CLIMATE CHANGE, FOOD SECURITY, NATIONAL SECURITY and ENVIRONMENTAL RESOURCES

GLOBAL ISSUES & LOCAL PERSPECTIVES

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Preface

This book adopts an exegetical approach as well as a pedagogic model, making it attractive agriculture and environmental economics teachers, professional practitioners and scholars. It is eschews pedantry and lays bars the issues in such clarity that conduces to learning. The book elaborates on contemporaneous climate change, food security, national security and environmental resources issues of global significance and at the same time, is mindful of local or national perspectives making it appealing both to international and national interests. The book explores the ways in which climate change, food security, national security and environmental resources issues are and should be presented to increase the public's stock of knowledge, increase awareness about burning issues and empower the scholars and public to engage in the participatory dialogue climate change, food security, national security and environmental resources necessary in policy making process that will stimulate increase in food production and environmental sustainability.

Climate Change, Food Security, National Security and Environmental resources: Global issues and Local Perspectives is organized in four parts. Part One deals with Climate Change with Six Chapters, Part Two is concerned with Food Security with Nine chapters, Part Three deals with National Security with Five Chapters, while Part Four pertains Environmental Resources, has Five Chapters.

Ahmed Makarfi / Eteyen Nyong

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Chapter 1:

The Concept of Technical Efficiency and Effects of Climate Change on Palm Oil Processing

Eteyen Nyong

Abstract

The study analyzed climate change technical efficiency of palm oil processing in South-South Nigeria. The specific objectives were to; describe socio-economic characteristics of palm oil processors; determine the technical efficiency of palm oil processors; identify factors influencing technical efficiency of palm oil processors; and examine the constraints associated with palm oil processing in the study area. Multistage sampling and random sampling techniques was used in selecting one hundred and fifty (150) respondents. Primary data were used for the study, the data were collected using a well-structured questionnaire complemented with interviews in order to ensure accuracy of data needed for the study. The data were analyzed using descriptive statistics, stochastic (Cobb-Douglas) frontier production functions and four-point type likert scale. random sampling technique was used to obtain one hundred and fifty (150) respondents for this study. The result showed that majority (74%) of the respondents were female while 26% were accounted for male gender engaged in palm oil processing. Majority (82%) were married, 14.7% were divorced, 2% were single while 1.3% were widow/widower. Majority (54.7%) attained secondary education, 39.3% attained primary education while 8% attained tertiary education. The average age, experience, processing capacity, household size and monthly income was 37 years, 9 years,

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457.7kg and N57,340 respectively. The respondent's' levels of technical efficiency ranged between 16% and 100% with a mean of 71%. The estimated parameters for the Stochastic Production Function show that all the coefficients of the variables were significant at 1% level and positive except labour and water while inefficiency effects model showed that age, education, experience and monthly income had positive and significant effects on the level of technical efficiency of palm oil processors. The major constraints identified as the hindrances to the optimum production palm oil were poor storage facilities, followed by high cost of processing, unavailability of improved processing equipment, lack of access to credit, high cost of fuel, inefficient marketing, etc. The major constraints to the performance of palm oil processors and marketers were high transportation cost, inadequate capital, high processing cost, high market charges and lack of storage facilities. It was recommended that Governments should make available basic infrastructure such as storage and processing facilities to reduce postharvest loses and further enhance the profit margin of actors across the processing area

Introduction

The African oil Palm, Elaeisguinensis belongs to Aracaceae family, which contains 225 genera with over 2500 species Along with coconut and date palm cultivars. The oil palm is a native of tropical Africa from Sierra Leone in the west through the Democratic Republic of Congo in the East. In Nigeria, it is mostly found in the southern part of the country. Prior to the commercial exploration of petroleum in Nigeria, agricultural sector contributing immensely to the economy , According to Ugwu (2009), before independence, Nigeria was a major exporter of agricultural commodities such as palm oil, cocoa, groundnut, cotton and rubber. Nigeria is a net importer of palm oil and its product, whereas, between 1961 and 1965, Nigeria was the largest producer palm oil, accounting for 43 percent of the world production (Olagunju,2008). However. Since then , the level of oil Palm production has been decreasing drastically. In the early 90s, Nigeria accounted for ú percent of the world production (WRW,2001:Oladipo,2008), in 2004, it was 3 percent while in 2010, Nigeria produced 2•2 percent of palm oil and 9•4 percent of palm kernel (FAOSTAT,2010). Nwajiuba and Akinsami (2003) noted that the contribution of oil palm as an export and foreign exchange earning started declining as Nigeria petroleum earning to the escalated, drawing labour away from rural farm sector to the urban non-farm sector.

There is a continuous demand for oil palm produce globally by the domestic and industrial sector. Vogel (2002) estimated that for every five month. Perchance two litres of palm oil are consumed for cooking every month. Therefore, the demand for oil palm products has far surpassed supply; a scenario that assumed would further push price up over time. The market keeps growing with respect to the increasing population, growth rate, and improvement in purchasing power of Nigerians. The gab between demand and supply for the oil palm products may more widen by the emerging capability for more sophisticated products by the local food industry. To Foster research budget the demand-supply gab in oil palm sub-sector , Nigeria institute for oil research (NIFOR)aimed at improving oil palm production and processing through technological advancement , in areas such generating hybrid varieties of processing technologies which can reduce losses and obtain higher extraction rate (Aghalino, 2000, Aliu. 2010.). Now,. Nigeria is having more extensive oil palm plantations, with at least 2500 hectares planted to this crop (WRM, 2000). Yet, processed oil palm products continue to decrease in quantity. This has been attributed to losses encountered during processing (Orewa,2009).

In order to revitalize the oil palm sub-sector to improve the standard of living of the rural populace that depends on produce for their livelihood, processor were encouraged to move away from improved processing technologies such as threshers, digesters, motorized press, sterilizer and clarifiers were developed and introduced to the processors (Again, 2006), in view of the fact that the bottle neck in palm oil processing is crude processing techniques. In spite of the huge investment and research efforts at developing these improved methods, the traditional processing techniques are still put to use by most processors thereby casting doubt to the efficacity of the improved processing technologies.

Away from oil palm products being known for food, palm oil production provides jobs for at least 1•8 million Nigerian (Ayodele,2010), and serve as source of revenue to large proportion of the resources of the rural processors in Nigeria (Olagunju,2008). In spite of the greatest potentials of oil palm processing in Nigeria, the efficiency and inefficiency of utilization of available resources has remained on unanswered question in the quest for increased output. Knowing the concept of efficiency to be concerned with the relative performance of the processes used in performing given inputs into outputs . A production process is said to be inefficient when it uses more physical resources than an alternative method in producing a unit of output. Technical efficiency as defined by Heady (1982) is the measure of a firms success in producing maximum output from a given set of inputs.

