



## **Adoption of Recommended Palm Oil Processing Technology in Isoko North Local Government Area, Delta State, Nigeria**

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### **Authors' contributions**

*This work was carried out in collaboration between two authors. Author AD designed the study, performed the statistical analysis, wrote the protocol, wrote the first draft of the manuscript and managed the analyses of the study, while author NR managed the literature searches. Both authors read and approved the final manuscript.*

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### **ABSTRACT**

The significant roles played by oil palm production in the economy of Nigeria in the years before the advent of crude oil cannot be over-emphasized. The study examined farm families' adoption of recommended palm oil processing technologies in Isoko North Local Government Area, Delta State, Nigeria. The sample comprised 50 palm oil processors selected through random sampling technique. Data were collected with the aid of the structured questionnaire. Moreso, the group discussion was conducted with knowledgeable palm oil processors and owners of palm oil mills in selected communities. Data analyses were done with descriptive statistics (i.e. percentages). The result revealed that the perception of farmers on the level of adoption of recommended technologies (sterilizer, digester, and mechanical press) was high, threshing and separating machine was low and oil clarifier had zero level of adoption. The highlight the major constraints facing processors. These includes, high cost of processing, access to credit facilities, lack of government support, lack of extension contact, fluctuation of selling prices, inaccessibility to processing technologies and high cost of transportation. It was recommended that cost of processing equipment be subsidized by

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government and credit facilities made more accessible to small scale processors. Researchers should develop more semi- mechanized palm oil processing technologies that do not require huge cost, while palm oil processors should be encouraged to form cooperatives so as to pull their resources together to take advantage of these technologies.

*Keywords: Oil palm; palm oil; processing; recommended; adoption.*

## 1. INTRODUCTION

The oil palm production is a perennial crop that originated in the tropical rainfall forest of West Africa. Between 1961 and 1976 World oil palm production was 2.5 million tonnes, with Nigeria accounting for 43%. However, since then oil palm production and processing in Nigeria has virtually been stagnated. But today world oil palm production amounts to 14.4 million tones with Nigeria which was one of the largest producers in West Africa account for 7%. According to [8] in comparing the characteristics of oil palm sector in Malaysia and Nigeria reported that Malaysia success is built on plantation management together with processing in large modern mills.

Since independence, Nigeria agricultural sector has experience slow output growth that has not kept pace with increasing population. This has resulted in declining agricultural export, domestic food supplies and a growing reliance on food importation. Nigeria has been particularly fortunate in having vast oil reserves, but it has also been plagued by economic chaos, instability and terrorism over the past decades. Palm oil processing is a major source of income and employment to the large proportion of the resource-poor rural population in Nigeria.

Palm oil processing business in Isoko nation is a viable venture. However, is very challenging owing to its laborious nature. A survey of the processing techniques in the area revealed that users of recommended technologies do not own them. They often pay to use the improved processing machines to process their palm oil.

Furthermore, [2] emphasized that the motivation for individual participation in the processing of palm oil in pre-colonial period stemmed from the individuals' view of what he or she stands to gain from the exercise, Due to its economic value, plan oil processing is considered as a traditional source of revenue for people.

In Isoko Land men for instance processed plan oil to meet domestic consumption needs and to satisfy social obligation such as payment of

bodies price, buying of essential items such as clothing, salt domestic utensils etc. suffice to say, palm oil processing serves as a source of livelihood, income food and other socio-economic needs of processors [12].

Moreso, [7] opined that processors who were using a traditional method of palm oil processing prior to their adoption of the recommended technologies affirmed that their output increased considerably since they adopted the recommended technologies. The study equally noted that with traditional method of processing, it will not be possible for an individual processor to process the same quality of palm oil as with those that adopt recommended technologies.

