FUDMA Journal of Sciences (FJS)
ISSN online: 2616-1370
ISSN print: 2645 - 2944
Vol. 3 No. 4, December, 2019, pp 190 –200

EVALUATING THE EFFECTS OF ADOPTION OF IMPROVED PROCESSING TECHNOLOGIES ON TECHNICAL EFFICIENCY OF PALM OIL PROCESSORS IN OGUN STATE, NIGERIA

[*1]Ogunmola O. O., [2]Oyawole F. P. and [2]Oladele B. O.

[1]Department of Agricultural Economics and Extension, Bowen University, Iwo, Osun State, Nigeria
[2]Department of Agricultural Economics and Farm Management, Federal University of Agriculture, Abeokuta, Ogun State, Nigeria

[*]Corresponding Author's Email: omotoso.ogunmola@bowenuniversity.edu.ng

ABSTRACT
Although Nigeria is ranked third among palm oil producers globally, her production still falls short of local demand, indicating a gap in processing efficiency. This study examined the effect of adoption of improved processing technologies on technical efficiency of rural processors. The study is based on a primary dataset collected from 80 palm oil processors who were selected through multistage random sampling from Ipokia and Ado-Odo Ota Local Government Areas of Ogun State, Nigeria. Data were analysed with budgetary analysis and stochastic frontier analysis to estimate the profitability and technical efficiency of oil palm processing enterprise respectively. An average processor is capable of realizing 36 kobo as gain on every naira invested in the business. The results showed that the enterprise yielded profitable returns to the processors. The mean technical efficiency (TE) 0.95 indicates that 95% of the respondents are efficient and 5% inefficient. Quantity of palm fruits, quantity of water, and transportation cost were the crucial factors that contributed to the TE of oil palm processors while age, membership of association and adoption of oil clarifier significantly affect their technical inefficiency. The study recommends proper training on palm oil processing towards usage of the desired technology to attain capacity building.

Keywords: Adoption, Palm oil, Stochastic Frontier Analysis, Technical Efficiency

INTRODUCTION

African oil palm (*Elaeis guineensis* Jacq.) is a tropical crop cultivated mainly for the production of palm oil (FAO, 2015). Its historical background can be traced to the tropical rain forest region of Africa with the main belt running through the Southern Latitudes of Cameroon, Côte d'Ivoire, Ghana, Liberia, Nigeria, Sierra Leone and Togo into the equatorial region of Angola and the Congo (Ajani *et al.*, 2012). It belongs to the Arecaceae family which contains about 225 genera with over 2600 species along with coconut and date palms cultivars (Breure, 2003).

Nigeria is ranked third among the largest producers of palm oil globally. Despite this huge production, it does not translate into exportation, as palm oil imports are still necessary to meet her domestic demand. In fact, the local shortage in oil palm industry is estimated to be around 1,070,000 MT annually, which negative implications for manufacturing industries and local consumption (Adetola, 2015). The primary goal is therefore to satisfy the domestic demand and if possible, compete in the palm oil export market with other producing nations like Malaysia and Indonesia in order to gain much needed foreign exchange (Ayodele, 2010).

Palm oil processing can be listed among the major sources of livelihood and income to a large proportion of poor rural population in Nigeria, especially in the South-Western part of the country. Palm oil processing technologies may be grouped into four categories according to the degree of complexity of the operational machinery. These are the traditional methods, small-scale mechanical units, medium-scale mills and large industrial mills (Nwalieji and Ojike, 2018). However, most of rural smallholder processors (over 80%) in developing countries still rely on traditional methods of processing, which lowers the level of palm oil extraction efficiency (Muzari *et al*., 2012). In addition, this process yields palm oil that is high in free fatty acids (FFA) content (up to 30% in some cases), which can cause obesity and Type 2 diabetes (Ugwu, 2009; Adaigho and Nwadiolu, 2018).

