

## Economics of Palm Oil Processing in Southwestern Nigeria

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**Abstract:** The study was designed to investigate the economics of palm oil processing in Southwestern Nigeria. Hydraulic hand press technique was the predominantly used method in processing while the profitability analysis revealed that palm oil processing was profitable. Multiple regression analysis showed extraction cost and cost of palm fruit to be negatively and significantly associated with net return while depreciation of tools and other inputs showed inverse relationship with net return. In contrast no significant relationship was found to exist between net return and such factors as processing experience and cost of labour.

**Keywords:** Oil, Processing, Returns, Regression, Cost

### INTRODUCTION

The oil palm is a perennial crop that originated in the tropical rain forest of West Africa. It spread to South America in the 16th century and to Asia in the 19th century. During the 1970s, Asia overtook Africa as the principal oil palm producing region in the world. In recent decades, the domestic consumption of palm oil in West Africa has increased more rapidly than its production. After centuries as the leading producing and exporting region, West Africa has now become a net importer of palm oil.

Between 1961 and 1965 world oil palm production was 1.5 million tons, with Nigeria accounting for 43%. However, since then, oil palm production in Nigeria has virtually been stagnated. But today, world oil palm production amounts to 14.4 million tons, with Nigeria which is one of the largest producers in West Africa, accounting for only 7%. Kei *et al* (1997) compared the characteristics of the Oil palm sectors in Malaysia and Nigeria and found out that Malaysia's success is

built on plantation management together with processing in large modern mills. The plantation mode of production is characterized by large scale monoculture under unified management. In Nigeria by contrast, 80% of production comes from dispersed small holders who harvest semi wild plants and use manual processing techniques. Several million smallholders are spread over an estimated area of 1.65 million hectares in the southern part of Nigeria. In addition, to the agro-climatic and structural (size and scale of production and processing sectors) there are other environmental and coordination factors like little use of modern inputs and extension service; previously controlled by monopoly marketing board; low provisions of market information, standards and quality control (Udom, 1986)

Since independence in 1960, Nigeria's agricultural sector has experienced slow output growth that has not kept pace with population increases. This has resulted in declining agricultural exports and domestic food supplies

and a growing reliance on imported food. Nigeria has been particularly fortunate in having vast oil reserves but it has also been plagued by economic chaos and political instability over the past three decades while the decline in the agricultural sector can be partly explained by drought and serious pest and diseases infestations, there are other prominent reasons for its decline, including the neglect of the agricultural sector after the oil boom, and unfavourable government policies which greatly affected the technology generation capacity and technology environment, farm level production and marketing environment and production and coordination machinations between different stages of the oil palm sector in Nigeria (Hyman, 1990).

Because of the increased demand for palm oil resulting from an increase in population and income growth, relative to the low productivity of the oil palm sector, Nigeria has become a net importer of palm oil. At the same time, the rapid devaluation of the Naira combined with high transportation costs from ports to internal markets put imported oil in a competitively disadvantaged position. Thus Nigeria's first goal is to meet the domestic demand and then if possible seeks to become competitive in export markets. Nigerian palm oil production is potentially competitive in the domestic market if oil palm industry would enhance the overall economic development through the income and employment effects in the rural and urban economies.

Palm oil processing is a major source of income and employment to a large proportion of the resource poor rural population in Nigeria especially in the southwestern part of the country. In recent times, its production has drastically downsized. Evidence from (CBN/ NISER, 1992) revealed that

this situation has been brought about by a number of socio-economic and political factors along with the technological know how in the industry. Principal among the factors responsible for this decline is the inefficiency that exists in the production system for palm oil processing. Such inefficiencies arise from high cost of labour, lack of linking roads for transportation, electricity, water, inadequate credit facility.

The processors in the study area process oil palm to get palm oil, kernel and fiber. The methods of getting these products are very tedious and laborious. This requires substantial proportion of labour force. The success or failure of a processing depends largely upon how labour and other associated resources are efficiently used. An efficient processing technique increases the quality and quantity of food available for consumption and trade (Ukpabi, 2004).

