PROFITABILITY ANALYSIS OF OIL PALM PROCESSING TECHNIQUES IN EDO STATE, NIGERIA

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Abstract

This study examined the profitability analysis of oil palm processing techniques among palm oil processors in Edo State Nigeria. Multistage sampling technique was used to select 240 respondents from 15 villages across five major palm oil-producing Local Government Areas: Ikpoba-Okha, Ovia North-East, Ovia South-West, Orhionmwon, and Uhunmwonde. Data were collected using structured questionnaire, and analyzed using descriptive statistics, budgetary techniques and ordinary least square. Results showed that 76.67% of respondents were male, with an average age of 47.17 ± 6.10 years and a mean household size of 7.20 ± 2.42. About 81.25% had formal education, 52.92% were association members, 40.83% had access to credit, and only 19.17% had contact with extension agents. In all, 12.08%,71.67% and 16.25% adopted traditional, semi-mechanized and mechanized processing techniques respectively. The result of the study further revealed that the net returns value of ₦140,206.30, ₦1,378,782.25 and ₦3,968,757.35 per processor per annum and a Benefit Cost Ratio of 1.52, 1.66 and 2.02 per processor per annum for manual, semi-mechanized and mechanized processors. The result of the regression estimates showed that the net profit of processors in the study area was affected by factors such as processing techniques, cost of FFB, transportation cost, labour cost, diesel cost, milling charges and depreciation on milling equipment. The study concluded that oil palm processing is a profitable venture in the study area irrespective of the processing technique adopted, however, with the mechanized processors being most profitable. The study recommended that the government, NGOs and other stakeholders in palm oil production should initiate a policy that will facilitate the transition of palm oil processors from the use of semi-mechanized to mechanized processing techniques.

Keywords: Oil palm fruits; Processing Techniques; Palm Oil, Budgetary Techniques, Edo State

INTRODUCTION

Background

The Nigerian palm oil industry has undergone dramatic changes over the years recording slow growth in domestic production and losing its export share to the world market (Merem *et al.,*2020). In the early 1960s, Nigeria was the world's largest palm oil producer and exporter with global market share of 43%. Currently, Nigeria ranks as the fifth-largest producer globally, contributing only 2% or 1.5 million MT of the world's total output of 79.834 million MT far behind Indonesia, Malaysia, Thailand, and Columbia (USDA, 2024).

Palm oil, derived from the fleshy mesocarp of oil palm fruits, is the most widely used vegetable oil (Andoh, S.S; Nuutinen, T; Mingle, C; and Roussey, M; 2019). Approximately three billion individuals depend on palm oil as a regular component of their diet, making it a

staple cooking oil frequently utilized in Africa and Asia for food preparation. In Nigeria, palm oil is highly consumed and holds significant economic importance due to its nutritional advantages and diverse applications that extend beyond food (Ndidi, N; Tamuno-boma, O; Udiomine, B.A; and Tamunomiebam, E.I; 2020). Besides its use in edible products, palm oil serves as a raw material for manufacturing a variety of non-food items, such as soaps, cosmetics, inks, resins, and fatty acids. In fact, palm oil is an ingredient in over half of the products available in supermarkets worldwide (PWC, 2019). Consequently, due to its varied uses, the global demand for palm oil has grown rapidly over the past several decades (Farzad, T; Hertel, W and Navin, R; 2019).

Oil palm processing which involves the transformation of low value palm fruits to value added palm oil (Adejo, E.M; Ibrahim, H; Gbenga, O; Negedu, A and Oyewole B.O; 2023) is done using different processing techniques which range from traditional, semi-mechanized to mechanized methods (Uchenna,E.C; Ojimelukwe, P.C; Okorie-Humphrey, C and Ogbedeagu, C.O; 2023).The techniques adopted determine the quality and yield of palm oil, which in turn affects the income of palm oil processors (Ruswanto, A; Ramelan, A.H; Praseptiangga, D and Partha, I.B; 2019) particularly in Edo state where palm oil production is a major economic activity.