Thus, the potential of palm oil processing enterprise to meet local demand, and lift rural people out of poverty has been severely curtailed due to the low efficiency of processing technologies. In order to improve the quality of the palm oil extracted and the efficiency of operation, as well as reduce the drudgery and tedium associated with traditional processing techniques, the Nigerian Institute for Oil Palm Research (NIFOR), located in Edo State, Nigeria has developed Small-Scale Palm oil Processing Equipment (SSPE), which comprises of four units; sterilizer, digester, and separating engine and oil clarifier (PIND, 2012).

However, while there are studies (Gunn 2014; Adaigho and Nwadiolu, 2018) that have assessed factors influencing the adoption of these technologies, there is a gap in literature about their effects of their adoption on the technical efficiency of palm oil processors. Given that these new technologies have been conceptually associated with greater efficiency in palm oil processing, it is necessary to investigate this claim so as to provide empirical basis for its promotion among rural processors. Thus, this study was conducted to examine the effect of adoption of these new technologies on the technical efficiency of palm oil processors.

MATERIALS AND METHODS

Description of the study area

The study was conducted in Ogun State, Nigeria. Ogun State is one of the six States that make up Southwest Nigeria. It lies between latitudes 6.2°0′ and 7.8°0′ North and longitudes 3.0°0′ and 5.0°0′ East of the Greenwich Meridian with the population of 3,751,140 and approximately 16980.55 km^2 in area (NPC, 2006). The State is bounded on the West by the Republic of Benin and on the East by Ondo State. To the North is Oyo State while Lagos State and the Atlantic Ocean are to the South. The geographical location of the State makes it accessible to the economically developed regions in Nigeria. The rainy season begins in May and lasts till November (Climate and Weather, 2019), with average annual rainfall of 2152mm. The average annual temperature is above 27.1^{0}C with an annual relative humidity of 78%. Agriculture is the main occupation in Ogun state, providing income and employment of about 70% of the labour force. The State's agricultural potential is rich, due to its comparative advantage in six major crops: cassava, cocoa, cotton, kola, oil palm and rice.

