FACTORS INFLUENCING PROCESSORS' WILLINGNESS TO ENGAGE IN MECHANIZED PALM FRUITS PROCESSING IN ABIA STATE, NIGERIA

[1]Amusa, T. A., [2]Anugwo, S. C. and [3]Esheya, S. E

[1] Department of Agricultural Economics, Michael Okpara University of Agriculture, Umudike
[2]Department of Agricultural Economics and Extension Services, Federal University, Oye, Ekiti State
[3]Department of Agricultural Education, Ebonyi State College of Education, Ikwo
Correspondence: E-mail: hamfeeq@yahoo.com

Abstract
The study investigated factors influencing processors' willingness to engage in mechanized palm fruits processing in Abia State, Nigeria. Purposive, multi stage and random sampling technique was used for selecting 90 palm fruits processors across the three agricultural zones in the state. Primary data were collected for the study using a close-ended structured questionnaire. The data were analyzed using descriptive statistics, gross margin and binary probit model. The study found that traditional technologies are widely practiced among palm fruits processors in Abia state than mechanized processing. The gross margin of the palm fruits processors was ₦74,960.00 with net return of ₦72,230.00 and profitable index (PI) of 0.38. The result of the binary probit model showed that the explanatory power of the specified variables as indicated by the pseudo R^2 value of (0.772) was relatively high and good while the overall goodness of fit as reflected by Prob>Chi^2 (0.000) was also good. Out of the nine explanatory variables specified in the model, six (education, household size, experience, income, extension visits and membership of cooperative) were statistically significant at 1 and 5%. Some of the notable challenges facing the processors include high cost of processing input, high cost of transportation, fluctuation of prices of products, poor road network, labour intensive nature of palm fruit processing and inadequacy of labour supplies for palm fruit processing among others. Based on these findings, the study recommended provision of soft loans to processors for acquisition of modern processing machines, creation of awareness and capacity building training for palm fruits processors in the use of modern processing machines.

Keywords: Palm fruits, palm oil, traditional, mechanized processing, willingness to engage

Introduction
Oil palm (*Elaeis guineensis*) is a multipurpose tree crop with almost all parts of the tree having one form of socio-economic value or the other. Oil palm is capable of stabilizing global food security especially in developing countries and has become an increasingly important driver of economic development and poverty reduction in the major producing countries of the world, Nigeria inclusive. Hence, the significance of oil palm to Nigerian economic cannot be over emphasized. For instance, Onoh and Peter-Onoh (2012) stated that, the importance of oil palm to the national economy range from production of food for human and livestock consumption, employment, income to farmers and the nation and raw materials for industries. Oil palm has been a major source of foreign exchange to Nigeria as well as source of revenue to major segment of the rural population of south east Nigeria. Ayinde, et al. (2012) noted that the world's growing population will require more than 230 million tonnes of edible oils by 2021, with palm oil contributing more than 100 million tonnes. The principal product of oil palm is palm fruits from which other economics products such as palm oil, palm kernel oil, palm kernel cake and cracked shells are derived through processing. Palm oil is the world's largest source of consumable oil, accounting for about 38.5 million tonnes of the global edible oil and fat. The uses of palm oil are enormous, ranging from cooking to industrial use for

soap making, pomade, metal plating, lamp oil, glycerine, butter and manufacturing of paints among others. Palm oil has extensive domestic and industrial applications and as a source of edible oil, it contributes to food security, health and well-being of the citizens (Ikuenobe, 2010). According to Ibitoye, Akinsorotan, Meludu and Ibitoye (2011) palm kernel oil is also used for soap making, as a source of glycerine, for manufacturing margarine, cooking fats and for making lubricants among others. The residue obtained after extraction of oil is called kernel cake, which is useful in livestock feed production.