Having recognized that small scale palm oil processing is inefficient (Omoti, 2004) and unprofitable the study was focused on medium-large scale processors. The research was undertaken to pursue these objectives

- i. Identify the existing rural holders processing techniques
- ii. Evaluate the profitability of palm oil processing enterprises and
- iii. Determine the factors affecting the net return of the processors.

## LITERATURE REVIEW

The oil palm sub- sector of the agricultural sector of the economy presented itself as a potential productive sector that could be used to diversify the economy after years of neglect. Historically, this subsector has been a source of

growth in a stagnant economy because of the numerous economic potentials of the oil palm (Purvis, 1970). Ahmed (2001) highlighted the importance of the economic tree crop in providing direct employment to about 4 million Nigeria people in about 20 oil palm growing states in Nigeria and indirectly to other numerous people involved in processing and marketing. Omoti (2001) stated that Nigeria has enormous potential to increase her production of palm oil and palm kernel primarily through application of improved processing techniques. Agboola (1993) opined that improved technologies that meet both growth and sustainability goals can be effectively used by oil palm processors. However, most technologies are designed for developed rather than developing countries. Nevertheless, most farmers in developing countries use imported seed materials obtained from research stations but without a corresponding application of packages which are meant to be used with them. Even where these packages are used as instructed, yields are always lower than those obtained in research stations where seeds are bred. Efforts to raise agricultural production and farmer's standard of living require the introduction of improved farm equipment and technologies as well as increased availability and utilisation of energy and power. However, the vast majority of farmers work at near subsistence level of production (Cobezas *et al*, 1995).

Jalani, *et al* (2000) stressed that oil palm processors should embrace well integrated capital intensive, high volume and high extraction rate in their processing method in order to encourage high transformation of oil palm industry in the country. Kei *et al* (1997) highlighted that the stagnation in the oil palm sector in Nigeria was influenced by the

overall agricultural policies that could be classified into three periods. Following the independence (1960-1970), the industrialization was financed by export taxes through commodity marketing boards which monopolized commodities such as cocoa, groundnut, palm oil, cotton and rubber. The resulting producer price had a damaging effect on the production of export crops. In addition, the civil war from 1967 to 1970 had devastating effects on the economy. In the oil export boom period (1970-1985) with OPEC's intervention oil prices in early 1970 increases fourfolds and oil became the dominant export commodity and source of government revenue.

The appreciation of the Naira and the reduction of duties on food imports made food imports cheaper than domestic staples. These actions created biases against agricultural exports (Forest, 1993). During the sap period (1993-2003) on the positive side there was a rise in output prices, improvement in production efficiency and on an increase, in opportunities for small business enterprises. On the negative side however, it led to increased input prices and a sharp increase in the cost of living relative to nominal income (CBN/NISER, 1992) so, national-level consumption has declined following sap implementation. Kei, *et al* (1997) in their study observed that because of the increased demand for oil palm products, resulting from an increase in population and income growth, relative to the low productivity of the oil palm sector, Nigeria has become a net importer of palm oil. At the same time, the rapid devaluation of the Naira combined with the high transportation costs from ports to internal markets put imported oil in a competitively disadvantage position.

Thus, Nigeria's first goal should meet the domestic demand and then if possible, seek to become competitive export markets. Nigerian palm oil production is potentially competitive in the domestic market if oil palm sector productivity is increased by shifting the technology frontier further. Transformation of the oil palm industry would enhance the overall economic development through the income and employment effects in the rural and urban economies. Based on these premises, the present study dwells on the profitability of oil palm processing techniques in Southwestern Nigeria.

## METHODOLOGY

The data used in this study were primary data collected by means of structured questionnaire administered on a random sample of 120 processors in Ondo state, which is a major palm oil processing area in Southwestern Nigeria. Five towns were purposively selected for the study viz: Irele, Okiti pupa, Eseodo, Odigbo and Ikale. From each town, twenty four palm oil processors were selected using random sampling technique. The analytical tools used in this study were descriptive statistics, profitability technique and multiple regression analysis.