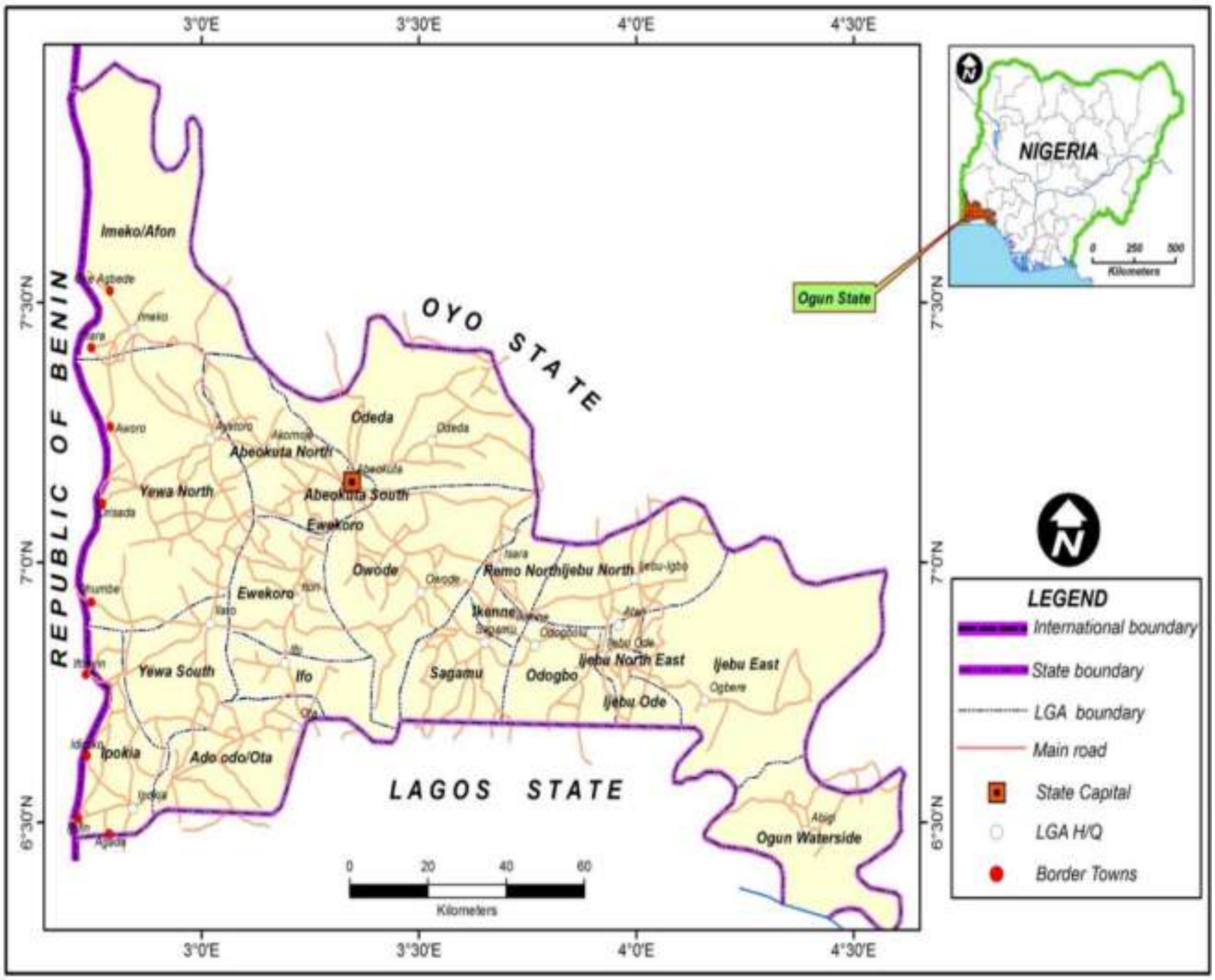

Fig. 1: Map of study area, Ogun State, Southwest Nigeria
Source: Authors' illustration

Sampling Technique and Sample Size

The population of this study comprises oil palm processors in Ogun State. Multistage sampling technique was used to select 80 oil palm processors in the study area. The first stage involved the purposive selection of two local government areas (Yewa and Ipokia Local Government Areas), based on the peculiarity and dominance of oil palm plantation and processing in these studied areas. These rural areas produce and process about 80% of the oil palm consumed in Ogun State. The second stage was the simple random selection of 4 villages from each LGA. The villages selected are 'farm settlement', Idolehin, Isalu and Alagogo in Yewa LGA; and Tube, Ifonyintedo, Tongeji and Madoga in Ipokia LGA. The third stage involved the simple random selection of 10 oil palm processors from the selected 8 villages to make up 80 respondents as the sample size used for this study.

METHODS OF DATA COLLECTION

Primary data were collected from the farmers through a paper type interview schedule. The interview was conducted in the respondent's local language for easy understanding. During the course of this study, several precautions were taken to ensure the protection of the rights of respondents to the questionnaire and interview. No interview began without receipt of informed consent from each respondent. The data collected include among others, the socio-economic characteristics of the oil-palm processors, quantity and cost of various inputs employed in production and monetary value of oil palm processed.

ANALYTICAL TECHNIQUES

Data were analysed using descriptive statistics (such as mean, tables and percentages), budgetary analysis and stochastic production frontier model. Descriptive statistics were used to describe the socioeconomic characteristics of the farmers and the processing techniques. Budgetary techniques were employed in estimating the cost, returns, gross margin, net income (profit) and measures of profitability (such as profit per naira invested) while the stochastic production frontier was used to analyse the technical efficiency of the oil palm enterprise in the study area.