About 80% of palm oil production is destined for human consumption with the balance going to animal feed and to various industries. Azizan (2006) stated that the fruits of the oil palm tree contain 45 to 55% oil and unlike other vegetable oils, palm oil contains high levels of beta carotene and tocotrienols, which have been found to help protect against cancer. Fresh harvested palm fruits are highly perishable, unless it undergoes processing to convert it to palm oil and other by-products for increased shelf life. Processing therefore becomes necessary since oil palm fruits require processing within 48 – 96 hours after harvest (Owolarafe and Arumughan, 2007). Palm fruit processing is the set of methods and techniques used to transform the raw palm fruits into palm oil, palm kernel oil, palm kernel cake and other by-products for human and livestock consumption or industrial uses. In essence, the processing of palm fruits reduces its bulkiness, stops deterioration of the perishable fruits, adds value to the products, increases the shelf life and acceptability of the processed products in the market. Palm fruits are processed by processors into other by-products using traditional and mechanized methods of processing. The traditional method of processing palm fruits is common among the smallholder processors which are carried out by steeping the pounded fruit mash in hot or cold water; removing fibre and nuts in small baskets and hand squeezing; filtering out residual fibre from the oil/water emulsion in perforated metal colanders or baskets; boiling and skimming palm oil from the oil/water mixture and drying the recovered oil (Poku, 1998). Pounding (digestion) and oil extraction are the most tedious and essential operations in traditional palm fruit processing; therefore, early efforts concentrated on these tasks. In small-scale processing, digestion, that is, the breaking up of the oil-bearing cells of the palm fruits' mesocarp, is the most labour intensive activity (Kwaski, 2002).

Two methods of fruit maceration are common in traditional processing: pounding cooked/soaked fruits in large wooden or concrete mortars with a wooden pestle and foot trampling the cooked but cold fruits in canoes or specially constructed wooden troughs. The traditional method of palm fruits processing is highly laborious, time consuming and wasteful as about 25% - 35% of the potential palm oil and palm kernel oil are lost during processing. On the other hand, mechanized processing of palm fruits is adjudged to be efficient as it reduces drudgery and increased quality and quantity of processed products. Nwankwojike, Odukwe and Agunwamba (2011) noted that the modern processing of the oil palm fruits bunches into palm oil and kernel products is mostly practiced using mechanical methods due to the tedious and drudgery nature of the traditional techniques. The sequence of unit operations involved in the processing of the harvested oil palm fresh fruit bunches into palm oil and kernel by mechanical methods is; sterilization stripping-digestion-palm oil extraction-clarification-nut/fibre separation-drying of nuts-nut cracking-kernel/shell separation-drying-storage of the extracted oil and kernel (RMRDC, 2004). The mechanized method of palm fruits processing according to Ukpabi (2004) is an efficient processing technique that increases the quality and quantity of palm oil available for consumption and trade. Palm fruits processing enterprise in Nigeria and Abia State in particular is still widely carried out with the use of traditional methods by homestead and small processors who contribute over 80.0% of national palm oil and palm kernel output. Therefore, their engagement in mechanized processing techniques will

significantly impact on national palm oil and palm kernel output thereby increasing processors income and the food security situation in Abia State and the country in general. It is based on this background that this study was carried out to empirically investigated the factors influencing processors' willingness to engage in mechanized palm fruits processing using Abia State, Nigeria as case study. Specifically, the study identified technologies in processing palm fruits in the area, cost, returns and profitability of palm fruits processing, determinants of processors' willingness to engage in mechanized palm fruits processing and challenges facing palm fruits processors in the study area.

Materials and Methods

Area of Study

The study was carried out in Abia State, southeastern part of Nigeria. The state is located within the tropical rainforest zone and lies between longitudes 7^{O} 10^{1} and 8^{O} East of the Greenwich meridian and latitudes 4^{O} 40^{1} and 6^{0} 14^{1} North of the equator (National Bureau of Statistics, 2005). Abia State is made up of seventeen (17) administrative local government areas broadly divided into three agricultural zones which include: Aba, Ohafia and Umuahia agricultural zones. The state lies south of Enugu and Ebonyi States as well as east of Anambra and Imo States. It is bounded in the east by Cross River and Akwa Ibo States and in the south by Rivers State. Abia State has a climate marked by two major seasons; the raining season which lasts between April to October and dry season lasting from November to March like other states in the rainforest zone. Abia State occupies a land area of about 5,243.775sq.km which is approximately 5.85% of the total land area of Nigeria (National Bureau of Statistics, 2005). The population of Abia State according to National Population Commission (2006) is 2,833,999 people. Agriculture is one of the main occupations of the people of Abia State, providing income and employment for more than 65% of the population. Poultry, goat, pigs and cattle are some of the livestock mostly reared on intensive/semi-intensive and extensive bases by small holder farmers in the state. Food crops grown in the state include yam, cassava, maize, cocoyam and different types of vegetables while the main agricultural cash crops in the state are cashew, mango, citrus and oil palm among others.