Crude palm oil (CPO) produced from palm trees has many advantages compared to other vegetable oils. These are long-lasting, resistant to pressure, and have relatively high-temperature tolerances. In addition, palm oil also has many advantages including 1) the utilization of palm oil is very broad in food and non-food categories. 2) palm oil productivity reached 3.2 tons/ha while soybean, radish, copra and sunflower oils were only 0.34; 0.51; 0.57; and 0.53 tons/ha (Fauzi,2012). Efficiency is a very important factor of productivity growth, especially in developing agricultural ecenomies where resources are meager and opportunities for developing and adopting better technologies are declining (Bifarin et al ..,2010). Actually, the presence of shortfalls in technical efficiency means that output can be increased without requiring additional conventional inputs or introduction of new technologies. Technical efficiency is a measure of performance. It is the ratio of input used to produce maximum output. Factors affecting technical efficiency are assumed to be due to household specific demographic characteristic (Unai, 2001).

Soekartawi (1991) indicates that the production process is considered to be efficient if limited resources can be utilized optimally to produce optimal output. However, producers often incapable to achieve the target (potential production). This indicates that the utilization of production factors has not been maximized resulting in the less efficient production process so that the resulting product does not reach the target

Statement of Problem: In Nigeria, palm oil has become the major stable oil for consumption in most homes and unfortunately the domestic production of the product has not been with the high demand for it. Palm oil sector is one of the promising sector that can revive the agricultural sector. its potential of poverty reduction, food security, job creation can be achieved when there is a change that will reduce variations in outputs, use of efficient production system and adoption of better market oriented approaches. This potentials has motivated research institute to device technologies that will boost palm oil production. The government has also initiated numerous undertaking to improve oil palm production and offer potentials for growth among smallholder processors. Despite these concerted effort to intervene, there still exist a yield gap between the producers actual production level and the maximum output , hence technical inefficiency.

The problem of socioeconomic characteristics such as age of the farmer, level of education of the farmer, size of household ownership of the farm, farmers status and primary occupation has an effect on palm oil production. The age of farmers is of the most important characteristics that contributes to the technical efficiency of palm oil production, this is because the production process is tedious and farmers willingness to go into palm oil production will have variations age. The ownership of the farm also is another socioeconomic characteristics that has really affected the technical efficiency of palm oil production because most of the farmers owns the farm by pledge and they pay exorbitantly for the plantation and a lot of complications occur when the real owner wants to get the plantation back and this can discourage farmers as well. This study is going to identify other constraints faced by farmers which might have an effect on the technical efficiency of palm oil production.

Nigeria is experiencing supply shortage of all grades of vegetable oil, especially palm oil .Local market prices are currently more than double the international price. Palm oil is marketed in the country throughout the year and majority of the population keep demanding for oil. Studies also reveal that the method used in palm oil processing has remained rudimentary and undeveloped; and this has led to decline in palm oil production output.

Objectives of the Study

The broad objective was to analyze the technical efficiency of palm oil production in South- South Nigeria. The specific objectives were to; examine the socioeconomic characteristics of the palm oil producers in Essien Udim Local government area; analyze the technical efficiency level among farmers in Essien Udim Local government area; determine the factors influencing technical efficiency of palm oil production of farmers in Essien Udim Local government area; and examine the constraints faced by palm oil producers in Essien Udim Local government area.

Efficiency: The term efficiency refers to the peak level of performance that uses the least amount of inputs to achieve the highest amount of output. Efficiency requires reducing the number of unnecessary resources used to produce a given output, including personal time and energy. It is a measurable concept that can be determined using the ratio of useful output to total input. It minimizes the waste of resources such as physical materials, energy, and time while accomplishing the desired output. Efficiency is the ability to achieve an end goal with little to no waste, effort, or energy. Being efficient means you can achieve your results by putting the resources you have in the best way possible. Put simply, something is efficient if nothing is wasted and all processes are optimized. This includes the use of money, human capital, production equipment, and energy sources. Efficiency can be used in a variety of ways to describe various optimization processes.

Technical efficiency is the effectiveness with which a given set of inputs is used to produce an output. A firm is said to be technically efficient if a firm is producing the maximum output from the minimum quantity of inputs, such as labour, capital, and technology. Thiam *et al.* (2001) highlighted the importance of efficiency as a means of fostering production which has led to proliferation of studies in agriculture on technical efficiency around the globe. Analysis of technical efficiency in agriculture has received particular attention in developing countries because of the importance of productivity and growth in agriculture for overall economic development. A measure of producers' performance is often useful for policy purposes and the concept of efficiency provides theoretical basis for such a measure (Jatto *et al*., 2012).

Types of Efficiency:

There are several types of efficiency, including allocative and productive efficiency, technical efficiency, 'X' efficiency, dynamic efficiency and social efficiency.

Allocative efficiency: Allocative efficiency occurs when consumers pay a market price that reflects the private marginal cost of production. The condition for allocative efficiency for a firm is to produce an output where marginal cost, MC, just equals price, P.

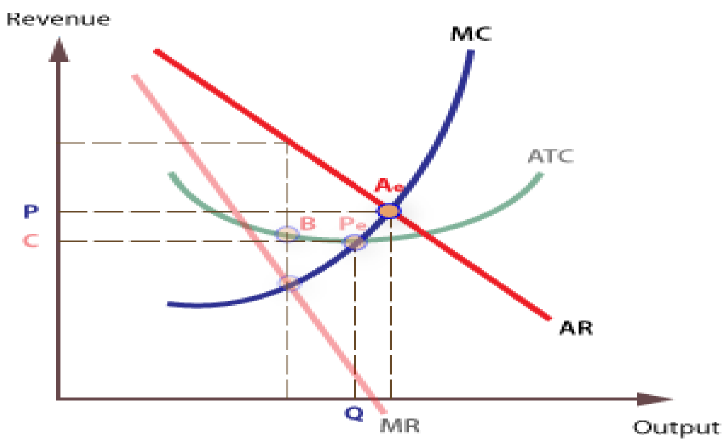

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Fig 2.1 Allocative Efficiency

Productive efficiency: Productive efficiency occurs when a firm is combining resources in such a way as to produce a given output at the lowest possible average total cost. Costs will be minimised at the lowest point on a firm's short run average total cost curve. This also means that ATC = MC, because MC always cuts ATC at the lowest point on the ATC curve.

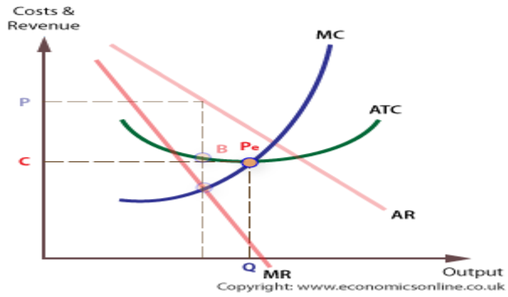

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Fig 2.2 Productive Efficiency

Technical efficiency: Technical efficiency relates to how much output can be obtained from a given input, such as a worker or a machine, or a specific combination of inputs. Maximum technical efficiency occurs when output is maximised from a given quantity of inputs. The simplest way to differentiate productive and technical efficiency is to think of productive efficiency in terms of cost minimisation by adjusting the mix of inputs, whereas technical efficiency is output maximisation from a given mix of inputs. Identifying allocative and productive efficiency points. To identify which output a firm would produce, and how efficient it is, we need to combine data on both costs and revenue. We can assume that most real firms face a downward sloping demand (AR) curve, and MR falls at twice the rate.