BUDGETARY ANALYSIS

The mathematical expression of the budgetary techniques leading to the estimation of costs, returns, gross margin, net income (profit) and measures of profitability is as stated:

Profit (π) on oil palm enterprise = Gross Margin (GM) - Total Fixed Cost (TFC) ……… (1)

For this study, no fixed cost was incurred because all the interviewed processors have been in the business for more than five years so; it was difficult to compute the values for their equipment. In order to correct for this, the maintenance or the running cost of these equipment were computed under variable cost. Therefore;

Profit (π) on oil palm enterprise = Gross Margin (GM) …………………………………. (2)

The calculation of gross margin is given as:

$$\prod_j = [(P_y)Q_y]_j - \sum_{i=1}^{n}[(P_{xi}X_i) + TC]_j \quad \text{……………………………………………………. (3)}$$

Where;

$\prod_j$ is the gross margin of the j^{th} processor

$[(P_y)Q_y]_j$ is the total revenue for the j^{th} processor

$[(P_{xj})X_{ij} + TC]_j$ is the total variable costs of the j^{th} processor, which include the operational costs in the whole enterprise such as input costs, cost of labour (both skilled and unskilled) and transport costs.

T is the transaction costs. This includes transport cost and the cost of searching for inputs sellers and output buyers.

P_y is the output price received by the j^{th} processor

Q_y is the output of the j^{th} processor

Whereas P_x is the input price paid by the j^{th} processor for the i^{th} input or service and X_{ij} the quantity of i^{th} input or service used by the j^{th} processor.

To use the gross margin as a measure of business performance, it is usually expressed in terms (as a ratio) of a major variable input.

Profitability

This is a measure of business performance of the oil palm processing enterprise. It was estimated using the returns to investment as stated in the equation below:

Returns to Investment (RI) = $\frac{Total\ Revenue}{Total\ Cost}$ …………………………………………….. (4)

RI is the amount of money that would be generated on a naira invested in business. The higher the rate of return, the more profitable an enterprise is during the period under consideration.

Technical Efficiency of Palm Oil Processors
The stochastic production frontier (using the Cobb-Douglas functional form) was used to determine the technical efficiency or inefficiency of oil palm processors in the study area. The stochastic production frontier model was adopted to specify the relationship between input and output level of oil palm processing in the study area (Coelli, 1995). The production frontier model without random component is written as:

$y_i = f(x_i ; \beta). TEi$ …………………………………………………………………...… (5)

y_i = observed output of the *i*th oil palm processor in kg

x_i = vector of input used by the *i*th oil palm processor (palm fruit, labour, water, fuel, transportation) and their relevant explanatory variables associated with the production of the *i*th oil palm processor

$f(x_i; \beta)$ = the production frontier (Battese and Tessema, 1992)

β = vector of unknown parameter associated with explanatory variables in the production function to be estimated

TE_i = technical efficiency defined as the ratio of observed output to maximum feasible output

A stochastic component that describes random shocks affecting the processing process is added. These shocks are not directly attributable to the processors or the underlying technology. The shock may come from changes in weather or an economic adversity (v_i) denotes the shock effect and each processor faces a different shock effect. The stochastic production frontier then becomes:

$yi = f(x_i ; \beta). TEi . exp(v_i)$ ..………………………………………………………….. (6)

TE_i is assumed to be stochastic variable with a specific distribution common to all processors. Thus $TE_i = (-u_i)$ where $u_i \geq 0$. The function then becomes:

$y_i = f(x_i ; \beta). exp(-u_i). (v_i)$……………………………………………………...…… (7)

Assuming that $(x_i ; \beta)$ takes the log-linear Cobb-Douglas form, the model is then written as:

$lny_i = \beta_0 + \sum_n \beta_n lnx_{ni} + v_i - u_i$ …………………………………………………..…... (8)

Where:

yi = output of oil palm processed by processor (kg)