Sampling and Data Collection

Purposive, multi stage and random sampling technique was used for selecting 90 palm fruits processors across the three agricultural zones in the state. The first stage involved purposive sampling of the three agricultural zones (Aba, Ohafia and Umuahia) in the state due to the overwhelming palm fruits processing activities across the state. In second stage, two local government areas (LGAs) were randomly sampled from each of the three agricultural zones making six LGAs for the study. At the third stage, random sampling was used to select three communities from each of the six LGAs making 18 communities for the study. The fourth stage of the sampling involved random selection of five (5) palm fruits processors from each of the 18 selected communities making a total of 90 processors that constituted the sample for the study. With the assistance of agricultural extension agents and key informants in the selected communities, the lists of the palm fruits processors were compiled from which sampling was drawn. Data for this study were obtained from primary source through the use of close-ended structured questionnaire. The data for the study were collected between April and May, 2017 by the researchers and their assistants. Due to close monitoring of the 90 copies of the questionnaire administered to the respondents, the anticipated 100% return rate was achieved. The questionnaire was structured to gather data on socio-economic characteristics of the processors, local and modern technologies use in palm fruits processing in the area, the cost, returns and profitability of palm fruits processing and challenges facing palm fruits processors in the area. Data collected were analysed using descriptive

statistics such as mean and gross magin analysis and inferential statistics (binary probit model analysis).

Estimation Procedure

Descriptive Statistics (Mean)

Mean was used to establish the extent of utilization of local and modern palm fruits processing technologies by processors in the area. The values attached to the response options of the 4-point rating scale in the questionnaire were: Highly Utilized (HU) = 4; Moderately Utilized (MU) = 3; Less Utilized (LU) = 2 and Not Utilized (SD) = 1.

The arithmetic mean for the values was computed as:

$$\frac{4+3+2+1}{4} = \frac{10}{4} \qquad = \mathbf{2.50}\ (\boldsymbol{cut-off\ point}) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots..(1)$$

Using 2.50 as criterion reference point or cut-off point, any item with mean value of 2.50 and above was interpreted as “Utilized” while items with mean values of less than 2.50 were regarded as “Not Utilized”.

To identify the challenges facing palm fruits processors in the area, descriptive statistics (mean) was also employed using 4-point rating scale. The values attached to the response options of the 4-point rating scale were: Very Serious (VS) = 4; Serious (S) = 3; Less Serious (LS) = 2 and Not Serious (SD) = 1. In the same manner, using 2.50 as criterion reference point, any item with mean value of 2.50 and above was interpreted as “Serious challenge” while items with mean values of less than 2.50 were interpreted as “Not Serious” challenges.

Gross Margin Analysis

The profitability of processing palm fruits in Abia State was estimated using gross margin analysis. The model is expressed as:

Gross Margin

$$\mathrm{GM} = \mathrm{TR} - \mathrm{TVC} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.(2)$$

Where: GM = Gross Margin

TR = Total Revenue

TVC = Total Variable Cost

Rate of Return on Investment (RRI)

$$RRI = \frac{NR}{TC} X \frac{100}{1} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.\ldots\ldots\ldots.\ldots\ldots\ldots(3)$$

Where: RRI = Rate of Return on Investment

NR = Net Return

TC = Total Cost

Profitability Index (PI)

$$\mathrm{PI} = \frac{NR}{TR} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots..\ldots\ldots\ldots\ldots\ldots\ldots\ldots.(4)$$

Where: PI = Profitability Index

NR = Net Return

TR = Total Revenue

Operating Expense Ratio (OR)

$$\mathrm{OR} = \frac{TVC}{TR} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.\ldots\ldots.(5)$$

Where: OR = Operating Expense Ratio

TVC - Total Variable Cost

TC = Total Revenue

Binary Probit Model

Binary probit model was used to estimate factors influencing processors’ willingness-to-engage in mechanized palm fruits processing in Abia State. Discrete choice models attempt to analyze

decision marker's preferences between alternatives in which the choices are mutually exclusive and exhaustive (Green, 1997). Since the willingness of processors to engage in mechanized palm fruit processing was obtained from a dichotomous (discrete) choice question with Yes = (1) if willing to engage or No = (0) if not willing, binary probit model was employed to estimate the factors that predicts processors' willingness to engage in mechanized palm fruits processing in Abia State.