Although Nigeria is one of the world's top producers of palm oil, it has lost its position as the world's largest producer (Chiemela,C.J; Ukwuaba, I.C; Ugbede, O.E; Ibe, J. and Onyekwe, C.N; (2021); Adah Adah, O.C; Akor, J.A and Ademu, A; (2022) and is yet to attain self-sufficiency in the production of palm oil and palm oil-related products (Nwankwo E.C. 2016). Nigeria not only stopped its palm oil exports but also became a net importer of palm oil, even sourcing it from Malaysia, which originally obtained the seedlings from Nigeria (Nwalieji, H.U and Ojike, H.U. 2018). Currently, Malaysia ranks as the world's second-largest producer of palm oil and continues to export it. Kei, K; Mywish, M and Duncan B (1997) in their analysis of oil plantations in Nigeria and Malaysia, observed that Malaysian production occurs on a large scale with modern processing methods, while in Nigeria, palm oil production remains small-scale and relies on manual techniques. In Nigeria, the low technology approach caused the decline of palm oil production as the use of locally invented technology in the current oil palm production yields less results, hence, self-sufficiency in the sector will never be achieved (Enkenta and Ajala, 2017). Therefore, a major impediment to achieving self-sufficiency is attributed to the inefficiencies in processing techniques as about 25-75% of potential palm oil is lost during processing due to inadequacies in processing techniques (Eric and Ikheloa, 2017). To remedy this situation, the intervention strategy implemented by the Government of Nigeria (GON) through the Central Bank of Nigeria (CBN) since 2022 aims to promote the establishment of oil palm plantations nationwide, with a goal of cultivating a minimum of 350,000 hectares by 2028, which is expected to yield approximately 650,000 metric tonnes of palm oil to help meet the supply deficit (Orji, 2023). Nonetheless, achieving these projected figures is contingent upon the application of adequate processing techniques. Embracing efficient palm oil processing techniques is anticipated to boost palm oil production while also minimizing the losses incurred due to inefficient processing methods. Therefore, the general objective of this study is to analyze the profitability of oil palm processing techniques in Edo State, Nigeria

while the specific objectives are to:

I. Profile the processing techniques adopted by processors in the study area
II. Estimate the profitability or net returns of palm oil processors
III. Determine the factors that affect net returns of palm oil processors in the study area.

METHODOLOGY

The study area is Edo State, Nigeria. The choice of Edo State is based on the high intensity of palm oil production as it is presently the largest palm oil producing state in Nigeria contributing 15% to the nation's palm oil production (United States Department of Agriculture (USDA),2024). Edo State, situated in Nigeria's South-South geopolitical zone, was established in 1991. It is bordered to the North and East by Kogi State, to the South by Delta State, and to the West by Ondo State. The state is positioned roughly between Latitude 05°44'N and 07°34'N of the Equator, and Longitude 06°04'E and 06°43'E of the Greenwich Meridian. Average annual rainfall ranges from 250 cm in the coastal regions to 150 cm in the northernmost areas of the state. Temperatures vary between 22°C and 36°C. The predominant soil type found throughout the state is a reddish-yellow ferrosol, which differs across various locations. Likewise, vegetation changes from the lush rain forest in the Benin lowlands to savanna in the uplands of Akoko-Edo. The majority of the population in this state is engaged in agriculture. Key cash crops grown include rubber, cocoa, and oil palm, while other crops such as yams, cassava, rice, plantain, guinea corn, and a variety of fruits and vegetables are also produced (Bankole A.S; Ojo S.O; Ojemade A.C; Adakaren B and Oghogho I.A;2019). Approximately 75% of Edo State's population relies on agriculture for their employment and income, which supports traders, artisans, and professionals across multiple fields.

Four stage sampling technique was used for this research. The first stage was the purposive selection of Edo state based on the high intensity of palm oil production. The second stage was the purposive selection of 5 LGAs out of the 18 LGAs in the state. The third stage was the purposive selection of 3 villages each from the selected LGAs based on the concentration of palm oil processors. The fourth stage was the random selection of 240 palm oil processors proportionate to size based on the records obtained from the Palm Oil Millers Association of Nigeria. Edo State Branch.

Primary data from a cross-section of palm oil processors collected with the aid of a well-structured questionnaire were used for this study. The data collected for this study were analyzed using descriptive statistics, Budgetary techniques and Ordinary Least Square Regression Model. Descriptive statistics such as frequency counts and percentages were used to profile the processing techniques adopted by processors, budgetary techniques was used to estimate the profitability of the oil palm processing techniques and ordinary least square regression analysis was used to determine the factors that affect net profit of processors in the study area.