β_n = regression coefficients to be estimated

x_i = input variables used in oil palm production

v_i = 'noise' component (i.e. stochastic disturbance term). $v_i's$ are assumed to be independently and identically distributed $N(\mu, \sigma_v^2)$ random error (Battese and Tessema, 1992)

u_i = non-negative technical inefficiency component. $u_i's$ are assumed to be independently and identically distributed non-negative truncation of the (μ,σ^2), (Battese and Tessema, 1992)

v_i *and* u_i together constitute a compound error term

ln = natural logarithm

Equation 8 is then expanded as:

$lnY_i = \beta_0 + \beta_1 lnX_1 + \beta_2 lnX_2 + \beta_3 lnX_3 + \beta_4 lnX_4 + \beta_5 lnX_5 + e$…………………..….. (9)

where:

X_1 = Quantity of Palm fruits (kg)

X_2 = Quantity of water (litres)

X_3 = Fuel (litres)

X_4 = Labour (man-day)

X_5 = Transportation (Naira)

Determining the factors affecting technical inefficiency, the following mathematical expression was used:

$$U_i = \propto_0 + \propto_1 Z_1 + \propto_2 Z_2 + \propto_3 Z_3 + \propto_4 Z_4 + \propto_5 Z_5 + \propto_6 Z_6 + \propto_7 Z_7 + \propto_8 Z_8 + \propto_9 Z_9 + e_i \quad \text{……} (10)$$

where:

U_i= Technical inefficiency

Z_1 = Sex (1 for female, 0 for male)

Z_2 = Age (in year)

Z_3 = Household size (number)

Z_4 = Duration of membership in association (years)

Z_5 = Processing experience (years)

Z_6 = Access to sterilizer (dummy; 1=yes, 0=otherwise)

Z_7 = Access to digester (dummy; 1=yes, 0=otherwise)

Z_8 = Access to separating engine (dummy; 1=yes, 0=otherwise)

Z_9 = Access to oil clarifier (dummy; 1=yes, 0=otherwise)

e_i = Error term

$\propto_1 - \propto_6$= Parameters to be estimated

TE_i = Technical efficiency

In this study, parameters of the stochastic frontier production function were estimated using the maximum likelihood estimation method using STATA version 13 which also estimates the variance parameter in term of parameterization:

$$\sigma^2 = \sigma_v^2 + \sigma_u^2 \quad \text{……} (11)$$

$$\gamma = \sigma_u^2 / (\sigma_v^2 + \sigma_u^2) \quad \text{……} (12)$$

$$\gamma = \sigma_u^2 / (\sigma^2) \quad \text{……} (13)$$

The parameter gamma (γ) which is the variance ratio has the value between zero and one ($0 < \gamma < 1$). The parameter γ is the total output attained at the frontier which is attributed to technical efficiency that is explaining the total variation in output from the frontier level attributed to technical efficiency. Thus $1 - \gamma$ measures technical inefficiency of palm oil processors (Battese and Tessema, 1992).

RESULTS AND DISCUSSION

Socio-economic Characteristics

Table 1 revealed that most (63.7%) of the processors were female. The high rate of women involvement in processing could be attributed to the nature of work done such as cooking palm fruits, manual fibre separation, washing of equipment and containers, cooking of crude oil for clarification, packing of oil fibre and nuts, which is socially regarded as female responsibility in *Yoruba* society. This corroborates with the findings of Korie *et al*., (2013) who reported that the oil palm processing enterprise is female dominated.

The study showed that 41.3% of the processors were married, while 86.4% of the processors' age range between 26 - 55 years. The average age of processors in the study area is 47 years, which is still reasonably middle-aged. This is important because palm oil processing requires processors to be agile and energetic. Secondly, younger processors are typically less risk-averse and are more willing to try new technologies, which ultimately influences their productivity. Furthermore, most (60.0%) of the processors had primary education, while the mean number of years spent in school was 12 years. Conceptually, education eases the introduction of new techniques, and is an important driver of adoption of new technologies (Adebiyi and Okunlola, 2010). As the average processor has about 12 years of formal education in the study area, it suggests that comprehension and adoption of better processing technologies will diffuse faster.