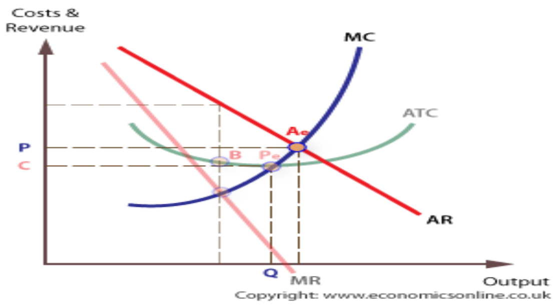

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Fig 2.2 Technical Efficiency

Diagrammatically, productive efficiency occurs where ATC is at its lowest, and is equal to MC. **Measurement of Efficiency:** Efficiency is measurable and can be expressed as a ratio or percentage. You can measure it by using the following formula:

Efficiency = Output ÷ Input

Output (or work output) is the total amount of useful work completed without accounting for any waste and spoilage. If you want to express efficiency as a percentage, simply by multiplying the ratio by 100.

i.e. Efficiency= output÷input × 100

N/B: Efficiency measures any performance that uses minimal inputs to get the maximum number of outputs. Put simply, you're efficient if you get more by using less.

Production: Production is a process of value addition, which is developed to transform a set of input elements like man, raw material, capital, energy, information into finished products and services in proper quality and quantity. In other words, Production is a process of combining various inputs (man, machine, material, money) in order to make something for consumption (product or services). Significance of value addition in production can be transform row material into goods, assemble many small parts, or design a service. Production can be seen every day in factories, offices, hospitals, etc. Production can be agricultural, manufacturing, or service.

Factors of Production

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Nature: Nature is a very important factor for any production. It is impossible to carry out production without land, water, and other resources. Suitable land and the availability of water make production easier. Natural resources, such as oil and coal, can be extracted from the land and refined for production purpose consumption. Cultivation of crops on land by farmers increases its value and utility. Area, the shape of the production site, cost, drainage, and other facilities, the probability of floods, chance of earthquakes, etc. influence the selection of plant location. Water is used for processing, drinking and sanitary purpose within a production site. Depending upon the nature of the plant water should be available in adequate quantity and proper quality. In the production of leather, textile, etc. climate is an influencing factor. For such industries extreme humid or dry conditions are not suitable for production.

Labour: Human effort is a necessary factor for production. Skilled labour can make a significant difference in any production. Another important factor that influences plant location decisions is the availability of labour near the factory. The combination of an adequate number of labour with suitable skills and reasonable labour wages can highly benefit the production firm. Labour by an uneducated and untrained worker is generally paid at low wages. Skilled and trained workers are referred to as human capital and they get paid at higher wages because they bring more than their physical capacity to the workplace. Hire skilled labour for their specific work increase the productivity of a production unit.

Capital: Capital generally refers to money. But money is not a factor of production, because money is not directly involved with the production of product or services. Money used as a resource to buy capital goods like machine, equipment, raw materials etc. It is important to distinguish between private capital and personal capital. Buying a car for personal use and family transport is not considers capital. But buying a vehicle for commercial uses considers as capital. During a financial crisis or when they suffer losses, companies cut back on the capital expenditure to ensure profits. And, during periods of economic expansion, they invest in capital to purchase machinery and equipment to bring new products to market.

Enterprise: Enterprise is the activity that combines all the other factors of production into a product or service for the consumer market. Enterprise as a function involves in organizes other factors like applying government rules and regulation, working discipline within the production site, etc. into an operating unit. A good management team is greatly benefited in every business enterprise.

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Types of Production: There are four main types of production that are generally employed. Which type is suitable is decided by the nature of the product being produced, demand of the product on the market and supply of raw materials.

Unit or Job type Production: Unit or Job type Production is most commonly observed when you need to produce one single unit of a product at a time. A typical example of Job production is tailored outfits that are made just for you according to your size or a cake that is made just like you want it. This type of production depends a lot on the skill of the worker. Dependency is more on manual work than mechanical work because every product is different from others. Customer service plays an important role in Unit or Job production.

Batch Production: Batch production most commonly used in consumer durables, FMCG or other such industries where there are a large variety of products being manufactured with variable demands. Batch production takes place in batches. The manufacturer needs to know the number of units he has to manufacture, and they are manufactured in one batch. Batch Production is done in batches, so once a batch production starts, stopping the process midway may cost a huge amount to the company. Demand and supply play a major role in batch production. For example – the production of the seasonality of products heavily depends on the demand.

Mass Production: Mass production is also known as flow production or assembly line production. This is one of the most common types of production system used in the auto-mobile industry and is also used in industries where continuous production is required. For example- the manufacturing process adopted by ford company. An Assembly line or mass-production plant typically made for specialised product manufacturing. There are multiple workstations installed and the assembly line goes through all the workstations one by one. The work is done in such a manner each workstation is responsible for one single type of work. As a result, these workstations are very efficient and production due to which the whole assembly line becomes productive and efficient.

Market demand does not play a major role in Mass production. However, the production capacity of the company determines the success of mass production. Mass production requires huge initial investment and working capital.

Continuous Production or process production: There is a lot of similarity between mass production and continuous production. It can be differentiated by the amount of mechanical work involved. In Mass production, both machines and humans work together. But, in continuous production, most of the work is done by machines rather than humans. In continuous production, the production is continuous,24×7 hours, in a year. An example of Continuous production is brewing. In brewing, the production goes on 24 hours a day and 365 days a year. This is because brewing takes a lot of time and attention as well. Once production started you cannot stop, otherwise, it will lead to a huge loss. so, a controlled environment is required for continuous production.

Efficiency Theory: Prateek (2020) explained the three efficiency theories thus;There are three different Theories of Efficiency that we are going to focus on. The first Theory of Efficiency is Pareto efficiency or Pareto optimality. The second is the Kaldor–Hicks improvement, and lastly the Zero-profit condition or Zero Profit Theorem.

Pareto Efficiency theory: Pareto Efficiency or Pareto optimality is a Theory of Efficiency in which given an initial allocation of goods among a set of individuals a change to a different location that makes at least one individual better off without making any other individual worse off is called a Pareto improvement. An allocation is defined as "Pareto Efficient" or "Pareto Optimal" when no further Pareto improvements can be made.

*Kaldor-Hicks Efficiency theory***:** Kaldor-Hicks Efficiency is a Theory of Efficiency where an outcome is considered more efficient if a Pareto optimal outcome can be reached by arranging sufficient compensation from those who are made better off to those who are made worse off so that all would end up no worse than before. The Kaldor-Hicks efficiency builds upon the Pareto Efficiency since it has less stringent criteria.Example:

Person A has 10 hens = Person A 20 hens

Person B has 100 hens = Person B 99 hens

This is a Kaldor-Hicks improvement, and not a Pareto improvement.

