and 40% were females, 77.5% of them married with mean household size of 8 persons while 37.5% had tertiary level of education. Furthermore, the Mechanical press technology was the highest ranked technology adopted in the study area. Costs and returns analysis showed a total returns of ₦1,963,815, total cost of ₦ 1,107,840, and net farm income of ₦855,975. The profitability ratios were as follows; return per 1 naira (₦) invested was 0.77, Gross Ratio 0.56, Expense Structure Ratio 0.028 and Benefit Cost Ratio is 1.77. The results of the factors affecting profitability showed that the linear function was the lead equation. The study recommends that improved technologies that will reduce processing time, quantity of fuel consumed and increase quality of palm oil produced should be provided at subsidized rate to processors. Government should ensure that the price of diesel and fuel be further subsidized to allow businesses break-even in their production, since this is a vital component of the processing firms. Social amenities like electricity, pipe borne water should be provided in the area to facilitate palm oil processing.
Keywords: Profitability, Palm Oil, Palm fruits, Processing, Processors, Break-even

Introduction

Palm oil is an important extract usually gotten from the processing palm fruits. Oil palm (*Elaeis guineensis*) is one of the most important economic oil crops in Nigeria. Oil palm is indigenous to the Nigerian coastal plain though it has migrated inland as a staple crop (Alabi, Famakinwa and Akinnawonu, 2020; Nwalieji and Ojike 2018). Nigeria is among countries that are considered to be the largest producer of palm oil which is extracted from the fleshy mesocarp of the palm fruit and has been a vital resource in the majority of Nigerian diets. The global need for palm oil is fast increasing because of increase in population globally. Palm oil also serves as a source of income for the majority of individuals in developing countries (Bassey, 2016). It is an important ingredient in Nigeria's daily diet, hence the need for increase profitability of the palm oil processors. Apart from the critical role it plays in complementing the dietary need of families in Nigeria, the wastes generated when the fruits are processed are also of economic importance. The sludge is used in making traditional soaps and fertilizer and the palm kernel cake is used widely as feed ingredient in aquaculture and livestock industry and for fertilizer (Tiku and Bullem, 2015). It is also a vital raw material highly needed in food processing companies and other agro-allied companies. Refuge gotten from fresh fruit bunch processing (sludge, shell, and fiber) can be used as fuel for the mills, making briquettes to substitute for fuel wood, Partnership Initiatives in the Niger Delta (PIND), (2019).

Processing is a way of adding value to an agricultural produce (Akpaeti, *et al.*, 2019). Palm oil processing plays a critical role in

income generation, provision of part-time employment and sustainable dietary regime in Imo state, Nigeria. Value addition of palm oil brings about other products like palm kernel oil (PKO), palm kernel cake (PKC) in addition to other industrial products used in confectionary and cosmetic industries. In Nigeria, oil palm grows well in 24 out of the 36 of the federation, namely; Abia, Akwa Ibom, Cross River, Rivers, Bayelsa, Imo, Anambra, Ebonyi, Enugu, Delta, Edo, Ondo, Ogun, Osun, Oyo, Ekiti, Benue, Kwara, Kogi, Nasarawa, Plateau, Taraba, Adamawa and Kaduna (especially in the southern part) (Ekenta *et al.,* (2017). With respect to the volume of production, Delta, Edo, Akwa-Ibom, Cross River, Bayelsa, Rivers, Anambra, Enugu, Imo, Abia, Ogun, Ondo, Oyo and Ekiti are the major palm oil producing states in Nigeria with about 80% of their total production coming from smallholders who harvest semi-wild plants.