Ordinary Least Square (OLS) Regression: Model Specification

Ordinary least squares regression was employed to identify the factors influencing the net returns of processors in the study region. This approach serves as an economic method for forecasting the dependent variable's value based on the independent variables' values. The coefficient of determination (R^2) indicates the extent to which variations in the independent variables (Xi) account for the variation in the dependent variable (Y).

Model Specification

The OLS model is specified as $Y=\beta_0 + \beta_1 X_{1t} + \beta_2 X_{2t} + \beta_3 X_{3t} \dots\dots\dots\dots\dots\dots + \beta_n X_{nt} + \varepsilon_{it}$

Where Y = the dependent variable is the net returns of processors.

X_{1t} = Processing techniques (traditional techniques=1, semi-mechanized techniques=2, mechanized techniques =3)

X_{2t} = Oil palm fruit cost (₦)

X_{3t} = Water cost (₦)

X_{4t} =Diesel cost (₦)

X_{5t} = Transportation cost (₦)

X_{6t}= Labour cost (₦)

X_{7t} = Milling charges (₦)

X_{8t}= Repairs (₦)

X_{9t}= Depreciation on milling equipment (₦)

RESULT AND DISCUSSION

Profile of Processing Techniques adopted by Processors

The study identified three (3) categories of oil palm processing techniques in the study area which include traditional processing techniques, semi-mechanized processing techniques and mechanized processing techniques. Processors were placed into each of these categories base on the extent to which machines were involved in their processing activities. That is, processors were categorized base on whether machines were fully used, partly used or not used at all in the stages involved in palm oil production which includes threshing, sterilization, digestion, pressing, clarification and drying. In a situation where no machines were used in any of the stages, the processor was categorized as one who adopted the traditional processing technique. On the other hand, if machines were used in at least one of the stages of palm oil production but not all the stages, then the processor was categorized as one who adopted the semi-mechanized processing technique. Lastly, if machines were used in all of the stages involved in palm oil production, then the processor was categorized as one who adopted the mechanized processing technique.

As shown in Table 1, a total of 12.08% of palm oil processors used traditional processing technique, 71.67% used semi-mechanized, while 16.25% used mechanized processing technique. This agrees with the findings of (Obayelu, A.E; Ayodeji, O.O and Adeoye, O.P; 2022), though in Afijio Local Government Area of Oyo State, who revealed that majority (95%) of palm oil processors used semi-mechanized processing techniques while the remaining 5% used traditional techniques. Furthermore, it partly agrees with the findings of (Adejo E.M; Ibrahim, H; Gbenga, O; Negedu, A and Oyewole B.O; 2023) in Kogi State that 18.75% of processors used the manual/traditional processing technique, 68.75% used the semi-mechanized techniques while 12.5% used the mechanized techniques. It partly agrees with this study in that most of the processors in both

states used semi-mechanized processing techniques. The fact that manual processors were the least used in Edo State showed that traditional processing technique was gradually going into extinction. The wide use of the semi-mechanized and mechanized processing techniques could be due to the fact that Edo State is the seat of the Nigeria Institute for Oil Palm Research (NIFOR) which is a government research institute that conducts research and development activities related to oil palm cultivation, processing, and technology development (NIFOR, 2021).

On the other hand, this finding is inconsistent with the findings of Egwu (2024), though in Enugu State, whose results showed that more than half (55.0) percent of palm oil producers use the traditional method of palm oil processing to produce their product whereas 17.5 percent used the mechanical method.

Table 1: Profile of processing techniques adopted by processors in the study area

Oil Palm Processing Techniques	Frequency	Percentage (%)
Traditional	29	12.08
Semi-Mechanized	172	71.67
Mechanized	39	16.25
Total	240	100