The profitability technique can be expressed as  

$$NFI = GFI (P (Q).Q) - TC (VC + FC)$$

Where:

NFI - Net farm income

GFI- Gross farm income

PQ – Price per unit of output

Q- Total output

TC- Total Cost of production

VC- Variable Cost

FC- Fixed Cost

The multiple regression technique was applied using three functional forms namely, linear, semi-log and Cobb-Douglas. The best fit was selected after considering the levels of estimated error, magnitude of R<sup>2</sup>, number and signs of estimated regression coefficients. Explicitly the model is specified as follows

$$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, U)$$

Where

Y= Net returns of palm processors (₦)

X<sub>1</sub>=Education (years)

X<sub>2</sub>= Processing Experience (years)

X<sub>3</sub>= Labour Cost (₦)

X<sub>4</sub>=Extraction Cost (₦)

X<sub>5</sub>= Depreciation on Tools (₦)

X<sub>6</sub>= Cost of Palm Fruits (₦)

X<sub>7</sub>= Processing Period (days)

X<sub>8</sub>=Other Costs (water transport, firewood etc.)

X<sub>9</sub>= Technology Used dummy 1-improved method, 0 – traditional method

U- error term.

### Descriptions, measurement and expected signs of variables.

Dependent Variable (Y): Net returns of palm processors (₦) - The dependent variable Y which represents the actual net returns of palm processed by respondents, is a continuous random variable measured in Naira.

Independent Variables (X<sub>i</sub>):

X<sub>1</sub> Education (years)- This refers to the level of formal education received by the farmers. It is measured by the year of schooling. Educational level of the farmers is expected to have positive relationship with the net returns since educated farmers are more likely to be business alert and possess the ability to seize business initiatives or advantage.

$X_2$ = Processing Experience (years)- This indicated the number of years spent so far in processing business. According to Omoti (2001), the primary determinants of a potential processor's capabilities are experience in business and the quality of the information provided as far as extension workers are concerned. Based on their exposure it could be adjudged that they possess greater ability to predict possible problems and likely solutions that result in higher income. It is therefore expected that the farm experience will have a positive relationship with net returns.

$X_3$ = Labour Cost (₦),  $X_4$ =Extraction Cost (₦),  $X_5$ = Depreciation on Tools (₦),  $X_6$ = Cost of Palm Fruits (₦),  $X_8$ =Other Costs (water, transport, firewood etc.) - These variables are measured in terms of amount spent on hired labour used, extraction, depreciation of fixed items, palm fruits, water, transport and firewood respectively. They are measured in naira and expected to have negative relationship with the net returns.

$X_7$ = Processing Period (days) - This is the number of days between the time of fruits harvest and final output. The oil palm fruit is harvested manually using a cutlass, after which it is shredded, picked, parboiled, pounded and pressed. Delay in the time interval between harvest and final output may render the quality of red oil produced low, hence reduces the net returns from the final output (Onwubuya, 1997). It is measured in days and expected to have negative relationship with the net returns.

$X_9$ = Technology Used (dummy) 1-improved method, 0 – traditional method –users of improved method of processing like mechanical, diesel - powered digesters are scored 1, while users of crude method like use of manual digesting/producing of parboiled fruit, using pestles and mortars are scored

zero. This choice of scoring was adopted based on past literature (Jalani, *et al* 2000).

## RESULTS AND DISCUSSION

### Socio-Economic Characteristics of the Sampled Processors

The mean age of sampled processors was 56 years and this implied that those involved in the processing of palm oil are no more in their active age and so, are growing old. However, younger ones should be encouraged to participate in these processing operations. Education plays an important role in palm oil processing operations since it will facilitate the adoption of innovations that will improve palm oil processing. The study revealed that 50% of the respondents had primary education, 44% had secondary, and 1% had tertiary education while 4% had none.

The average size of palm plantation of the processors was 2.2 hectares, 64% of processors had farms less than two hectares while 36% of processors had plantation ranging between three and four hectares. This characterized the stagnant nature of oil palm production in Nigeria with 80% of national production from smallholders (Hyman, 1990). Out of 120 sampled processors 20% has been in processing for between 1-5 years, 50% had 6-14 years processing experience, the remaining 30% had been in processing for 15 and 20 years. The mean processing experience is 13 years.