In recent times, palm oil production has drastically dropped compared to its demand. A number of socio economic and political factors along with technological know-how in the industry may be responsible. Principal among these factors responsible for the decline is the inefficiency that exists in the production system for palm oil processing. Such inefficiency arise from high cost of procuring technologies, lack of link roads, electricity, inadequate credit facility and inadequate information and lack of contact with extension agents. Adoption is defined as the acceptance and continued use of new technologies. The level of adoption can also be defined as the extent of usage by the respondent practicing the new ideas or innovation. It is a snap short decision but a mental process over a period of time [3] and [13]. According to [1] adoption is a process with many possible scenarios. He reiterated that farmers do not accept innovation immediately; they need to think over it before making a decision. The reluctance of a farmer to adopt an innovation or not, depend on the farmer's perception of the innovation. Similarly, the adoption of a technology depends on how appropriate, it is to the farmer and also how feasible, available, affordable and profitable the farmer perceive. The technology can reach farmers through technology transfer.

Similarly, [5] asserted that generally in agriculture, factors that affect adoption of

recommended practices include profitability, compatibility and variability of such technologies. An innovation is an idea, practice or technology that is new to a decision-maker [15] and may be embodied in new and improved products and processes, new organizational forms, the application of existing technology to new fields, new resources and new markets [9]. Adoption of an innovation can also be defined as the process which a particular farmer is exposed to, considers, and finally rejects or practices a particular innovation. There are the number of factors that influence the extent of adoption of technology such as attributes of technology, the adopters or clientele, which is the object of change.

### 1.1 Statement of Problem

Nigeria is the third largest producer of palm oil in the World, yet she import palm oil to meet her domestic demand. Nigeria's goals, therefore, should be to meet the domestic demand and if possible compete with other countries such as Malaysia and Indonesia that are currently leading countries in palm oil processing [4]. For the palm oil processing industry to sustain this competitive edge, continued research is very crucial in regard to appropriate processing technology to pave the way forward in shaping the future of the palm oil industry. However, in Nigeria, 80% of palm oil processors comes from dispersed smallholders who harvest semi-wild palm fruits and use manual processing techniques, a processing technique that is labour intensive and highly inefficient. The manual processing technique often results in low palm oil extraction rate and high free fatty acids (FFA) content that can be up to 30% in some instance [14,17]. Obviously, most rural farmers often adopt manual processing technique in palm oil processing as against the recommended practices. This gives rise to low production and high fatty acids. The study hopes to proffer answers to the following questions. What are the factors that make palm oil processing technique inefficient? Does the high cost of procurement of technologies affect adoption? Are there enough extension agents to inform and guide the processors in the adoption of recommended processing technology? Where they exist do they function optimally? This study takes a concise look at the adoption of recommended palm oil processing technology in Isoko North local government Area, Delta State.

## 2. REVIEW OF RESEARCH LITERATURE

### 2.1 Conceptual Framework

The model adopted for the study is technology acceptance model (TAM). TAM is a model developed for assessing the process of technology diffusion. Since our interest is to examine the factors enhancing adoption of recommended palm oil processing technology, this section therefore examine process, social and other factors influencing the adoption of technology. According to [18] the attributes of technologies that modify the adoption and diffusion process include characteristics of the potential adopters and strategies that contribute to successful technology adoption and integration. Hence, within this context, "adoption" refers to the stage in which a technology is selected for use by an individual or an organization, "innovation" is similarly used with the nuance of a new or "innovative" technology being adopted. "diffusion" refers to the state in which the technology spreads to general use and application. "Integration" connotes a sense of acceptance, and perhaps transparency within the user environment. Typically, past adoptions of a new technology have signaled a confidence in its potential to alleviate particular problem or to make a job easier or more efficient.

TAM proposes two specific benefits - perceived ease of use (PEOU) and perceived usefulness (PU) that determine behavioral intention to use technology. Behavioral intention is a measure of the strength of one's intention to perform a specified behavior. Perceived usefulness is defined as a prospective user's subject probability that makes use of a specific technology will increase his or her job performance within an organizational industry. These innovations have progressed from the development of individual machines, to carry out particular operations, to machines that combine several operations in the process. The mechanized process in palm fruit processing to palm oil extraction includes; threshing, sterilization, digestion, pressing, clarification and settling of palm oil, and eventually oil storage.