Zero Profit Theorem: In the Zero Profit Theorem, the entry into a competitive industry will continue until all opportunity for positive economic profit is reduced to zero.

Marginal Cost = Marginal Revenue = Price

Above Average Cost = Positive Economic Profit

Theory of Production: Production is the most basic Economic activity and involves the creation of utility. According to Olayide and Heady(1982), production is the process whereby some goods and services called inputs are transformed into other goods and services called output. Powell(1978), considered production as the process of transforming raw materials into something consumed by someone else and further outlined it's characteristics as the transformation of resource(raw material) into sellable product whose value is higher than of the raw material alone. Ojo (2004) defined production process as one whereby some goods and services called inputs are transformed into other goods and services called output. Koutsoyiannis (1979) refer to this technical relationship as the Production function and involves the use of inputs. In Agriculture, major input include land, capital labour and measurement of resources (Abang, 2008).

Production Function: In production function, the productivity of labour, capital and other inputs as well as the contributions to Total output caused by technical progress is measured. This enables one to attribute the growth of output to the proximate causes such as; the growth in the labour force, the increase in the stock if capital, Economics of scale and the catch of all technical progress. This function describe the technical relationship between input and output in any Production process. Halcrow (1980) defines it as the technical relationship between input and output, indicating the maximum amount of output that can be produced with each and every set or combination of specific inputs. Byrns and stone (1989) supported this perspective adding that Production function summarizes the current state of technology and specified the amount of various contributions of inputs.

According to Walter (1970), the ingredients of the Production function are the technical condition, the knowledge and availability of techniques and any limitation imposed on the supply of factors of production to the firm. The production function is purely technical relationship which connect factors inputs and outputs. It's describe the law of proportion, that or the transformation if factors inputs into output, at any particular period. Abang (2008) defined production as purely technical relationship between quantities of various addition inputs used and the optimum output of the commodity that is produced. Production function exhibits the law of diminishing returns. The law states that if additional units of an input are held constant, output increase at increasing rate reaches maximum and finally declines. Therefore, it is best to produce where additional use of input increase output at increasing rate considered to be the rational stage of production and cease further of input where output begin to decline.

Mathematically, the production function was assumed to be continuous and differentiable function of the firm;

Y= f(x)

where

Y= output

X= input

f= given technology

OR

Y= f(X1, X2, X3 /X4)--------- input-output equation

Where;

Y= Output (kg)

X1-X3 = variable factors of production, measured in physical units

X4= Fixed factors of production

The parameter of interest are:

APPX1 =Y/X1, APPX2 = Y/X2, APPX3 = Y/X3

MPPX1 = ΔY/ΔX1, MppX2 =ΔY/ΔX2, MPPX3 = ΔY/ΔX3

Where

APP= Average Physical production

MPP= Marginal Physical product

Marginal Physical Product (MPP)

The Marginal physical Product of a production function is the increase in output resulting from a small increase in one of the inputs, holding other input constant. This means change in inputs is a result of change in a variable output.

It is mathematically expressed as;

$$MPP = \frac{\text{Change in TPP(output)}}{\text{Change in input}}$$

It can also be written as

MPP= $\Delta Y/\Delta X$

Average Physical Product (APP)

Average Physical Product is the amount of output produced by per unit of input. It is obtained by dividing the total output at a given level by the number of unit of inputs applied at the corresponding level. APP reflects the average contribution of an input to the total products. It is expressed mathematically as;

APP = TPP/X = Y/ X

Elasticity of Production (EP)

This is defined as the percentage change in output as a result in percent change in input or it is a degree of responsiveness to total product to changes in variable input. It is mathematically express as;

$$EP = \frac{\% \Delta \text{ in output}}{\% \Delta \text{ in input}}$$

Therefore Ep = MPP/APP × 100

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Olayide and heady(1982) identified three main rate of return which includes constant returns, increasing return and decreasing return to scale. The letter is commonly used in the production of farm crop in Agriculture and has the characteristics of the stages where optimum efficiency of production of resources used is being approached as well as the situation where misallocation or over utilization of output beyond the limit of technical efficiency (APP) exist. In Agriculture, most Production function relating to crop and livestock production have a narrow range of increasing return and a wide range of diminishing marginal productivity.

Empirical: Socio economic Characteristics of Palm Oil Processors

According to Nwaleji (2018) who conducted a research on the characteristics of small-scale oil palm production enterprise in Anambra state has a result that shows that about 43.0% of the respondents were between 50-59 years of age while the mean age was 48.67 years. This implies that palm oil processors were at their middle and productive age hence would be able to carry out tedious operations in palm oil processing. The majority (74.2%) of the respondents were female, while 25•8% were male. The finding was in line with that of Ajani, Onwubuya and Nwalieji (2012) which noted that women in the communities are responsible for the processing and sale of oil palm produce. The majority (76.7%) of the respondents were married which implies that there are more married palm oil processors in the study area. 25.8% were male.

Philomena Ogwuike, in their research on Analyzing the Technical Efficiency of Small–Scale Palm-Oil Extracting in Ohaji/Egbema LGA Nigeria and Pobe LGA, Benin Republic, As evidenced, majority of the processors in Nigeria (80%) and Benin (63%) are male. The higher proportion of men may not be unrelated to the heavy manual labor demand of palm oil processing. Intense heat from boiling/sterilization activities has been reported as one cause of abortion among female processors. This strenuous nature of processing activities of palm oil makes it unsuitable for women at the child-bearing stage. Most of the activities in palm oil extraction are indeed highly labor intensive. Majority of the processors in the study areas are within the age range of 31-50 years, and represent about 74% of Nigerian respondents and 88% of Benin respondents. This represents the active economic age group implying that palm oil processing in both areas attracts vibrant young men and women. While as much as 49% Beninese attained primary education, and 42 up to secondary, only 23% Nigerians attained primary education while as large as 77% attained up to secondary school. Table 1 also shows that more than half the Nigerian (53 %) and Beninese

(59%) processors have mean processing experiences of 12 and 11 years respectively. They are therefore experienced enough to understand the basic principles of the business of palm oil processing. Majority of the Nigerians, (94%) and Beninese (73%) are into full time processing implying that the returns from palm oil processing is adequate to sustain the processors' family needs. This confirms the assertion of Vandebeeck (2004) that palm oil processing is a good business. About 92% Nigerians and 79% Beninese sell their palm oil to urban wholesalers who play dual supportive roles. Apart from buying the bulk of the palm oil produce, they provide financial aids by depositing payment for a bargained amount of palm oil to be produced. Alternatively, they provide FFB to processors who may collect the palm kernel nuts in exchange for the processing services rendered or better still charge processing costs. The two major sources of investment capital were (i) personal savings – Nigerians 86% and Beninese 30% and (ii) Micro-finance- Beninese 49%.The Beninese Beneficiaries of the micro-finance are still in constant need of financial aids because the amounts obtainable are usually low, ranging between NGN10, 000 and NGN20, 000. The poor accesses to institutional credits among the Nigerians was explained by the lais-affaire attitude of the respondents who claim neglected in the system and so, make no efforts to seek for institutional credit financing.