The mean processors' experience was 20 years, and about 46.3% of the processors had spent 11-20 years in palm oil processing. The effect of processing experience on efficiency in literature is rather unclear. On the one hand, some empirical studies suggest that possessing more processing experience positively influences processing efficiency. On the other hand, other studies suggest that less experienced processors who are likely younger in age may be more willing to try modern techniques, thus improving their efficiency (Ikani *et al*., 1998). More so, 52.8% of the processors did not belong to cooperative societies, which may deprive them having access to credit facilities to increase their scale of production. According to Mignouna *et al.* (2011), belonging to a cooperative society enhances social capital allowing trust, idea and information exchange.

The average processor in the study area has a household size of 7 persons, indicating the availability of family labour to relax the labour constraints for the oil processing enterprise (Nwalieji and Ojike, 2018). The results also showed that about two-thirds of the processors (60.7%) had extension visits in the past year. Access to extension services is a key component in the diffusion of improved technologies, as extension agents act as links between the researchers and end-users of a technology, especially in developing countries. In a similar study, Genius *et al*. (2010) showed that extension agents usually target specific influential farmers who then promote the technology in their localities.

Table1: Socio-economic Characteristics of Respondents

Variable	Frequency (n=80)	Percentage	Mean
Sex			
Female	51	63.7	
Male	29	36.3	
Marital Status			
Single	1	1.3	
Married	33	41.3	
Divorced	29	36.3	
Widow	17	21.3	
Age			
26 – 35	1	1.3	
36 – 45	29	36.3	
46 – 55	39	48.8	47
56 – 65	10	12.5	
66 and above	1	1.3	
Education			
No formal education	15	18.8	
Primary education	48	60	
Secondary	12	15	12
Tertiary	5	6.2	
Experience			
1 – 10	3	3.8	
11 – 20	37	46.3	
21– 30	25	31.3	20
31– 40	10	12.5	
Above 41	5	6.3	
Cooperative			
Member	38	47.5	
Non- member	42	52.4	
Household Size			
2 – 4	7	8.8	
5 – 7	48	57.5	7
8 – 10	22	27.5	
11 – 13	3	3.8	
14 and above	2	2.5	
Extension Contact			
No	25	31.3	
Yes	55	60.7	

Source: Computed analysis of field survey**,** 2019

Identification of Improved Processing Technologies

Table 2 shows the various improved techniques adopted by the sampled processors for the processing of palm oil in the study area. It was shown that only 15% of the respondents adopted sterilizers, while separating engine and oil clarifier were both used by 18.8% of the respondents. Similarly, 25% of them adopted digester, while 22.5% had adopted mechanical press. The level of adoption of these technologies is relatively low and in contrast with crop production technology which have been reported to have relatively higher levels of adoption (Bello *et al.*, 2012; Adejoh *et al.*, 2012). This may be as a result of the high financial capital required to purchase these equipment, as well as the complexity associated with their use (Adetunji, 2004; Agwu, 2006).

Table 2: Distribution of Improved Processing Techniques

Improved Techniques	Frequency		Percentage	
	Yes	No	Yes	No
Sterilizer	12	68	15.0	85.0
Digester	20	60	25.0	75.0
Separating engine	15	65	18.8	81.2
Mechanical press	18	62	22.5	77.5
Oil Clarify	15	65	18.8	81.2