Palm oil is primarily gotten from three sources namely: the collection of fresh palm fruit bunches from wild groves, private plantations owned or managed by individual farmers, and large corporate or government owned plantations (Partnership Initiatives in The Niger Delta (PIND) Foundation, (2019). The estimate for oil palm plantations in Nigeria ranges from 169,000 hectares (72,000 ha of estate plantations and 97,000 ha of smallholder plantations) to 360,000 hectares of plantations (Agriculture Nigeria, 2019). Oil palm fruit processing involves harvesting, threshing or bunch quartering, fruit loosening, boiling, digestion, pressing/oil extraction, clarification and packaging/storage. All these stages are done manually except the digestion or pounding of cooked fruits which is done by a diesel engine powered digester equipment (Osei-*Amponsah et al.*, 2018). Nwalieji *et al.*, (2018), Alabi *et al.*, (2020) and Onu, *et al.*, (2021) revealed in their respective studies that, oil palm fruit processing is a major economic activity of the people of Southern Nigeria and is mostly carried out by rural dwellers particularly women under manual and subsistence methods. Nevertheless, there is yet an untapped potential for massive processing of palm oil in Nigeria, especially in Ohaji Egbema L.G.A., where this study was carried out. Ohaji Egbema is made up of several communities with large numbers of palm fruit oil processors. Among these communities are; Umuagwo, Mgbirichi/Abakuru, Egbema, Umuokanne, Obosima, etc. In Nigeria, majority of palm oil processors are subsistence farmers who are limited by availability of capital, thus resulting to a situation where they make use of crude and locally fabricated machines which is usually associated with drudgery and inefficiencies in palm oil processing. The manual processing technique often results in low palm oil extraction and high free fatty acid (FFA) content that can be up to 30% in some instance (Nwankwo, 2016). In countries like Indonesia and Malaysia, the palm oil industry has helped lift millions of people out of poverty. These two countries together account for about 85 per cent of global palm oil product. Oil palm plantations have created millions of well-paying jobs, and enabled tens of thousands of smallholder farmers to own their own land. In countries like Indonesia the palm oil industry accounts for 1.6 per cent of GDP and employs 4.5 million people. As the majority of the harvest is exported the industry brings in more than $18 billion a year in foreign exchange, the single biggest contributor in the country (Asian agri–History, 2019). In Nigeria, this fortune cannot be harnessed because of inefficiencies associated with processing of the palm fruits. These inefficiencies usually result to low extraction rate, massive loss of palm oil along the processing line, and production of low-quality technical palm oil (TPO) hence loss of revenue. It is based on this background that this research was conceptualized to determine the profitability of processing Palm Oil in Ohaji Egbema L. G. A. of Imo State. In order to achieve this broad objective, this research had to; examine the socio-economic characteristics of oil palm fruits processors in the area, identify the technologies adopted in processing palm fruits in the area, estimate the profitability of palm oil processors in the study area and examine the factors affecting the profitability of palm oil processing in the study area

Methodology

The Study Area

This study was carried out in Ohaji Egbema L. G. A. of Imo state. Ohaji Egbema is located in located on latitude 5˚15'0"N and 5˚36'0"N and longitude 6˚35'0"E and 7˚0'0"E. It is an oil-rich Local Government Area of Imo State with Its headquarters at Mmahu-Egbema. The local council has an area of 890 km^2 and lies in the south-western part of Imo State. The Local Government Area is in the rich agricultural zone of Imo State. Hence, agriculture is the mainstay of the people with faming, fishing, palm oil processing, hunting, and animal husbandry vigorously practiced. Arable crops grow very well in the area which includes cassava, yam, maize, cocoa yam, etc. It occupies an area, approximately 908,010 sq. km. and has an estimated population of 800,904 (NPC, 2014). Ohaji Egbema L. G. A. comprises of three (3) districts; (Ohaji East, Egbema North, Ohaji West) with 12 council wards. The Local Government has sixteen (16) autonomous communities (Egbema, Umuagwo, Oloshi, Umunwaku, Obile, Obitti, Mgbirichi\Abakuru, Opuoma, Assa, Awara, Ikerede, Umuokanne, Obiakpu, Ohuba, Obosima, Mmahu). The occupation of the people of Ohaji Egbema L.G.A is mainly farming, hunting, palm fruit processing, fishing and animal husbandry. A good number of the indigenes are public servants. Palm oil processing is one of the economic activity that most household are engaged in and make ends from it.