Empirical Review: Technical Efficiency Level of Palm Oil Processors

Productivity differences in Small Scale Palm Oil Processors using different processing technologies in Ghana.,(2021)by Isaac Osei-Mensah, Bright Owusu Asante, had the following results on technical efficiency). The estimated average TE with respect to the individual processing technologies are 0.635, 0.669 and 0.834, traditional, digester and expeller technologies, respectively. To determine the productivity of palm oil processing, this shows that palm oil production in the area under study is dominated by female. This implies that small scale palm oil processors generally operate below their optimal level with their available resources and given technology. It further implies the processors using the traditional technology was less efficient than those using other two technologies. The findings resonate with Abdulsalam et al. (2014), who found traditional users achieved lower mean technical efficiency (62%) than improved technologies (81%). The estimated coefficients for all inputs, which represent partial output elasticity, fall between zero and one for all three processing technologies as well as the meta frontier, hereafter, satisfying the mono-tonicity condition. The results further indicate that he most important factors increasing the palm oil processing across all three processing technologies are family labour and the cost of palm fruits. This finding highlights the significance of labour and cost of materials in essential factors in

Philomena (2010), in their research on Analyzing the Technical Efficiency of Small–Scale Palm-Oil Extracting in Ohaji/Egbema LGA Nigeria and Pobe LGA, Benin Republic, and the results was that the Technical Efficiency of the Nigerian processors ranges between 88% and 100% with a mean of 97%. Thus, in the short run, an average Nigerian processor has a scope of increasing palm oil production by about 3% by adopting the technology and technique used by the best practiced processor. This implies that Technical Efficiency is not a significant problem facing the Nigerian small scale palm oil processors in this study. The Technical Efficiency of the Beninese processors is a wide range between 40 and 97% with a mean value of 89%. This shows that there is an efficient use of the available technology and that, the average processor has a scope of increasing palm oil output by 11% by adopting the best used technology and technique available. With Technical Efficiency of 97% and standard deviation of 2.9 for the Nigerians and 89% Technical efficiency and standard deviation of 8.37 for the Beninese a mean significance difference at 1% level was obtained.

Ojo (2005) in a research revealed that the technical efficiencies of the mills varied substantially and ranged between 0.32 and 0.95 with a mean value of 0.75 indicating high relative technical efficiency. Thus in the short run, there is a scope for increasing the performance of intermediate technology palm oil extraction mills by 25% by adopting the technology and techniques used by the best practiced mills. These technologies and techniques include acquisition of a 6 or 8 horsepower lister engine, hydraulic press and ensuring adequate sourcing of palm fruits by owning oil palm plantations as well as purchasing more palm fruits from the oil palm estates and leasing oil palm farms to improve capacity utilization.

Empirical: Determinants of Technical Efficiency of Palm Oil Processors

In a research conducted by Ismiasih (2017)on technical efficiency of palm oil production in West Kalimantan in Indonesia outline farmers age, formal education, ownership of capital, counseling participation an cooperative membership as factors that determine technical efficiency.According to Iwala, and Okunlola (2006) The predicted farm specific 22.2% by adopting the production technologies adopted by the mean of 0.778. Thus, in the short run, there is a scope for increasing efficiency of oil palm production by about technical efficiencies (TE) ranged between 0.463 and 0.999, with a best technology friendly oil palm farmer in the area.

Based on the distribution of technical efficiency, palm oil farmers in West Kalimantan Province are technically efficient farmers with an efficiency value range between 0.70 and 0.90, however, there is a need to increase managerial efforts to achieve very efficient category. This could be achieved by improving the skills and techniques in cultivation as conducted by technically efficient farmers. This result is in accordance with Junaedi research (2016) which describes the technical efficiency of cotton farmers in South Sulawesi. The majority is technically inefficient possessing efficiency value below 70 with a range of 0.50 -0.69 with an average technical efficiency equal to 0.65. A similar result was encountered in Proyoga's research (2010), which states that the technical efficiency level of organic rice farmers in Central Kalimantan varies from 0.47 to 0.96 with an average value 0.70

Empirical Review: Constraints faced by palm oil processors

According to Nwaleji (2018) who conducted a research on the characteristics of small-scale oil palm production enterprise in Anambra state has a result that shows that major Constraints to Palm Oil Production indicates three major constraints were extracted based on the responses of the respondents. Factors 1, 2 and 3 were named incentive/infrastructure, productivity and socio-economic constraints, respectively Incentive/infrastructural constraints included poor market networks (0.617), lack of storage facilities (0.550), insufficient fund for buying of processing machine (0.445) and poor incentives to processors (0.584). The findings imply that good market for the sale of palm oil produce had not been adequately established in the area by either the government or private bodies. Also, the processors had poor access to processing and storage facilities to increase production due to lack of fund. All these were attributed to poor infrastructure/ incentives to the palm oil producers which hinder their productivity. This is in line with Edem (2012) who noted that the absence of infrastructure such as storage facilities, transportation systems, access roads, communication channels are sources of inefficiencies in the value chain. As a result, smallholders prefer to farm in cottage or cooperative mills or sell crops via middlemen to avoid evacuation, storage and transport (UNIDO, 2010).

Study Area

The study was conducted in Akwa Ibom State, Nigeria. The state is the nation's third largest petroleum producer (NPC, 2007). The state has a population of 3.9 million people, as of 2006 with a density of 35 persons per kilometer, (NPC, 2006). Akwa Ibom State is situated between latitudes $4^{0}32^{1}$ N and $5^{0}3^{1}$N and longitude $7^{0}25^{1}$ E and $8^{0}25^{1}$ E and situated between Cross River, Rivers and Abia State on the South East. It has a total area of 8412km^2, a shoreline of 129km long and encompasses the Qua Iboe River Basin, the eastern part of the lower Cross River Basin and the eastern half of the Imo River estuary (NES, 2000). The Qua Iboe River, Cross River, Imo River and their tributaries control the drainage, and deposition of sands and clays. Qua Iboe River is the major hydrographic feature, which drains a greater part of the state and enters the sea at Ibeno, which is the major operational base of Mobil in Akwa Ibom State.

A multi-stage sampling technique was used to select 90 small-scale groundnut oil processors. In stage I, Oron metropolis was purposively selected. The choice was determined by the fact that it is the major commercial centre of the State and constituted about 85% of the target population for this study. In stage II, five LGAs were purposively selected because they were notable and six Communities predominant areas for palm oil processing. In stage III, three palm oil processors were selected each from the market LGAs. In stage IV, a total of 90 palm oil processors were selected.

Sampling Procedure and Size: Multi-stage sampling technique using structured questionnaire complemented with interviews were used to select the representative palm oil processing households for the study. The first stage involved the random selection of five clans from the eleven clans that make up Essien Udim. The second stage is the random selection of 10 villages per clan to make a total of 50 villages. From each of the selected villages, 3 households were randomly selected. A total of 150 palm oil producing households will be sampled. Data on socio economic characteristics of respondent, technical efficiency, determinant of technical efficiency and constraints associated with palm oil production will be obtained for the study.