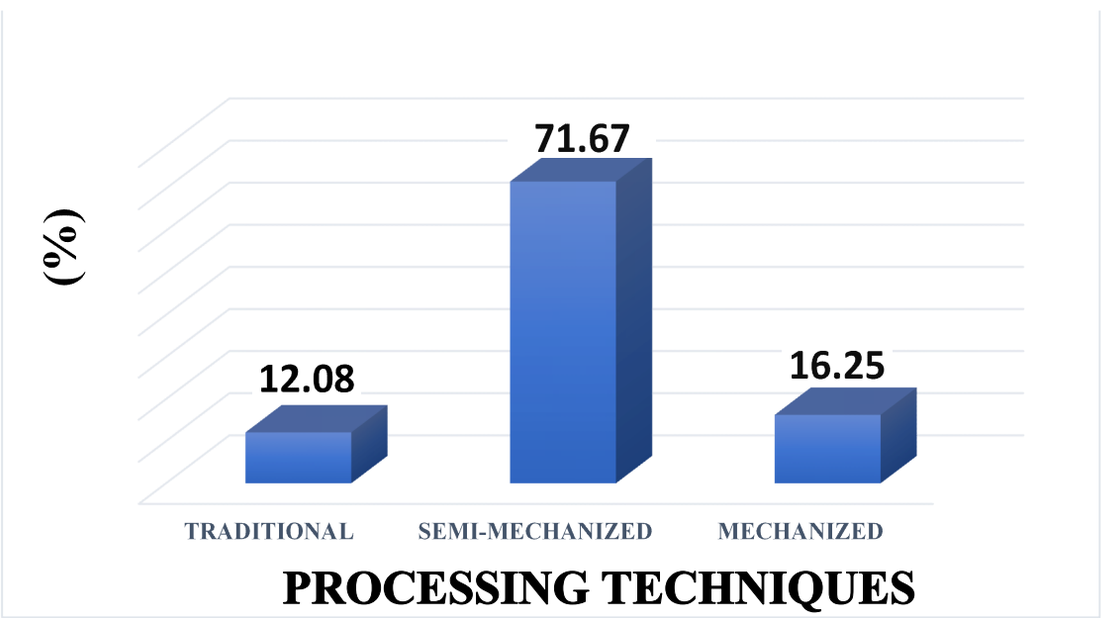

Figure 1: Bar Chart showing the categories of palm oil processing techniques

Comparative Profitability analysis of the three (3) categories of processing techniques

The budgetary technique was used to obtain information on profitability among the different palm oil processing techniques in Edo State. In estimation of the depreciation cost on fixed assets, the straight-line method was employed. As presented in Table 4.9, the total variable cost took the most significant share of the total value ranging from 85.90% to 90.59% across the various palm oil processing techniques. The total revenue, total cost, gross margin and net profit significantly differ amongst the three categories of palm oil processing techniques. In addition, the benefit-cost ratio (BCR) indicates that the use of mechanized processing techniques with a BCR of 2.02 is more economically attractive than the other groups.

The result in table 4.9 revealed that oil palm processing in Edo State is a profitable enterprise irrespective of the processing technique, however, with the mechanized being most profitable and traditional being least profitable. This is consistent with the findings of Adejo *et al* (2023) that revealed that mechanized processors were more profitable than semi-mechanized processors who in turn were more profitable than traditional processors. The processors who used the mechanized techniques were more profitable due to the difference in quantity produced and extraction rate (percentage yield).

Quantity of FFB processed: In terms of quantity processed, Table 4.10 below shows that the average quantity of FFB processed per annum by processors using the traditional processing techniques was 0.842 tonnes (842kg) while the quantity of FFB processed by users of semi-mechanized processing techniques was 5.826 tonnes (5826kg) which is approximately seven times those using traditional processing techniques. Moreso, the average quantity of FFB processed per processor per annum from the use of mechanized processing techniques was 11.244tonnes (11244kg) and this was almost 2 times the quantity processed from the use of semi-mechanized processing techniques and approximately 13 times the quantity from the use of traditional processing techniques. Therefore, processors who adopted the mechanized processing techniques on average processed more FFB, had more quantity of palm oil and therefore had more income from processing activities than the other categories.

Extraction rate (% yield): In terms of extraction rate, the extraction rate was estimated for the three (3) categories of processing techniques in the study area using a given quantity of FFB.

The oil yield in percentage for 1 tonne (1000kg) of the fresh fruits was calculated using the formula below:

Note: 1000kg of FFB can be processed into 220-230 Litres of palm oil using the traditional processing techniques and a litre of palm oil is equivalent to 0.9kg (density of palm oil is 0.9kg/L).