The hypothesized determinants of processors' willingness to engage in mechanized palm fruits processing include:
$\mathbf{X_1}$ = Age (number of years)
$\mathbf{X_2}$ = Education (number of years spent in school)
$\mathbf{X_3}$ = Household Size (number of persons)
$\mathbf{X_4}$ = Experience (number of years)
$\mathbf{X_5}$ = Income (in naira)
$\mathbf{X_6}$ = Num. of Educated members (number of persons)
$\mathbf{X_7}$ = Extension Visits (in number of visits)
$\mathbf{X_8}$ = Membership of cooperative (Dummy, 1 if a member, 0 if otherwise)
$\mathbf{X_9}$ = Access to credit (Dummy, 1 if having access, 0 if otherwise)

The model is specified as:
The explicit form of the binary probit model is specified as:
$\Pr (Y = 1/X) = ß_0 + ß_1X_1 + ß_2X_2 + ß_3X_3 + ß_4X_4 + ß_5X_5 + ß_6X_6 + ß_7X_7$ .....+ e
Where:
Y = Dichotomous probability estimate with 1, if a processor is willing to engage in mechanized palm fruits processing and 0 if not willing.
$ß_0$ = Intercept
$ß_1, \ldots ß_{14}$ = Coefficients of the independent variables.
$X_1, \ldots X_9$ = Determinants of processors' willingness to engage in mechanized processing'.
e = the stochastic error term.

The use of traditional Technologies in Processing Palm Fruits
The result in Table 1 showed that all the 6 items of traditional technologies in palm fruits processing have mean values that ranged from 3.25 to 3.91 which are all greater than the cut-off point value of 2.50 on 4-point rating scale. This finding indicates that the identified six local technologies are utilized in processing palm fruits into palm oil, palm kernel and other products in the study area. Adeniyi, Ogunsola and Oluwusi (2014) reported that pounding (digestion) and oil extraction are the most tedious and essential operations in traditional palm fruit processing. In small-scale processing, digestion, that is, the breaking up of the oil-bearing cells of the palm fruits' mesocarp, is the most labour intensive activity. Two methods of fruit maceration are common in traditional processing: pounding cooked/soaked fruits in large wooden or concrete mortars with a wooden pestle and foot trampling the cooked but cold fruits in canoes or specially constructed wooden troughs (Kwaski, 2002). In affirmation, Poku (1998) stated that the general traditional method of oil extraction consists of steeping the pounded fruit mash in hot or cold water; removing fibre and nuts in small baskets and hand squeezing; filtering out residual fibre from the oil/water emulsion in perforated metal colanders or baskets; boiling and skimming palm oil from the oil/water mixture and drying the recovered oil.

Table 1: Mean ratings of the processors on the extent of utilization of traditional palm fruits processing in Abia State (n = 90)

SN	Traditional palm fruit processing	$\overline{X}$	SD	Remark
1	Axe or cutlass for removing palm fruits from the bunches	3.89	0.53	**Utilized**
2	Sticks for removing palm fruits	3.45	0.69	**Utilized**
3	Pots or drum for boiling palm fruits	3.91	0.98	**Utilized**
4	Pistol and mortar for pounding palm fruits	3.66	0.59	**Utilized**
5	Sack for pressing out oil from the mashed palm fruits	3.25	0.98	**Utilized**
6	Local container for collecting oil	3.57	0.60	**Utilized**

Note: $\overline{\mathbf{X}}$ = Mean; **SD** = Standard Deviation.

Source: Field Survey, 2017.

The use of Mechanized Palm Fruits Processing

The result presented in Table 2 revealed that 6 out of the 12 items of modern technologies in palm fruits processing have mean values that ranged from 2.52 to 3.77 which are all greater than the cut-off point value of 2.50 on 4-point rating scale. The five modern technologies with their respective mean values are: the use of boiler drum (3.04), head pan for packing palm fruits (3.62), wheel barrow for palm fruits (3.77), the use of hand gloves for work (2.52), shovel for packing palm fruits (3.85) and hydraulic press (2.65). This finding indicates that the identified five identified modern technologies are utilized in processing palm fruits in the study area. The mean values on the remaining six items, specifically the use of presser (machine) for pressing oil out of mashed palm fruit (2.32), digester (2.15), cracker for cracking (2.13), separating knives (2.23), shackers (2.20) and the use of filter for sieve (2.27). This finding indicates that the identified six identified modern technologies are not utilized in processing palm fruits in the study area. However, most of the medium-and large-scale processors use mainly use the digester screw presses, which are more efficient and expensive compared to the other two equipment. The traditional method of extraction used by the small-scale processors results in low quality palm oil with very high free fatty acid (FFA) content and a large quantity of dirt and water (Afoakwa, 2013). In agreement with this finding, Davies, Olatunji and Burubai (2008) found that improved technologies in food processing were abandoned due to high operation cost. That some machines were equally abandoned based on old age, lack of good technicians (repairers), poor construction materials and non- availability of spare parts (mainly adulterated).