Sample Selection

Multistage and random sampling technique was used in the selection of the respondents. At the first stage, simple random sampling technique was adopted in selecting eight (8) communities in the Local Government Area. The second stage involve the random selection of two (2) villages was selected from each of the eight communities, making sixteen (16) villages. At the third stage, five (5) oil palm fruits processors were randomly selected, this gave a total of eighty (80) palm oil processors which constitutes the sample size for the study. Primary data were collected and used for analysis. Oral interviews and the use of structured questionnaires were designed to obtain information relating to the socio-economic characteristics of the processors, volume of palm oil processed and purpose of engaging in palm oil processing. The processing technologies used and their level of returns achieved from the processing of palm fruits.

Data Analysis

Analysis of data for this study was carried out using descriptive statistics such as frequency distribution, mean, percentage, adoption index, net margin analysis and Ordinary Least Square multiple regression analysis. The socio-economics characteristics of oil palm fruit processors and methods adopted in processing palm fruits were achieved using descriptive statistics. Estimation of the profitability of palm oil processors was achieved using the Net Margin analysis and profitability index.

The model was specified as follows;

NM = TR —TC
Where:
NM = Net Margin
TR= Total Revenue = PQ (Price x Quantity)
TC= Total Cost
TC = TVC + TFC
Here;
TVC = Total Variable Cost
TFC = Total Fixed Cost
Profitability Index = NFI/TVC
Where
NFI = Net farm income
TVC = Total variable cost.

Decision Rule

According to Spencer,. (2020), If PI > 0.5, the investment is profitable and If PI < 0.5, the investment is not profitable

In determining the factors affecting the profitability of palm oil processing, the Ordinary Least Square multiple linear regression models was employed. The model is specified explicitly as follows;

$Y = b0 + \beta_1 X_2 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \ldots + e$ and implicitly as follows;

$Y = F(X_1 X_2, X_3, X_4, X_5, X_6, X_7, X_{8,} X_9 X_{10})$

specified as follows;

Where,

Y = Profitability
X_1 = Total Fresh Fruit Bunch (FFB) processed per annum
X_2= Depreciation on asset
X_3= Water (liters)
X_4= Age of respondents (years)
X_5= Educational level of respondents (year)
X_6= Gender (using dummy variable, 1=male, 2=female)
X_7 = Processing technologies (using dummy variable; 1 =manual; 0 = Mechanical)
X_8 = Diesel cost (₦)
X_9 = Household size of respondents
X_{10} = Processing experience
b_0 = Constant term
e= error term
β1-β7= coefficients estimated.

Four functional forms; linear, exponential, semi-log and Cobb-Douglas functions were fitted for factors affecting profitability. The function with highest R^2, highest value of F-ratio, and highest numbers of significant variable was chosen as the lead equation to describe the factors affecting profitability.