Therefore;

220L of palm oil = (0.9kg/L *220L) = 198kg

230L of palm oil = (0.9kg/L*230L) = 207kg

$$\%Yield_{Traditional\ techniques} \frac{mass\ of\ oil\ extracted\ (kg)}{mass\ of\ FFB\ used\ (kg)} \quad 198kg/1000kg \ *100 = 19.8\%$$

$$\%Yield_{Traditional\ techniques} \frac{mass\ of\ oil\ extracted\ (kg)}{mass\ of\ FFB\ used\ (kg)} \quad 207kg/1000kg \ *100 = 20.7\%$$

Therefore, the extraction rate or percentage yield of palm oil using traditional processing techniques is 19.8% - 20.7%

Note: 1000kg of FFB can be processed into 270-280 Litres of palm oil using the semi-mechanized processing techniques and a litre of palm oil is equivalent to 0.9kg (density of palm oil is 0.9kg/L)

Therefore; 270L of palm oil = (0.9kg/L *270L) = 243kg

280L of palm oil = (0.9kg/L*280L) = 252kg

$$\%Yield_{Semi-mechanized\ techniques} \frac{mass\ of\ oil\ extracted\ (kg)}{mass\ of\ FFB\ used\ (kg)} \quad 243kg/1000kg \ *100= 24.3\%$$

$$\%Yield_{Semi-mechanized\ techniques} \frac{mass\ of\ oil\ extracted\ (kg)}{mass\ of\ FFB\ used\ (kg)} \quad 252kg/1000kg \ *100= 25.2\%$$

Therefore, the extraction rate or percentage yield of palm oil using traditional processing techniques is 24.3% - 25.2%

Note: 1000kg of FFB can be processed into 320-330 Litres of palm oil using the semi-mechanized processing techniques and a litre of palm oil is equivalent to 0.9kg (density of palm oil is 0.9kg/L)

320L= (0.9*320) kg=288kg

$$\%Yield_{mechanized\ techniques} \frac{mass\ of\ oil\ extracted\ (kg)}{mass\ of\ FFB\ used\ (kg)} \quad 288kg/1000kg \ *100= 28.8\%$$

$$\%Yield_{mechanized\ techniques} \frac{mass\ of\ oil\ extracted\ (kg)}{mass\ of\ FFB\ used\ (kg)} \quad 297kg/1000kg \ *100= 29.7\%$$

Therefore, the extraction rate or percentage yield of palm oil using mechanized processing techniques is 28.8% - 29.7%

This result is in line with that of Uchenna *et al.* (2020), who found that the oil yield from the semi-mechanized processing method ranged from 20.40 to 20.70%, while the oil yield from the traditional processing method ranged from 15.50 to 15.70%. This suggests that the semi-mechanized method of processing palm oil produced a higher oil yield than the traditional method. The yield percentage difference between the two processing methods in this instance is approximately 5%, which is consistent with the results of this investigation. Conversely, the traditional method of processing oil palm is the least economical due to its laborious, time-consuming nature and typically low oil yield. Often, about 25%-75% of potential oil is lost during processing (Nyakuma, 2015) while 71.8-90.6% end up as waste under smallholder palm oil processing in Nigeria depending on the variety of oil palm (Eric and Ikheloha, 2017)

Table 2: Comparative Profitability Analysis of processors in the study area

ITEM	Traditional PT	Semi-Mechanized PT	Mechanized PT
Revenue			
Quantity of processed palm oil (Litres)	188.61	1607.98	3654.3
Price of palm oil per Litre	2100	2100	2100
Revenue from palm oil (TR_1)	396081	3376758	7674030
Quantity of uncracked palm kernel (kg)	126.3	873.9	1686.6
Price of palm kernel per kg	110	110	110
Revenue from palm kernel (TR_2)	13893	96129	185526
Total Revenue =TR_1+TR_2	**409974**	**3472887**	**7859556**
Variable Cost			
Quantity of FFB (tonnes)	0.842	5.826	11.244
Price of FFB per tonne	125000	125000	125000
Cost of FFB	105250	728250	1405500
Water	9579.31	30398.26	87666.67
Firewood	5724.14	9095.94	0
Transport	79379.31	317657	496948.7
Diesel (1250 per Litre)	0	258066.9	743782.1
Labour	39034.48	395407	506307.7
Milling Charges	0	74290.7	0
Repairs	5403.45	46762.5	102035.9
Total Variable Cost (TVC)	**244370.69**	**1859928.3**	**3342241.07**
Fixed Cost			
Depreciation on milling equipment	13567.42	157735.86	440109.9
Rent	9379.31	69813.95	102564.1
Platic drums/Jerricans	2450.28	6626.64	5883.58
Total Fixed Cost (TFC)	**25397.01**	**234176.45**	**548557.58**
Total Revenue =TR1+TR2	**409974**	**3472887**	**7859556**
Total Cost= TFC+TVC	**269767.7**	**2094104.75**	**3890798.65**
% of TVC to Total Cost	90.59%	88.82%	85.90%
% of TFC to Total Cost	9.41%	11.18%	14.10%
Gross Margin = TR-TVC	165603.31	1612958.7	4517314.93
Net Profit	140206.3	1378782.25	3968757.35
Benefit Cost Ratio = TR/TC	1.52	1.66	2.02