Sources and Data Types: A cross sectional data from selected Palm oil processors' household heads in the study area. Basically, primary data was used in the study.

Method of Data Analysis: Data were collected using structured questionnaires and were complemented by personal interview to ensure consistency and accuracy of data collected. The structured questionnaires were administered to 150 processing household heads in the study area. Series of cross sectional data were collected, scrutinized and use for data analysis.

Analytical Techniques

Several descriptive and econometrics tools were used to analyze the stated specific objectives.

Objective 1: Socioeconomic characteristics of Palm oil processors in the study area.

To examine the socioeconomic characteristics among palm oil producers

Descriptive statistical analysis was used to establish the socio-economic characteristics among palm oil producers.

Objective 2: Technical efficiency level among farmers

Stochastic frontier model was used to estimate the production function and the technical efficiencies for the farmers.

The Empirical Model: For this study, the production technology of palm oil producers, in South-South, Nigeria is assumed to be specified by the Cobb Douglas frontier production function defined as follows:

$In\ Q = b_0 + b_1 InX_1 + b_2 InX_2 + b_3 InX_3 + b_4 InX_4 + + V_i - U_i$ ……..(eq 3.1)

$\ln Y = \ln\beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + Vit - Uit$ - - - - - 3.2

Where:

Y = Quantity of palm oil processed (litres);

X_1 = Labour (Naira);

X_2 = Palm Fruit (Kg);

X_3 = Water (Naira);

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X_4 = Capital (Naira);

$B_1 - \beta_4$ = vector of the coefficients for the associated independent variables in the production function;

Uit = one sided component, which captures deviation from frontier as a result of inefficiency of the firm; and

Vit = effect of random stocks outside the processors control, observation and measurement error and other stochastic (noise) error term

To obtain the determinants of technical efficiency of processors, a regression of the value of inefficiency from the model against some socio-economic factors of the processors was used. Battese and Coelli (1995), expressed the technical inefficiency starting with the frontier production function

Objective 3

Determinants of Technical Efficiency:

The technical inefficiency effect model is described as;

$\mu i = \delta_0 + \delta 1Z1 + \delta 2Z2 + \delta 3\ Z3 + \delta 4Z4 + \delta 5Z5 + ei$ ……………………… (3.3)

Where;

μi = technical inefficiency effect of the ithpalm oil producer;

Z_1 = Age (years)

Z_2 = Educational level (years)

Z_3 = Marital Status (1= single, 2=married, 3=divorced, 4=widow/widower)

Z_4 = Experience (years)

Z_5= Household size (number of people)

Z_6= Monthly income (Naira)

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δ = parameters to be estimated.

ei= random disturbance following half-normal distribution

Objective 4

Constraints Faced by Palm Oil Producers: Four-point Likert type Scale was used to analysedthis objective. The scale will be categorized as:

Strongly Agree= 4

Agree =3

Disagree=2

Strongly Disagree=1

The weighted mean will be computed as: 4+3+2+1/4=2.5

Hence any constraints with mean score of 2.5 and above will be regarded serious constraints while those below 2.5 will be regarded not serious constraints.

Results and Discussions: Socio Economic Characteristics of Respondents

The result presented in Table 4.1.1 showed that majority (74%) of the respondents were female while 26% were accounted for male gender engaged in palm oil processing in the study area. This implies that females are mostly engaged in palm oil processing than their male counterparts in the study area. This result confirms the findings that processing is the responsibility of women (Yinusa, 2015; Sanusi*et al.,* 2022)

The distribution of the respondents based on their age group as shown in Table 4.1.1 indicates that majority (82.7%) of the processors were within the age group of 30-40 years, 16% were above 40 years while 1.3% were below 30 years. The average age of processors in the study area was 37 years which indicates that processors were middle-aged and still active. The result agrees with the findings of Sanusi *et al.* (2022) who reported that processors in Ogun State were still within their productive age with an average age of 48 years.

The distribution of the respondents based on their marital status as shown in Table 4.1.1 indicates that majority (82%) were married, 14.7% were divorced, 2% were single while 1.3% were widow/widower. The implication is that, majority of processors were married and would tend to utilize their members of family for some activities during production, thereby reducing the cost of hiring labourers. The result is similar with the findings of Sanusi *et al.* (2022) who reported that 72% of oil palm processors in Ogun State were married.

The distribution of the respondents based on their educational status as shown in Table 4.1.1 indicates that majority (54.7%) attained secondary education, 39.3% attained primary education while 8% attained tertiary education. The implication is that, the processors were literate in the study area. The high level of educational attendance among processors could have positive effects on their productivity which may in turn have impacts on their standard of living since the output of an educated processor may be higher compared to their uneducated counterparts. The finding is contrary to the finding of Sanusi *et al.* (2022) who reported that higher proportion (51%) of oil processors in their study area had no formal education.

The distribution of the respondents based on their experience as shown in Table 4.1.1 indicates that majority (56%) of processors had below 10 years of experience, 42.7% had within 10-20 years of experience while 1.3% had above 20 years of experience in palm oil processing in the study area. The average years of experience in the study was 9 years. This indicates that they possess experience that could improve processing and hence the greater tendency to be technically efficient. The result corroborates with Sanusi *et al.* (2022) who reported an average year of experience of 9.78 years in Ogun State.

The distribution of the respondents based on their household size as shown in Table 4.1.1 indicates that majority (71.3%) of processors had between 5-8 persons while 28.7% had below 5 persons. The average household size in the study area was 5 persons. The implication is that large family size translates to ready supply of family labour, i.e., more members of the household could provide a reliable source of labour. This result agrees with the findings of Sanusi *et al.* (2022), who opined that palm oil processors in Ogun State had an average household size of 5 persons.

The distribution of the respondents based on their access to extension service as shown in Table 4.1.1 indicates that majority (81.3%) of processors had no access to extension service while 18.7%

had access to extension services in the study area. The result implies that, extension services are not effective which explains why majority of processors could not have access to their services.

The distribution of the respondents based on their membership of cooperative as shown in Table 4.1.1 indicates that (23.3%) of processors were not members of cooperative societies while majority (76.7%) were members of cooperative societies. The implication is that, processors in the study area are not were aware of the benefits of belonging to cooperative which explains the high rate of membership.

The distribution of the respondents based on their monthly income as shown in Table 4.1.1 indicates that high proportion (44%) earned between N40,000 – N60,000, 43.3% earned above N60,000 while 12.7% earned below N40,000. The average monthly income in the study area was N57,340 which implies that palm oil processors were earning above national minimum wage and would have the capacity to afford their needs.

The distribution of the respondents based on their type of labour used as shown in Table 4.1.1 indicates that majority (69.3%) of processors used hired labour while 30.7% used family labour. Oil palm processing involves stages of activities which tends to be energy consuming, this explains the high rate of using hired labour during operations.