Table 2: Mean ratings of the processors on the extent of utilization of mechanized palm fruits processing in Abia State (n = 90)

SN	Mechanized in palm fruit processing	$\overline{X}$	SD	Remark
1	Presser (machine) for pressing oil out of mashed palm fruit	2.32	0.95	**Not Utilized**
2	Digester	2.15	0.70	**Not Utilized**
3	Cracker for cracking	2.13	0.71	**Not Utilized**
4	Separating knives	2.23	0.96	**Not Utilized**
5	Shackers	2.20	0.94	**Not Utilized**
6	The use of boiler drum	3.04	0.55	**Utilized**
7	The use of filter for sieve	2.27	0.85	**Not Utilized**
8	Head pan for packing palm fruits	3.62	0.63	**Utilized**
9	Wheel barrow for palm fruits	3.77	0.88	**Utilized**
10	The use of hand gloves for work	2.52	0.91	**Utilized**
11	Shovel for packing palm fruits	3.85	0.73	**Utilized**
12	Hydraulic press	2.65	0.58	**Utilized**

Note: $\bar{X}$ = Mean; **SD** = Standard Deviation.
Source: Field Survey, 2017.

Cost, Returns and Profitability of Palm Fruits Processing

The result in Table 3 presents the cost, returns and profitability of processing palm fruits in Abia State. The result showed that the estimated Total Revenue (TR) of the processors was ₦187,870.00 and Gross Margin (GM) of ₦74,960.00. The Net Return (NR) of the palm fruits processors was ₦72,230.00. The Profitable Index (PI) of the processors form the computation was 0.38 indicating that about 38% of the Total Revenue (TR) generated from palm fruits processing constitutes the net income of the processors. Hence, this indicates that palm fruits processing is a highly profitable farm enterprise in the study area.

Table 3: Cost, Returns and Profitability of Palm Fruits Processing in Abia State

Items	Amount (₦)
Revenue	
Palm oil	138,470.00
Palm kernel oil	36,900.00
Cracked shell	12,500.00
Total Revenue (TR)	**187,870.00**
Variable Cost (VC)	
Palm fruits	35,400.00
Firewood/energy	10,580.00
Labour	41,000.00
Water	3,250.00
Transportation	7,000.00
Miscellaneous cost	15,680.00
Total Variable Cost (TVC)	**112,910.000**
Fixed Cost (FC)	
Depreciation on processing tools/machines	1,820.00
Depreciation on storage facilities	910.00
Total Fixed Cost (TFC)	**2,730.00**
Total Cost (TC)	**115,640.00**
Gross Margin (GM)	74,960.00
Net Return (NR)	72,230.00
Profitability Index (PI)	**0.38**
Rate of Return on Investment (RRI)	62%
Rate of Return on Variable Cost (RRVC)	64%
Operating Expenses Ratio (OER)	0.60
Benefit Cost Ratio (BCR)	1.62

Source: Field Survey, 2017

The Rate of Return on Investment (RRI) of the palm fruits processing was 64% which indicates that an average processor in the study area earns 64% profit on every one naira (₦1.00) invested in palm fruits processing. The Rate of Return on Variable Cost (RRVC) of the processors was 64% which implies that 64% profit was realized from every naira (₦1.00) incurred as variable cost in palm fruits processing. The Operating Expense Ratio (OR) of 0.60 suggests that the variable cost consumed 60% of expenditure the palm fruits processing enterprise. The findings of this study agreed with that of Ohimain, Emeti, Izah and Eretinghe (2014) who investigated small-scale palm oil processing business in Nigeria and found that the average cost of procuring equipment and its

installations for a small-scale palm oil processing mill were estimated at ₦623,650.00. The gross margin return from this study was ₦44,000.00 while net return was ₦14,000.00. The gross ratio revealed that for every ₦1.00 return to the mill 68.00 kobo was spent on the production processes. Ekine and Onu (2008) reported a higher value, stating that 65.7% and 13.8% are cost of FFB and labour respectively during oil palm processing. The total fixed cost which was ₦2,600.00 representing 8.7% and the total variable cost which is ₦27,400.00 representing 91.3% of total cost. The report of Olagunju (2008) showed that total fixed cost and total variable cost represent 42.3% and 57.7% respectively. The variable cost such as energy (₦10,580.00) is high because most processing mills are not connected to nation grid. Therefore, the mill uses firewood. The findings of this study also agreed with that of Afolabi (2009) who found a profitability index of 0.35 for processing garri. In addition, the finding of this study is in line with the findings of Ibekwe, *et al* (2012) whose findings showed that processors generated profitability index (PI) of 0.42, Rate of Return on Investment (RRI) of 73% and Rate of Return on Investment (RRIC) of 178.