Planned change involves human intervention in controlling the direction of change towards a definite set goal [16]. The recommended palm oil processing technologies, for instance, is a planned change that is geared toward reducing drudgery associated with palm oil processing and

to boost output of adopters of the technologies. Most social change in our society occurs through adoption and diffusion process.

## **2.2 Cost Implication of Adopting improved Technology**

Due to various constraints occasioned by the global economic meltdown of the examined factors influencing adoption of palm oil processing technology it has become glaring that a number of the existing manufacturers are no longer prepared to adopt improved production technologies. As such, it was difficult obtaining reliable cost, date of the technology. However, the researcher opined that from the perception of the respondents to the issue of improved technology, cost of acquiring the technologies (may be up to 20 times the cost of traditional techniques) would be much more than the traditional method. Furthermore, considering other factors such as lack of infrastructural facilities that will make the adoption of the technologies to work in rural areas. It becomes apparent that improved technology would be out of the reach of these rural palm oil farmers without government intervention.

## **3. METHODOLOGY**

### **3.1 Study Area**

The study was carried out in Isoko North local government Area, Delta State. It has land mass of approximately 65,000 m<sup>2</sup>. The local government falls under the rainforest vegetation zone with a mean annual rainfall of 1800 mm per annum and average temperature of 31°C. It is situated on latitude 5°N and longitude 5°N and 6°S. The population figure of Isoko north local government area was estimated to be 144,155 by National Population conducted in 2006 [6]. The inhabitants are notable for farming. The area was chosen because oil palm is predominantly grown there. Other crops grown include maize, cassava, sweet potato etc.

### **3.2 Research Instrument and Data Collection Techniques**

Two-stage sampling technique was adopted for the study. Firstly, five (5) communities were randomly selected out of thirteen [13] that make up the Isoko North local government. Secondly, a sample comprising of fifty (50) palm oil processors were selected through proportionate

sampling technique from the chosen communities, Ozoro (15), Owhegbo (10), Ofagbe (5), Iyede (10) and Emevor (5). Data were collected through well-structured interview schedule and administered to knowledgeable farmers and owners of palm oil mills in chosen communities out of which relevant information were extracted on how processors view technology, their experience, educational level, constraints adoption of technology. A three-point likert type scale ranging from very high= 3, low =2 and not high =1 were used to determine the mean score of adoption of recommended palm oil technologies.

## **4. PRESENTATION OF RESULT**

This section dwells on presentation of data and discussion of result.

### **4.1 Socio-economic Characteristics of Respondents**

This section deals with the presentation of socio demographic of the respondents.

### **4.2 Discussion of Findings**

#### **4.2.1 Social economic characteristics of palm oil production**

Table 1 revealed that majority (68%) of the palm oil producers are males. This implies that males dominate the palm oil production enterprise in the study area. The table also shows that a simple majority (46%) of the palm oil producers were 51 years and above of age. This implies that palm oil producing enterprises is being manned by relatively elderly people. This will no doubt affect the productivity and output of palm oil farming negatively. The mean age of the palm oil processors is 59.2. Table 1 equally reveals that 52% of the palm oil farmers had the household size of 1-4 persons with a mean of 4.82. Household size is of high importance to the palm oil farmers since the consumption unit is also the production unit. Therefore the larger it is, the more labor that will be available for family use for the productive purpose. On the educational level, table 1 indicates that 60% of the palm oil producers had one level of education or the other, while 40% had no formal education. This implies that most of the respondents in the study area were educated and this will facilitates the rate of adoption of palm oil production technology which in turn will

increase the output and productivity of the enterprises. This finding is agreement with that of [11] and [10]. On the processing experience, table 1 revealed that Majority (40%) of the palm oil processors had processing experience of 5-8years with a mean of 7.2. This implies that palm oil processors have enough experience capable of enhancing quality decision. 88% of the respondents are married. The implication of this result is that there could be more support from the spouse and children of the farmers with a view to improving and increasing palm oil production. The result also revealed that 50% of

the respondents make use of both hired and family labor.