Results and Discussion

Age of the respondents, gender; marital status, level of education, household size, and processing experience of the respondents were the socio-economic characteristics considered for this study. Table 1.0 reveals that 73.8% of the processors had their ages between 46 -61 years, 16.3% of them had their ages between 62 -77 years and 10% of the respondents fall between 30 — 45 years of age, meaning that the respondents were in their middle age, still active in palm oil processing. With regards to the gender of respondents, the result showed that 61.3% of the respondents were male while 38.8% of the respondents were female. This point to the fact that palm oil processing in the Local Government Area is dominated by male processors. This is in contrast with the result reported by Oguleye *et al.,* (2020) where they found out that 47.2% of males were involved in Oil palm processing as against 52.8% of females. This result may be due to the fact that oil palm fruit processing involve the use of machines that requires physical energy to operate, hence the direct involvement of males in this activities. Table 1.0 also showed the distribution of the processors according to marital status. 77.5% of the them were married while 7.5% were single, divorced and widowed respectively. This implies that palm oil processing in the area was mostly the occupation of the married persons. The table below also shows the respondents distributed according to their level of education. 37.5% of the respondents had tertiary education, 32.5 % secondary education, 20% had primary education while 10% of the respondents do not have formal education. The finding showed that majority of the respondents has tertiary education. Table 1 showed clearly shows the distribution of processors according to household size. 91.2% of the respondents have between 6 — 10 persons, 8.8% of the respondents have between 1 — 5 persons. The table also showed that the mean household size of the processors in the study area to be 7.6 persons per households. This implies that the respondents have a large house hold size. Respondents with large household size take the advantage in substituting for hired labour in other to reduce production and processing costs. The table below showed the distribution of respondents according to processing experience. 33.7% of the respondents have between 17 — 22 years of processing experience, 25% of the respondents have between 11 — 16 years palm oil processing experience, 18.75% have between 5 — 10 years of experience in processing, 13.75% have between 29 — 34 years of experience and 8.75% have 23 — 28 years of processing experiences. The table showed the mean processing experience of 19.3 years. The mean years of processing experience here is higher the reported by Oguleye *up cit*, for processors in Osun State where the mean years of experience was given as 11.3years. The years of experience of processors here is high This implies that majority of the respondents in the study area were well experienced in palm oil processing.

Table 1: The Socio-Economic Characteristics of the Respondents in the Study Area

Age	Frequency	Percentage
30 — 45	8	10
46 — 61	59	73.8
62 — 77	13	16.3
Total	**80**	
Mean	**54.5 years**	
Gender		
Male	49	61.3
Female	31	38.8
Total	**80**	
Marital Status		
Single	6	7.5
Married	62	77.5
Divorced	6	7.5
Widowed	6	7.5
Total	**80**	
Level of Education		
No Formal Education	8	10
Primary Education	16	20
Secondary Education	26	32.5
Tertiary Education	30	37.5
Total	80	
Household size		
1 — 5	7	8.8
6 — 10	73	91.2
11 — 15	0	
Total	**80**	
Mean	**7.6 persons**	
Processing Experience		
5 — 10	15	18.75
11 — 16	20	25
17 — 22	27	33.75
23 — 28	7	8.75
29 — 34	11	13.75
Total	80	
Mean	**19.3 years**	

Source: Field Survey Data, 2021

Identified Technologies Adopted for Processing Palm Fruits by Respondents

Table showed the distribution of the respondents according to the technologies adopted in processing of palm oil. The technologies were ranked according to their usage. Mechanical press ranked highest in usage with 56.25%, traditional press ranked second highest with 37.50% usage, separating machine ranked the third highest with 31.25% usage, digester ranked fourth highest with 30.00% usage and thresher ranked least with 12.50% usage. This results differed from the one reported by Ogunmola *et al.*, 2019, where they stated that 15% of the respondents adopted sterilizers, separating engine and oil clarifier were adopted by 18.8% of the respondents, 25% of them adopted digester, while 22.5% had adopted mechanical press. This implies that the respondents used majorly mechanical press technology in processing fresh palm fruits other than the rest.

Table 2 Distribution according to methods of technology adopted

Methods of Technology	frequency		Percentage		Rank	
	Yes	No	Yes	No	Yes	No
Thresher	10	70	12.5	87.5	7th	1st
Sterilizer	15	65	18.75	81.25	5th	3rd
Digester	24	56	30	70	4th	4th
Separating machine	25	55	31.25	68.75	3rd	5th
Mechanical press	45	35	56.25	43.75	1st	7th
Oil clarifier	11	69	13.75	86.25	6th	2nd
Traditional press	30	50	37.5	62.5	2nd	6th