Table 4.1.1 Socio Economic Characteristics of Respondents

SOCIO ECONOMIC CHARACTERISTICS	FREQUENCY (N=150)	PERCENTAGE (%)
GENDER		
MALE	39	26.0
FEMALE	111	74.0
AGE (MEAN = 37 YEARS)		
< 30	2	1.3
30 – 40	124	82.7
> 40	24	16.0
MARITAL STATUS		
SINGLE	3	2.0
MARRIED	123	82.0
DIVORCED	22	14.7
WIDOW/WIDOWER	2	1.3
EDUCATIONAL LEVEL		
PRIMARY	59	39.3

SECONDARY	82	54.7
TERTIARY	9	6.0
EXPERIENCE (MEAN = 9 YEARS)		
< 10	84	56.0
10 – 20	64	42.7
> 20	2	1.3
HOUSEHOLD SIZE (MEAN = 5 PERSONS)		
< 5	43	28.7
5 – 8	107	71.3
ACCESS TO EXTENSION SERVICES		
YES	28	18.7
NO	122	81.3
MEMBERSHIP OF COOPERATIVE		
YES	35	23.3
NO	115	76.7
MONTHLY INCOME (MEAN = N57,340)		
< 40,000	19	12.7
40,000 – 60,000	66	44.0
> 60,000	65	43.3
TYPE OF LABOUR		
FAMILY	104	69.3
HIRED	46	30.7

Source: Field Survey, 2023.

Processing Capacity

The distribution of the respondents based on their processing capacity as shown in Table 4.1.2 indicates that majority (80%) of processors had between 300 – 500kg while 20% had above 500kg processing capacity. The average processing capacity in the study area was 457.7kg which implies that processors in the study area were into small scale production.

Method of Processing

The distribution of the respondents based on their method of processing as shown in Table 4.1.2 indicates that majority (96%) of processors used traditional methods while 4% used modern methods. This may be due to availability of locally made machines and/or adequate knowledge on how to handle such machines. The finding is in line with Sanusi *et al.* (2022) who reported that

68.90% of processors used traditional method due to lack of credit and high cost of modern machines.

Table 4.1.2 Production Characteristics of Respondents

PRODUCTION CHARACTERISTICS	FREQUENCY (N=150)	PERCENTAGE (%)
PROCESSING CAPACITY (MEAN = 457.7KG)		
300 – 500	120	80.0
> 500	30	20.0
METHOD OF PROCESSING		
TRADITIONAL	144	96.0
MODERN	6	4.0

Source: Field Survey, 2023.

Implements Used by Respondents

The result shown in Table 4.1.3 showed that digester (33.3%) was commonly used by processors, followed by separator (30.1%), spindle press (29.5%) and thresher (7.1%). The respondents had basic knowledge on the working principles of these implements.

Table 4.1.3 Implements Used by Respondents in the Study Area

IMPLEMENTS USED	FREQUENCY (N=150)	PERCENTAGE (%)
THRESHER	32	7.1
DIGESTER	149	33.3
SPINDLE PRESS	132	29.5
SEPARATOR	135	30.1

Source: Field Survey, 2023. *Multiple Response*

Technical Efficiency of Palm oil Processing: Table 4.2. Show the distribution of the technical efficiencies of respondents which is derived from the analysis of the stochastic frontier production function. The best palm oil producers have a technical efficiency of 1.00 (100%) while the worst farm has a technical efficiency of 0.16, the mean technical efficiency is 0.71 (71%) implying that, on an average the palm oil producers were able to obtain 71 of potential output from a given mix of production inputs. This indicates that in the short run, there is a scope for increasing technical efficiency in palm oil production in the study area by 29 percent.

The distribution of technical efficiency of the palm oil producers reveals that about 13.3% had technical efficiency of less than 40 percent while 34.7% had technical efficiency of 50-80 percent. However, 52% of the palm oil producers had a technical efficiency of 81-100 percent. The result is in line with that of Ismiasih (2017) who reported that the technical efficiency of palm oil producers varied from 97 percent to 19 percent with an average of 83 percent.

Table 4.2.1 Frequency Distribution of Technical Efficiency of Palm Oil Processors

TECHNICAL EFFICIENCY	FREQUENCY	PERCENTAGE (%)
< 0.40	20	13.3
0.40 – 0.80	52	34.7
0.81 – 1.00	78	52.0
MEAN	71	
MINIMUM	16	
MAXIMUM	100	

Source: Field Survey, 2023.

Technical efficiency maximum-likelihood estimation result of the stochastic frontier model is presented in Table 4.2.2. Technical efficiency model was fitted with 150 observations and the Prob>chi2=0.000 shows the rejection of the null hypothesis which say all parameters are simultaneously equal to zero. Technical efficiency estimates of lambda (λ)=7.11e^{+07}is greater than one. Also, the sigma squared value was statistically significant at 1% level. This implies a good fit of the model used, and that the conventional production function is not an adequate representation of the data. All of the explanatory variables used in the output model are significant at 1% level of significance.

The estimated parameters for the Stochastic Production Function show that all the coefficients of the variables were significant at 1% level and positive except labour and water. The negative coefficient of labour and water implies that the amount of labour and water is imposing a reducing effect on the efficiency of resource use during palm oil production in the study area. The finding is in contrary to the finding of Lawal *et al.* (2013) who reported that increasing labour use would result to increase in the output of palm oil.

The positive coefficients of FFB and capital imply that increasing volume of these variables is associated with increased output. The quantities of FFB and amount of capital used are significantly different from zero at 1% level for the processors in the study area. This means that palm oil processing in Nigeria depends on the availability of FFB and amount of capital. Palm oil producers would most likely increase production when there is availability of FFB and capital for operations. The finding of this study corroborates that of Bankole *et al.* (2018) who reported similar result in their study. Corroboratively; Lawal *et al.* (2013) reported that quantity of palm fruits and labour would increase the output of palm oil.

Determinants of Technical Efficiency of Palm Oil Processors: The result of the inefficiency effects model showed that age (0.8017321), education (0.343575), experience (0.2720567) and monthly income (0.9041693) had positive and significant effects on the level of technical efficiency of palm oil processors. These results indicated that technical inefficiency effects in palm oil processing decreased with age, education, experience and monthly income. Age (0.8017321) had a positive and significant effect on the level of technical efficiency of palm oil processors, implying that increased in age of palm oil processors increased technical inefficiency in the study area. This indicates older farmers would increase technical inefficiency in production. In other words, younger farmers are more efficient. The result is in line with that of Ismiasih. (2017) who had similar finding in their study.

Education (0.343575) had a positive and significant effect on the level of technical efficiency of palm oil processors, implying that increased in educational level of palm oil processors increased technical inefficiency in the study area. Ismiasih. (2017) asserted that the higher the level of education the inefficiency will be greater among palm oil processors. Occupation as a palm oil farmer is a tough job that does not take into account the latest education, the most important is having a passion for working and having a strong physical capacity. Experience (0.2720567) had a positive and significant effect on the level of technical efficiency of palm oil processors, implying that increased in experience of palm oil processors increased technical inefficiency in the study area. The reason for this finding may be attributed to the fact that palm oil processors who have spent long years in processing may be less willing to adopt modern techniques of processing. The result is in consistent with Adanguidi (2019).