#### **4.2.2 Palm oil processing technologies**

Table 2 revealed that the digester and mechanical press were adopted by all the process with a very high weighted mean of 3.0 each. The processors attested to the fact that both technologies help to reduce drudgery associated with the traditional method i.e. pounding of the palm fruit with pestle and mortar or the stress of mashing with feet in a wooden

**Table 1. Distribution of respondents according to social economic variables**

<b>Variables</b>	<b>Frequency</b>	<b>Percentage (%)</b>	<b>Mean</b>
<b>Gender (sex)</b>			
Male	34	68	
Female	16	32	
Total	50	100	
<b>Age (year)</b>			
31-40	10	20	
41-50	17	46	59.2
51 and above	33	46	
Total	50	100	
<b>Household size (person)</b>			
1-4	26	52	
5-8	20	40	4.82
9 and above	4	8	
Total	50	100	
<b>Educational level</b>			
No formal education	20	40	
Primary school education	14	28	
Secondary school education	11	22	
Post-secondary education	5	10	
Total	50	100	
<b>Processing experience (year)</b>			
1-4	15	30	
5-8	20	40	7.2
9 and above	12	30	
Total	50	100	
<b>Marital -status</b>			
Single	-	-	
Married	44	88	
Widower,	6	12	
Widow	-	-	
Divorced	-	-	
Total	50	100	
<b>Source of information</b>			
Fellow processors	35	70	
Friends	10	20	
Mass media	5	10	

Source: field survey data, 2017

**Table 2. Distribution of respondents according to level of adoption of recommended palm oil processing technology**

Palm oil processing technologies	Adoption	Mean score (weighted)	Percentage (%)	The overall perception of adoption
Thresher	5	0.1	3	Low
Sterilizer	120	2.4	80	High
Digester	150	3.0	100	High
Separating machine	50	1.0	33	Low
Mechanical press	150	3.0	100	High
Oil clarifier	0	0	0	No adoption

Source: field survey data, 2017

**Table 3. Distribution of respondent based properties acquired with palm oil proceed**

Items /properties	Frequency	Percentage (%)
House	14	28
Television	45	90
DVD	40	80
Radio	40	80
Cell phone	45	90
Motor cycle	30	60
Car	10	60
Spray machine	45	90
Set of chairs	30	60
Rubber mattress	25	50

Source: field survey data, 2017

**Table 4. Constraints to adoption of recommended technologies**

Variables	Frequency	Percentage (%)	Rank
High cost of palm oil processing	38	78.0	1 <sup>st</sup>
Access to credit facilities	26	52	2 <sup>nd</sup>
Lack of government support	7	34	3 <sup>rd</sup>
Lack of Extension contact	10	20	4 <sup>th</sup>
Fluctuation of selling prices	8	16	5 <sup>th</sup>
Inaccessibility to processing technologies	2	4	6 <sup>th</sup>
High cost of transportation	2	4	6 <sup>th</sup>

Source: Computed from field survey data, 2017

Trough the sterilizer has a weighted mean of 2.4 indicating a high level of adoption. The result showed that 80% of the respondents adopted the technology. The result also revealed that separator has a mean of 1.0. This implies that the technology has a low level of adoption; only 3% of the respondents make use of thresher mean of 0.1 the reason for the very low level of adoption is not uncommented to its expensive nature and tend to cut down their profit margin. The clarifying machine was not adopted at all.

#### **4.2.3 Properties acquired with proceeds from palm oil enterprise**

Table 3 revealed that palm oil processors that were interbreed were able to use the proceeds (income) from palm oil processing enterprise to

acquire a number of items to better their living condition. The respondents attested that through their involvement in palm oil processing, they enjoyed food, security, and also acquired many items, among them television, DVD, radio, motorcycle, cell phone, car, set of chairs e.t.c.