Source: Field Survey Data, 2021

Costs and Return of Oil Palm fruit processing in the Study Area

Table 4.3 showed the results of cost and returns of palm oil processing in the area. A total revenue of ₦ 1,963,815 was realized, a total cost of ₦ 1,107,840 were incurred, a net farm income of ₦ 855,975 was realized. Rate of return = Net revenue / Total Cost (855,975 / 1,107,840) = 0.77. The rate of return per investment was 1:0.77 which implies that for every ₦ 1 invested in palm oil Processing, 77 Kobo was realized. This showed that palm oil processing is a good business to invest. Gross Ratio = Total Cost/Total Revenue (1,107,840.00/1,963,815.00) = 0.56. Given that the gross ratio is 0.56. This is a pointer to the fact that, for every 1 Naira return gotten from this investment, 56 Kobo is being invested. Expense Structure Ratio (ESR) = Total Fixed Cost/Total Cost (N32, 011/N1, 107,840) = 0.028 The Expense Structure Capital of the investment is 0.028. This implies that 2.8% of the total cost of production is made up of fixed cost components comprising the depreciated value of the enterprise's assets. The low expense structure Ratio of this business in not unconnected to the fact that the processors were mainly involved in buying and processing of Fresh Fruit Bunches (FFB) as against owning or renting of oil palm estates, which would have increases the fix cost of production. The Benefit Cost Ratio (BCR) = Total Revenue /Total Cost (N1,963,815.00/N1,107) = 1.77. With a BCR of 1.77, the enterprise is profitable, and able to deliver a positive Net Present Value to the processor.

Table 3. Estimated Costs, Return and Profitability of Palm Oil Processing per Annum

Items	Description	Mean Amount ₦ / palm oil
Return	Sales of Palm oil and palm kernel	
Sales		1,963,815.00
Total Revenue(TR)		**1,963,815.00**
Variable Input		
Palm fruit	708 bunch@₦500	344,000.00
Water	100 litres@₦128	12,800.00
Diesel	59 litres@11,415	673,485.00
Labour	4 man-day@₦11,386	45,544.00
Total Variable Cost(TVC)		**1,075,829.00**
Fixed cost		
Depreciation on fixed input		32,011.00
Total Fixed Cost		**32,011.00**
Total Cost		**1,107,840.00**
Gross Margin		**887,986.00**
Net Palm Oil Income		**855,975.00**
RRI		**1:0.77**

Source: Field Survey Data, 2021

Table 4: Profitability Ratios of Palm Oil Processing in the Study area

Ratios	values
Rate of return	0.77
Gross Ratio	0.56
Expense Structure Ratio (ESR)	0.028
Benefit Cost Ratio	1.77

Determinants of Factors Affecting the Profitability of Palm Fruit Processing

Table 5 showed that the linear functional form provided the lead equation. The coefficient of multiple determinations (R^2) was 0.512% which implies that 51.2% of the variation of the profitability of palm oil processors was accounted for by the explanatory variables in the model. Variables such as quantity of water, quantity of diesel were positive and significant at 10% and 1% respectively while variable such as depreciation, education attainment were negative and significant at 1%.

Table 5: Estimated factors affecting profitability of palm oil

Variables	+Linear function	Exponential function	Semilog function	Cobb-Douglas function
Constant	0.874	0.318	4.439	13.176
	(4.393)***	(0.536)	(1.767)*	(2.125)**
TFF Processed	0.001	-0.04	-0.327	-1.304
	(0.253)	(-0.554)	(-0.956)	(-1.546)*
Depreciation	-1.258E-5	-3.372E-5	-0.341	-0.928
	(-5.120)***	(-4.603)***	(-1.129)	(-1.245)
Water	0.006	0.028	-0.130	1.323
	(1.578)*	(2.104)**	(-0.193)	(0.795)
Age	-0.003	-0.006	-0.376	-0.979
	(-0.951)	(-0.672)	(-1.398)	(-1.475)
Education attainment	-0.021	-0.048	-0.650	-0.266
	(-3.464)***	(-2.699)**	(-1.193)	(-0.198)
Sex	-0.014	-0.093	0.073	0.108
	(-0.384)	(-0.843)	(1.113)	(0.671)
Processing	0.048	0.111	0.021	0.251
Technology	(1.111)	(0.873)	(0.193)	(0.923)
Diesel	-6.648E-6	1.439E-5	0.171	0.396
	(-5.268)***	(3.822)***	(4.689)***	(4.403)***
R^2	**0.512**	**0.444**	**0.476**	**0.498**
Adj R^2	**0.451**	**0.374**	**0.531**	**0.563**
F- value	**8.407**	**6.388**	**4.643**	**5.148**