Source: Field survey data, 2019

Gross Margin analysis

The cost and return structure of palm oil processing in the study area is presented in Table 3. The average total revenue per season realized from palm oil processing was ₦42, 300 while the total variable cost incurred from palm oil processing was ₦24, 976.25 in the study area. The gross margin from palm oil processing in the study area was ₦17, 323.75. The results showed that cost of palm fruits is about one quarter (25.0%) of the entire total variable cost, and is the single most important input for oil palm processing. This is followed by transportation costs (18.2%), equipment maintenance (17.6%), electricity cost (12.3%) and water cost (11.0%). This implies that the overall cost incurred in oil palm processing can be significantly lowered if government can improve the state of basic infrastructure, such as stable electricity, good roads, potable water in these communities, which together make up about 40.0% of the entire processing cost. These results confirm the findings of Ekine and Onu (2008), who posited that oil palm processing cost is largely determined by cost of palm fruits, cost of hiring/purchase of equipment, transportation of the palm bunches and labour costs. Returns to Naira invested in palm-oil production in the study area were estimated to be 36%. This means that for every ₦1.00 invested, 36Kobo is gained in the business. This is expected since palm-oil processing involves more intricate practices which lead to higher sales (Oguzor, 2013). Overall, this shows that palm oil processing is profitable in the study area, and can be a veritable pathway to poverty alleviation in rural communities of Nigeria.

Table 3: Distribution of Budgetary Analysis per season

Outputs	**Cost (Average ₦)**	**Percentage**
Total Revenue	**42,300**	
Variable cost		
Cost of palm fruits	6,255	25.0
Labour cost	2,395	9.6
Water supply	2,735	11.0
Milling cost	397.5	1.6
Pressing cost	375	1.5
Equipment sterilization	801.25	3.2
Electricity	3,063.75	12.3
Transportation	4,555	18.2
Equipment maintenances	4,398.75	17.6
Total Variable cost	**24,976.25**	
Gross Margin (TR-TVC)	**17,323.75**	
Return on Investment (ROI)	**0.36**	

Source: Computed analysis of field survey, 2019

Maximum Likelihood Estimates of Production Function of Palm Oil Processors

The result of the Maximum Likelihood Estimates (MLE) of the parameters of the Cobb Douglas Stochastic Frontier Production Function (SFPF) and inefficiency model of palm oil processors is presented in Table 4. The variance parameters sigma-square was estimated at 0.004 ($p<0.01$). The sigma-square attests to the goodness of fit and correctness of the distributional form assumed for the composite error term. The parameter estimates of the production function of palm oil processors revealed that quantity of palm fruits ($p<0.001$), quantity of water ($p<0.01$) and transportation ($p<0.10$) are the significant variables that influence the level of efficiency of palm oil production in the study area. The quantity of palm fruits and quantity of water have positive coefficient implying that 1% increase in these inputs will lead to 0.98% and 0.009% increase in the quantity of palm oil production by the processors respectively, and this will increase the level of efficiency. However, the coefficient of transportation is negative implying that 1% increase in the cost of transportation during the processing of palm oil will result in 0.01% decrease in the efficiency level of palm oil processing. This is in harmony with Akangbe *et al.,* (2011) which revealed that transportation is among the constraints facing palm oil processors.

Moreover, the factors influencing the inefficiency of the palm oil processors in the study are age, duration of members in association and adoption of oil clarifier. The sign of the coefficients of these variables has important policy implications as positive sign implies negative effect on efficiency while negative sign signifies a positive effect on efficiency. The results show that coefficient of adoption of oil clarifier is negatively significant, implying that its adoption decreases technical inefficiency (and by implication, increases technical efficiency) of the palm oil processors. This confirms our hypothesis that better technology adoption improves technical efficiency, and provides empirical basis for the promotion of oil clarifiers among pam oil processors. This corroborates the findings of Emmanuel (2013), who found out that adoption of improved technology increased technical efficiency among palm oil processors in the western region of Ghana.

Age also negatively influences technical inefficiency, which implies that technical efficiency increases with age. Since processing experience increases with age, this suggests that more experience increases technical efficiency. The coefficient of duration of members in association is positive and significant at 1% level of significance. This implies that increase in the number of years the processors stay in their association, their level of technical inefficiency increases which invariably decreases the efficiency of palm oil processing.