Source: Field Survey, 2024

Determinants of factors affecting the net profit of processors in the study area

Ordinary least square (OLS) regression was used to determine the factors affecting the net returns (net profit) of the processors in the study area. OLS was used because the dependent variable "net profit" is a continuous variable (quantitative variable). The coefficient of determination(R^2) shows the level of variation in the dependent variable(Y), which is explained by the independent variables (X_i).

The results presented in Table 3 showed that several variables entered into the model were statistically significant. With an R^2 of 0.8983, it showed that 89.83% of the total variations or changes in net returns or net profit of processors were determined by the explanatory variables included in the model. The remaining 10.17% were determined by the error term. Also, an F-ratio of 13224.28 indicated that the overall regression equation was statistically significant at 1% level. Semi-mechanized processing techniques ($p < 0.01$) and mechanized processing techniques ($p < 0.01$) had a significant positive influence on the net returns of palm oil processors while and cost of oil palm fruits ($p < 0.01$), diesel cost ($p < 0.01$), transportation cost ($p < 0.01$) labour cost ($p < 0.01$), milling charges ($p < 0.05$), and depreciation on milling equipment ($p < 0.01$) negatively affected the net profit of palm oil processors in the study area.

Semi-Mechanized Processing Techniques

The semi-mechanized processing techniques had a positive coefficient of 138878.2 and a t-value of 3.48 which was statistically significant at 1%. The implication is that, the more the use of semi-mechanized processing techniques relative to the traditional techniques, the higher the net returns or net profit of the processor.

Mechanized Processing Techniques

The mechanized processing techniques had a positive coefficient of 1532689 and a t-value of 18.78 which was statistically significant at 1%. The implication is that, the more the use of mechanized processing techniques relative to the traditional techniques, the higher the net returns or net profit of the processor. Moreso, the positive coefficient of the mechanized processing techniques is higher than that of the semi-mechanized. Accordingly, net profit increases with the degree of mechanization. This is in line with research by Olatunji J.O; Ogunkunle, O and Taiwo. A; (2022), which found that agricultural mechanization has a significant positive impact on agricultural productivity and the profitability of farming and processing operations. It also contradicts the findings of Ozioma, N.E; Chibueze, N.F and Chiamaka U.E (2017) who found that increased technology utilization lowers the amount of oil palm fruit processed and, consequently, the output rocessed.

Cost of oil palm fruits

Cost of oil palm fruit with a coefficient 1.743418 and a t-value of 15.37 is statistically significant at 1% level and was also negative. This means that cost of oil palm fruits had an inverse relationship with the net profit of processors in the study area. The implication is that, the lower the cost of oil palm fruit, the more the returns from the processing enterprise by the processors. This is because oil palm fruit is a major resource used in oil palm processing. This also confirms the findings of Ogbonna and Ezedinma (2005), who opined that the cost of palm fruits was the highest cost factor in oil palm processing

Diesel Cost

The cost of diesel had a coefficient of -1.299404 and a t-value of -10.90 is statistically significant at 1% level and was negative. This means that diesel cost is inversely related to the net profit of processors in the study area. The implication of this is that the lower the cost of diesel, the higher the net returns of processors in the study area

Transportation Cost
The transportation cost of oil palm processing with a coefficient of -1.113318 and a t-value of -13.52 is statistically significant at 5% level and was also negative. The result was consistent with a prior expectation that returns from oil palm processing should be inversely related to the cost of transportation. The result implies that, the lower the transportation cost, the higher the net profit of processors in the study area.