Source: Field Survey Data. * = significant at 10%, ** = significant at 5%, *** = significant at 1%. Values on parentheses are t values. + = lead equation

Coefficient of depreciation was significant at 1% and negatively related to the profitability of palm fruit processing, implying that a 10% increase in the depreciation of equipment used the processing of oil palm fruit will lead to reduction in the profit of the processor by 0.0003%. This result suggest palm fruit processors should limit their level of accumulating fixed assets because high depreciation value will deplete the profit level of their investments. The coefficient of quantity of water was significant at 10% percent and positively related to profit. This implies that a 10% increase in the use of water by oil palm fruit processors will increase the profit of the processor by 0.06%. This assertion is true

because oil palm fruit processing requires heavy use of water to wash the digested pulp clean, thus making room for effective recovery. The more water a processor uses to wash the pulp, the more the oil recovered from the pulp resulting to more profitability on the part of the processor. Education attainment was significant at 1% and negatively related to profit, implying that a 10% increase in the level of education of a processor will reduce the profitability of the processors by 0.2%. This result goes to support the fact that the attainment of higher educational level does not necessarily impact on the profitability of the oil palm fruit processors, instead, the level of on-hands training attended, and access to improve technologies can impact more on the profit of processors. The coefficient of diesel used was significant and negative at 1%. This implies that the more diesel used by processors, the less profit they make. A 10 % increase in the quantity of diesel used by an oil palm fruit processor will lead to a reduction in the profitability of an oil palm processor by 0.000067%. Implying that water is a critical resource in oil palm fruit processing, hence the need to make it available and affordable for processor's

Recommendations

Based on the findings above, the following recommendation were made:

1. Cost of improved processing technologies should be subsidized by Government and made available to oil palm fruit processors. If the processors can easily access these technologies and use them, then their profit levels will be enhanced.
2. On-hands training should be organized by the Ministry of Agriculture through Extension Agents, non – governmental Organizations and farmers associations for Oil palm fruit processors to enable them improve on their profit level.

Conclusion

In conclusion, result from the analysis showed the mean age of respondents was 54.5 years, 60% of the respondents were males and 40% were females, 77.5% of them married with mean household size of 8 persons while 37.5% had tertiary level of education. Furthermore, the Mechanical press technology was the highest ranked technology adopted in the study area. In terms of costs and returns, the result showed a total return of ₦ 1,963,815, total cost of ₦ 1,107,840 was incurred, and net farm income of ₦855,975 was realized. The profitability ratios from this study were as follows; return per 1 naira (₦) invested was 0.77, Gross Ratio 0.56, Expense Structure Ratio 0.028 and Benefit Cost Ratio is 1.77. The result of the factors affecting profitability showed that the linear function was the lead equation.

3. Since water is a critical resource required for oil palm fruit processing, Government can assist the processors by sinking effective bore holes in areas where processing activities takes place.
4. Oil palm fruit processors operates like every other small and medium size entrepreneur (SME) who depend on diesel most times to run their processing plants. High cost of diesel will eat deep into their profit. Therefor government should subsidize the cost of diesel and ensure that it is available at all times to enable the processors increase their profit margin.

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