Monthly income (0.9041693) had a positive and significant effect on the level of technical efficiency of palm oil processors, implying that increased in monthly income of palm oil processors increased technical inefficiency in the study area. A plausible reason for this could be that palm oil processors would tend to diversify their investment when earning higher income, thereby paying less attention to palm oil processing activities.

Table 4.2a Regression Estimate of Profitability of Palm Oil Marketing

VARIABLES	COEFFICIENT	STANDARD ERROR	T VALUE
AGE	-4.9921	111.9720	-0.04
GENDER	-15012.09	1885.1	-7.96 ***
YEARS SPENT IN SCHOOL	7763.565	198.6304	39.09 ***
HOUSEHOLD SIZE	1107.764	617.6216	1.79 *
YEARS OF EXPERIENCE	321.2364	162.1846	1.98 *
VOLUME OF PALM OIL	130.3268	12.80433	10.18 ***
TRANSPORTATION	-46.65812	.756488	-61.68 ***

COST OF PURCHASE	3.436162	.1236902	27.78 ***
DISTANCE	55883.06	1882.716	29.68 ***
AMOUNT OF CREDIT	1.092213	.0212758	51.34 ***
CONSTANT	363275.7	6817.666	53.28 ***
R-SQUARED	0.9980		
ADJ R-SQUARED	0.9974		
PROB> F	0.0000		
ROOT MSE	3776.4		

Field Survey, 2023. NB *, **, *** implies 10%, 5%, and 1% respectively

Constraints Associated with Palm Oil Processing; The constraints identified as militating against smooth running of the palm oil processing in the study area are presented in Table 4.3. The major constraints identified as the hindrances to the optimum production palm oil were poor storage facilities (M= 3.63) ranked 1st, followed by high cost of processing (M=3.55) ranked 2nd, unavailability of improved processing equipment (M=3.53) ranked 3rd, lack of access to credit (M=3.46) ranked 4th, high cost of fuel (M=3.43) ranked 5th, inefficient marketing (M=3.41) ranked 6th, poor extension services (M=2.82) ranked 7th, high cost of improved processing equipment (M=3.02) ranked 8th, poor extension services (M=2.82) ranked 9th, difficulties in acquiring oil palm plantation (M=2.53) ranked 10th and bad road network (M=2.50) ranked 11th. The result corroborates with Lawal *et al.* (2013) who reported that oil palm processors were faced with problems of lack of processing machines (80%), inadequate capital/fund (55%), and transportation problem (62.5%). The finding is also in line with Onu *et al.* (2021) who reported that palm oil processors were faced with problems of lack of modern processing equipment (86.5%), high cost of labour (76.7%), lack of physical and social infrastructure (71.5%), inadequate safety and healthy environments (69.6%), lack of storage facility (69.4%), lack of technical information (62.8%), and difficulty in obtaining credit facilities (62.5%) were the constraints to engagement in oil palm processing in South-Eastern Nigeria.

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Table 4.2.2 Maximum Likelihood Estimates of the Parameters of the Stochastic Frontier Production Function

VARIABLE	*COEFFICIENT*	*STD. ERROR*	*Z*	*P>/Z/*
PRODUCTION FACTOR				
CONSTANT	3.416412	0.0000618	$5.5e^{+04}$	0.000
LABOUR	-0.0789767	0.0000138	-5709.53	0.000
PALM FRUIT	0.0374585	$5.93e^{-06}$	6319.81	0.000
WATER	-0.0059831	$8.77e^{-06}$	-681.87	0.000
CAPITAL	0.0460288	$7.18e^{-06}$	6409.34	0.000
INEFFICIENCY EFFECT				
AGE	0.8017321	0.2447675	3.28	0.001
MARITAL STATUS	0.343575	0.1924858	1.78	0.076
EDUCATIONAL LEVEL	0.4070442	0.1047322	3.89	0.000
EXPERIENCE	0.2720567	0.1225959	2.22	0.028
HOUSEHOLD SIZE	0.059117	0.1437714	0.41	0.682
MONTHLY INCOME	0.9041693	0.1291944	7.00	0.000
DIAGNOSTICS				
/INSIG2V	-37.13374	269.4976	-0.14	0.890
/INSIG2U	0.9740175	0.1154701	-8.44	0.000
SIGMA_V	$8.64e^{-09}$	$1.16e^{-06}$		
SIGMA_U	0.6144617	0.035476		
SIGMA^2	0.3775631	0.0435972		
LAMBDA	$7.11e^{+07}$	0.035476		

Source: Analysis 2023

Table 4.3 Constraints Associated with Palm Oil Processing in the Study Area

CONSTRAINTS	SA	A	D	SD	MEAN SCORES	RANK
LACK OF ACCESS TO CREDIT	101	29	8	12	3.46	4th
UNAVAILABILITY OF IMPROVED PROCESSING EQUIPMENT	115	12	10	13	3.53	3rd
HIGH COST OF PROCESSING	108	24	10	8	3.55	2nd
DIFFICULTIES IN ACQUIRING OIL PALM PLANTATION	43	11	79	17	2.53	10th
HIGH COST OF IMPROVED PROCESSING EQUIPMENT	70	25	43	12	3.02	8th
HIGH COST OF FRESH FRUITS BUNCH	106	15	9	20	3.38	7th
POOR EXTENSION SERVICES	58	42	15	35	2.82	9th
UNAVAILABILITY OF LABOUR	13	26	37	74	1.85	13th
INEFFICIENT MARKETING	105	19	8	18	3.41	6th
POOR STORAGE FACILITIES	115	22	6	7	3.63	1st
BAD ROAD NETWORK	61	15	12	62	2.50	11th
AVAILABILITY OF TRADITIONAL LAW ON DAYS OF WORK	22	9	101	18	2.23	12th
HIGH COST OF FUEL	111	9	14	16	3.43	5th

Source: Field Survey, 2023

Conclusion: The study revealed that palm oil processors were literate, young and small-scale processors. The result of this study showed that the technical efficiency of palm oil processors was high. The individual levels of technical efficiency ranged between 16% and 100% with a mean of 71%, this implies that there are opportunities for improving the productivity and income of the palm oil processors in the study area by increasing their resource use efficiency. The important determinants of technical inefficiency among palm oil processors were; age, education, experience and monthly income while poor storage facilities, high cost of processing, unavailability of improved processing equipment, lack of access to credit, high cost of fuel, inefficient marketing, poor extension services, high cost of improved processing equipment, poor extension services, difficulties in acquiring oil palm plantation and bad road network were the major constraints in the study area.

Recommendations: Based on the findings of the study, the following recommendations are suggested; Government and NGOs should encourage young people to engage in palm oil processing due to their level of reception in terms of improved method of palm oil processing compared to their counterpart. The motivation can be achieve through providing incentives such as improved processing facilities and adequate credit facility. The processor need to be enlightened through education on the basic processing techniques for improved efficiency in processing. This would enhance their productivity and profitability as well as improving their livelihood. Processors should be encouraged to explore multiple streams of income which will improve their income level as well as improving efficiency in processing through purchasing of efficient processing equipments.

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