About 76% of processors acquired plantation through inheritance, while 24% was acquired through rentage. The average household size of processors is 8 persons while the processing industry was dominated by men with 76% of male and 24% of female. The most

prominent system of labour requirement is family, which accounts for 64% while 36% is provided by hired labour.

The method of processing used by sampled processors were manual pressing method, power propelled hydraulic press and hydraulic hand press. About 9% of the processors used hand pressing technique while 53% and 48% used hydraulic hand press and power propelled hydraulic press respectively.

### Profitability Analysis in Palm Oil Processing

The mean annual cost of inputs and output in palm oil processing is shown in Table 1. The total cost of palm oil processing was ₦1, 477,095.16. The total fixed cost which was ₦624, 548.13 represented 42% and the total variable cost was ₦ 852,547.03 represented 57.7% of total costs. Palm fruits were the most important cost factors in palm oil processing, accounting for about 56.1%. However, the gross return was ₦1, 911,700 while a net return and return per naira from the enterprise were ₦434, 504.84 and 29.4% respectively implying that on every naira invested, a profit of 29 kobo was realised.

Benefit-Cost Ratio (BCR=TR/TC). As revealed in Table 2, this ratio is high (1.29), this shows an increase in returns. It indicates that the enterprise is profitable. It is probable that with increased capital, improved technology and skilled labour, this ratio will increase.

Expense Structure Ratio (ESR=FC/TC). The value of ESR is 0.423 which implies that about 42.3% of the total cost of production is made up of fixed cost components. This makes the business worthwhile to invest.

Table 1: Costs and Returns in Palm oil Processing Enterprise at Ondo State

| Items                                       | Value (₦)         | Percentage contribution to total cost |
|---------------------------------------------|-------------------|---------------------------------------|
| <b>Returns</b>                              |                   |                                       |
| Palm oil                                    | 1,870,000         |                                       |
| Palm kernel (cracked)                       | 15,600            |                                       |
| Palm kernel (uncracked)                     | 23,300            |                                       |
| Sludge                                      | 2,300             |                                       |
| <b>Total Gross Return</b>                   | <b>1911,700</b>   |                                       |
| <b>Variable Cost</b>                        |                   |                                       |
| Palm Fruits                                 | 478,759.00        | 32.4%                                 |
| Hired Labour (Harvesting and Processing )   | 122,644.50        | 8.3%                                  |
| Extraction charge                           | 83,702.61         | 5.6%                                  |
| Cracking charge                             | 64,218.72         | 4.3%                                  |
| Other expenses (transport, water, firewood) | 103,221.80        | 6.9%                                  |
| <b>Total variable cost</b>                  | <b>852,547.03</b> | <b>57.7</b>                           |
| <b>Fixed Cost</b>                           |                   |                                       |
| Rent (plantation)                           | 378,321.63        | 25.6%                                 |
| Interest on borrowed capital                | 136,503.70        | 9.2%                                  |
| Depreciation on assets                      | 24,000.00         | 1.62%                                 |
|                                             | 85,722.80         | 5.8%                                  |
| <b>Total fixed Cost</b>                     | <b>62,454.13</b>  | <b>42.3%</b>                          |
| Total Cost (TVC+TFC)                        | 1,477,095.16      | 100.00                                |
| Net Return                                  | 434,604.84        |                                       |
| Return per Naira                            | 29.4%             |                                       |

Source: Field Survey, 2007

Gross Ratio (GR=TC/TR). This is 0.77. This implies that from every ₦1.00 return to the industry, 77.00k is being spent.

Table 2: Profitability of Palm Oil Processing.

|                          |       |
|--------------------------|-------|
| Benefit Cost Ratio       | 1.29  |
| Rate of Return           | 0.29  |
| Gross Ratio              | 0.77  |
| Expenses Structure Ratio | 0.423 |

Source: Field Survey, 2007.