Table 4: Results of Stochastic Frontier Model

Variables		Coefficient	t-ratio	P>|t|
Constant		1.54***	18.51	0.000
Quantity of palm Fruits		0.98***	118.50	0.000
Quantity of Water		0.009***	2.60	0.009
Fuel		0.002	-0.55	0.92
Labour (man-day)		-0.001	-0.11	0.909
Transportation		-0.01*	-1.85	0.065
Inefficiency Model				
Sex		0.51	0.81	0.420
Age		-0.14**	-2.28	0.02
Household size		-0.33	-1.29	0.19
Duration of membership in association		0.12***	3.32	0.001
Processing experience		-0.33	-0.61	0.545
Sterilizer		0.69	0.39	0.695
Digester		0.95	0.86	0.390
Separating		2.13	1.30	0.194
Oil clarify		-3.13*	-1.74	0.082
Constant		1.16	0.39	0.694
Variance parameters				
Sigma Squared	$\delta^2u + \delta^2v$	0 .004***		
Gamma	δ^2u / δ^2	0.93		
Log Likelihood Value		169.60		

Source: Computed Analysis of field survey, 2019.
* Significant at 10% probability level; ** Significant at 5% probability level;
*** Significant at 1% probability level

Technical Efficiency Distribution

Table 5 revealed that 3.8% of the palm oil processors had technical efficiency between 0.80- 0.84, 5.0% of the palm oil processors had technical efficiency of between 0.85 - 0.89, 3.8% of the palm oil processors had technical efficiency of between 0.90 - 0.94, 86.3% of the palm oil processors had technical efficiency of between 0.95 - 0.99, while 1.3% of the palm oil processors had technical efficiency greater than 1.00. The mean technical efficiency of the palm oil processors was 0.95 which implies that most of the palm oil processors were able to obtain 95% of their output from input mix. This is very similar to the 94.2% reported by Emokaro and Ugbekile (2014) in Edo State, Nigeria. The variation in technical efficiency estimates is an indication that some of the processors are still using their resources inefficiently in the processing of palm oil and there still exists opportunities for improving on their current level of technical efficiency.

Table 5: Technical Efficiency Distribution

Class	Percentage
0.80- 0.84	3.8
0.85 -0.89	5.0
0.90 - 0.94	3.8
0.95 - 0.99	86.3
1.00	1.3
Total	80.0
Mean	0.95
Minimum	0.80
Maximum	1.00

Source: Computed analysis of field survey, 2019.

CONCLUSION AND RECOMMENDATIONS

This study was carried out to determine the effects of adoption of improved processing techniques on palm oil processing business in Ado-Odo Ota and Ipokia Local Government Areas, Ogun State. Multistage sampling technique was used to select 80 palm oil processors. Primary data was collected through the use of structured questionnaires; the data collected was analyzed through the use of descriptive statistics (such as frequency counts, percentages, means and standard deviation), budgetary analysis and stochastic frontier analysis. Oil palm processing is a major activity carried out by the people in the study area as a result of the favourable climatic condition for oil palm production. The technical efficiency indices computed show that the respondents under study have generally not attained the production frontier. This implies that there is a significant potential for the processors to sustainably increase output using the available inputs and existing technologies. Thus, there will be no need to develop new technologies to raise productivity, but, technical efficiency can be increased by increasing the usage of inputs already available. From the findings, the improved oil palm technology users in the study area are few.

Based on these findings, the study hereby recommends that proper training be given to palm oil processors on the usage of the desired technology to attain capacity building. More so, palm oil processors should be encouraged to form cooperatives so as to pool resources together to take advantage of these technologies. Government at all levels should assist with the provision of accessible roads to combat the high transportation costs which lower the profit margin of the processors, as well as other social infrastructure (water and electricity) which are needed in palm oil processing.

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