Labour Cost
The labour cost associated with oil palm processing had a coefficient of -1.003961 and a t-value of -17.11, indicating statistical significance at the 1% level, and it is also negative. This finding aligns with the expectation that profits from oil palm processing would have an inverse relationship with labour costs. Consequently, this result implies that a reduction in labour costs leads to an increase in profits from the processing operation.

Milling Charges
The milling charges of oil palm processing with a coefficient of -0.7258852 and a t-value of -5.02 is statistically significant at 5% level and was also negative. The result was consistent with a prior expectation that returns from oil palm processing should be inversely related to the cost of transportation. The result implies that, the lower the transportation cost, the higher the net profit of processors in the study area.

Depreciation on milling equipment
Cost of depreciation of the fixed asset of the processing enterprise with a coefficient -1.216507 and a t-value of -11.30 is statistically significant at 1% level and was also negative. The implication was that, the lower the cost of depreciation, the higher the returns from the processing enterprise by the processors. Machines and equipment are expensive, cost much and at times beyond what many processors can afford, hence, they hire or rent. According to Omoti (2004), the high cost of processing equipment is a significant issue that Nigerian processors face and has deterred prospective processors from starting their own mills.

Table 3: Determinant of net profit of palm oil processors in Edo State

Variables	Coeff.	St.Err	t-value	p >|t|
Semi-mechanized technique	138878.2***	39904.61	3.48	0.001
Mechanized technique	1532689***	81599.56	18.78	0.000
Cost of oil palm fruits	-1.743418***	0.011341	-15.37	0.000
Water Cost	-0.329	0.226001	-1.46	0.214
Diesel Cost	-1.299404***	0.119264	-10.90	0.000
Transport	-1.113318***	0.082323	-13.52	0.000
Labour	-1.003961***	0.058683	-17.11	0.000
Milling charges	-0.7258852***	0.14462	-5.02	0.000
Repairs	-0.273606	0.235379	-1.16	0.246
Depreciation on milling equipment	-1.216507***	0.107688	-11.3	0.000
_Constant	92826.06	2446.85	3.80	0.000
No of observation	240			
F(10,229)	13224.28			
Prob.>F	0.0000			
R-Squared	0.8983			
Adjusted R-Squared	0.8982			
Root MSE	1.20e+05			

****** p<0.01, ** p <0.05, * <0.1***

CONCLUSION

Based on the findings of the study, it was concluded that palm oil processing enterprise in the study area is profitable irrespective of the processing techniques, however, with the mechanized processing technique being most profitable. The net profit of processors in the study area was affected by factors such as processing techniques, cost of oil palm fruits, transportation cost, labour cost, cost of diesel, milling charges and depreciation on milling equipment.

RECOMMENDATIONS

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

I. The result of this study revealed that the use of mechanized processing techniques has been shown to be more profitable producing high yield of quality product that meets international standard, therefore, the government, Non-Governmental Organizations (NGOs) and other stakeholders in palm oil production should initiate a policy that will facilitate the transition of palm oil processors from the use of semi-mechanized to mechanized processing techniques.

II. To enhance profitability in palm oil processing, government agencies, private investors, and development partners should prioritize and invest in the promotion, accessibility, and affordability of semi-mechanized and fully mechanized processing technologies. Since net returns increase with the level of mechanization, supporting processors especially smallholders with subsidies, credit facilities, and training on mechanized equipment use will improve efficiency, productivity, and income levels across the sector.

III. To improve the profitability of palm oil processing enterprises, policymakers and stakeholders in the agricultural value chain should work to stabilize and reduce the cost of oil palm fruits. This can be achieved through initiatives such as supporting oil palm cultivation, improving supply chain efficiency, and facilitating access to affordable raw materials through cooperatives or bulk purchasing schemes. Reducing the cost of this key input will significantly enhance net returns for processors.

IV. Palm oil processors who adopted the mechanized processing identified high cost of diesel as the major constraint limiting palm oil production. This can be resolved through the provision of facility that helps convert the mill effluent or sludge into biogas that can be used to power the palm oil processing plant as obtainable in Presco Nig. Plc

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