#### **4.2.4 Constraints to adoption of recommended technologies**

In every adoption case, adopters are expected to experience some in relation to the recommended technologies, so also in this case of adopters of recommended palm oil processing technologies are likely to encounter some challenges. Therefore analysis of constraints of palm oil processing as in the study area revealed that 78% of the respondents asserted that cost of processing palm oil is high due to the several

cost involved. These factors include; cost of cutting the palm fruit bunch from the palm tree, cost of transporting bunches from point of harvesting to where a vehicle can convey it to the mill; cost of transporting bunches to the mill which depend on the distance cost of splitting the bunches; [7] reported that the cost of processing depends on the quantity of palm fruit to be process. More so, adding that cost of either buying the palm fruit or renting the palm plantations will end up squeezing processors profit margin to the barest minimum especially for those who process very little quantity of palm oil.

On the problem of lack of credit facilities, the result revealed that 52% of the processor agree that they do not have access to credit facilities simply because their do not belong to any association. The processor affirmed that each time they try to get credit individually the banks often ask them if they belong to trade union or request collateral to cover for the credit facilities, either of which they do not process. More so, the result in Table 4 shows that 34% of the respondents mentioned that lack of government support and family members is one of the reason that limit their adoption of recommended technologies. The respondents affirmed that their adult family members do not support them with their labour, since, these family members often consider palm oil processing as a dirty job, hence, they are not willing to help in the processing enterprise. This constraint was linked to the fact that majority of the processor does not belong to association. Furthermore, table 4 revealed 20% of the processor complained that extension agent does not visit them to teach them about the desired technologies and that where they exist they never function to expectation. The result also shows that 6% of the respondent asserted that fluctuation of selling prices is one of the identified constraints in the study area. The result shows that it was buyers of palm oil that fixed the price because they have a functional association. Hence processor is unable to control the price for the buyers this finding is inconsonant with the study of [7].

Table 4 also revealed that 4% of the processor express concern about their inaccessibility's to process technologies. This means that processors have difficulties of equipping their workers with the relevant equipments such as wheelbarrows, hand gloves, sharp cutlasses to enhance the processing. This problem is linked to lack of sufficient capital.

Finally, the result in Table 4 revealed 4% of the processor identified high cost of transportation as one of the limits factors to adoption of recommended technologies. This means most motorist charge very high for transportation palm bunches claiming that oil from the fruit gets their vehicle stained and dirty and that the roads leading to fruit collection is poor.

## **5. CONCLUSION AND RECOMMENDATION**

The present investigation was under taken with a view to examine the critical factors influencing adoption of recommended palm oil processing technology in Isoko North Local Government Area, Delta State. Adoption of the recommended technologies by processors in the study area has contributed immensely to processors' economic situation through income output increase. Result revealed that among the recommended palm processing technologies sterilizer, digester and mechanical press level of adopted by all the farmers with a very high overall perception of adoption weighted mean of 2.4 and 3.0, thresher and separating machine had a low weighted mean of 0.1 and 1.0 respectively, while that of oil clarifier shows zero adoption. On the constraints of non-adoption of recommended palm oil processing technologies, the study identified high cost of processing, access to credit facilities, lack of government support, lack of extension contact, fluctuation of selling prices etc as major challenging factors hindering adoption of recommended palm oil processing technologies.

Based on the above 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. Moreso, palm oil processors should be encouraged to form cooperatives so as to pull their together to take advantage of these technologies. Finally, government and non- governmental organization should help subsidize palm processing access to credit facilities, lack of government support, lack of extension contact, fluctuation of selling prices, inaccessibility to processing technologies and the high cost of transportation. Equipments and credit facilities made more accessible to palm oil processors so as to reduce the high cost of acquiring the technology.

## **COMPETING INTERESTS**

Authors have declared that no competing interests exist.

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