### Multiple Regression Results

The results of Multiple Regression of processor's net return on resource inputs in Ondo state is presented in Table 3. Double log production function is selected as the lead equation based on (i) the magnitude of R<sup>2</sup> (ii) the significance of F-value (iii) the t-values and (iv) the appropriateness of the signs of the regression coefficients. The F-ratio value is statistically significant at 1% which implies that the model is adequate for use in further analysis. The

coefficient of determination ( $R^2$ ) was 68%. This implies that the independent variables explain at least 68% of the variability in processors net returns in the study area.

The coefficient of labour cost, other inputs and processing periods are negative with the use of other inputs significant at 10% showing indirect relationship with processors net returns. This implies that those costs have decreasing impact on net return. The same thing applies to the coefficient of depreciation cost significant at 5% level indicating that as depreciation decreases the net return increase. These costs although essential are expected to decrease, so having increasing value on processor's net return. The coefficient of variables extraction cost, cost of palm fruits are negative and are both significant at 5% levels of probability, showing indirect relationship with the processors net return. This implies that they have decreasing impacts on the net return.

The coefficient of the improved method is positive and significant at 1% level. Efforts to raise agricultural production and farmer's standard of living require the introduction of improved farm equipment and technologies as well as increased availability and utilisation of energy and power. This therefore implies a positive relationship with the net returns from the oil palm processing. An advantage of the use of mechanical digestion is the shorter period expended, which means that the mash has higher temperature than when it is pounded manually. High temperature means that oil extraction is more efficient unlike with manual processing, which is slower and oil yield is cold and there is less output. (Cobezas *et al*, 1995). In contrast, no significant relationship exists between the coefficients net return and such factors as

processing experience and processing periods but their signs follow the *a priori* expectation.

Table 3: Determinants of Processors' Net Return at Ondo State.

| Explanatory Variable                           | Regression Coefficient | T-Ratio     |
|------------------------------------------------|------------------------|-------------|
| Processors Experience                          | 0.2748                 | 0.7893      |
| Labour Cost                                    | -0.05398               | -0.3319     |
| Extraction Cost                                | -0.8681                | -2.5889***  |
| Depreciation on tools                          | -0.3241                | -2.4326**   |
| Cost of palm fruits                            | -1.3589                | -3.26781*** |
| Processing periods                             | -0.1742                | -1.30731    |
| Other input costs (transport, water, firewood) | -0.8751                | -2.58231*** |
| Improved Method                                | 1.2134                 | 4.0121***   |
| Intercept                                      | -1.8459                |             |
| $R^2$                                          | 0.68                   |             |
| F                                              | 12.72***               |             |
| No of observation (n)                          | 120                    |             |

Source: Data Analysis, 2007

\*\* Significant at 5% levels.

\*\*\* Significant at 1% levels

$R^2$  - Coefficient of determination

## CONCLUSION

The present investigation was under taken with a view to analyzing the critical issues relating to economics of palm oil processing in Ondo state, Nigeria. Among the palm oil processing techniques about 9% of the processors used hand pressing techniques, while others used hydraulic hand press and power propelled hydraulic press. The results of the profitability analysis in palm oil processing in the area showed a level of profitability while factors such as high rentage of palm plantation, extraction and transport costs were the most critical factors inhibiting profit Table palm oil processing.

The results on the determinants of net return showed that extraction cost, cost of palm fruits are positively and significantly associated with the net return while depreciation of tools and other inputs were negatively but significantly related with the net return. On the other hand, no significant relationship was found to exist

between net return and such variables as processing experience and labour cost.

In order to accelerate the net returns in palm oil processing in the state, the government should endeavour to build roads in the area where they do not exist and maintain ready existing ones for easy access to raw materials and thus reduce transportation cost in order to boost the revenue of the processors. Processors should be encouraged to form co-operative groups so as to pool their resources together in order to acquire modern equipment thereby reducing extraction cost and enhance their revenue base.

Social amenities like electricity should be regularly supplied while pipe borne water should be provided in areas where oil is processed to facilitate palm oil production

Palm oil processors should adopt good management strategies to ensure efficient utilisation of assets. Processors revenue base can be more enhanced if multipurpose automatic machine could be supplied by government at subsidized rate to reduce extraction cost. In addition the Nigerian Institute of Oil Palm Research (NIFOR) should be revitalized, because it had been unproductive, inefficient and financially unsustainable.

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