Determinants of Processors' Willingness to Engage in Mechanized Palm Fruits Processing

Binary probit model was employed to estimate the factors influencing processors' willingness-to-engage in mechanized palm fruits processing in Abia State. The result of the binary probit model analysis presented in Table 4 showed that the explanatory power of the specified variables as indicated by the pseudo R^2 value of (0.772) was relatively high and good. This showed that the estimated independent variables are responsible for about 77% variation in palm fruits processors' willingness-to-engage in mechanized processing. The overall goodness of fit as reflected by Prob>Chi^2 (0.000) was also good. In terms of consistency with *a priori* expectations on the relationship between the dependent variable (willingness-to-engage) and the explanatory variables, the model had behaved well. Out of the nine explanatory variables specified in the model, six (education, household size, experience, income, extension visits and membership of cooperative) were statistically significant at 1 and 5%.

Table 4: Determinants of Processors' Willingness to Engage in Mechanized Palm Fruits Processing in Abia State.

Variables	Coefficient	Std. Error	z – Statistics
Intercept	4.448995	0.747977	5.95***
Age	-0.0395825	0.0316151	-1.25
Education	0.1177892	0.0529342	2.23**
Household Size	-0.4154359	0.1498861	-2.77***
Experience	0.068446	0.0208879	3.28***
Income	0.3865861	0.1344865	2.87***
Num. of Educated members	0.135524	0.1129147	1.20
Extension Visits	0.0979704	0.0446942	2.19**
Membership of cooperative	3.058365	0.9815766	3.12***
Access to credit	0.0432954	0.0398432	1.08
Number of Observation	90		
LR chi^2	135.03		
Prob> chi^2	0.000		
Pseudo R^2	0.77		

Note: *** denotes sig. at 1%, ** denotes sig. at 5%; * denotes sig. at 10%.
Source: Field Survey, 2017.

The coefficient of education of the processors was significant ($p<0.05$) and positively influence their willingness to engage in mechanized in palm fruits processing. This is expected as educated processors are more likely to adopt modern technologies in processing their palm fruits than uneducated counterparts. The findings of this study agreed with the result of the study of Knight,

Weir, Woldehanna (2003) who reported that that education encourages farmers to adopt innovations. Onoh and Peter-Onoh (2012) while investigating adoption of improved oil palm production technology among farmers in Aboh Mbaise Local government area of Imo State found that farmers' level of educational positively and significantly influence adoption of technology. The coefficient of household size was highly significant but negatively related with willingness to engage in mechanized in palm fruits processing. The negative significant relationship indicates that processors with large households are less likely to engage in mechanized palm fruits processing enterprise. The availability of labour in large farm households with more number of adults could be responsible for this relationship. Teklewold, Dadi, Yami and Dana (2006) reported that household size as a proxy to labour availability influence the adoption of a new technology positively as its availability reduces the labour constraints. Onoh and Peter-Onoh (2012) equally found that farmers' household size negatively and significantly influence adoption of technology. The years of experience of the processors was highly significant ($p<0.01$) and positively related with their willingness to engage in mechanized palm fruits processing. This implies that, as the years of experience of the processors increase, their tendencies to appreciate and willing to engage in mechanized processing of palm fruits. This finding supported the result of the study of Yohannes, John and Garth (2007) who established positive and significant relationship between years of farming experience and adoption of coping farm technologies such as fertilizer, pesticides, the use of improved livestock and seeds. The coefficient of income was highly significant ($p<0.01$) and positively related to processors' willingness to engage in mechanized palm fruits processing. This conforms with *a priori* expectation as income is a strong factor in technology adoption in both farm and non-farm enterprises. This finding is in line with that of Agabi (2012) who found out that increase in farmers' income increased farmers' access to adaptive technologies and coping capacity. In addition, the findings also agreed with that of Yohannes, John and Garth (2007) who found that income positively influence the adoption of fertilizer and pesticides in Ada and Selale districts of Ethiopia. Nhemachena and Hassan (2007) reported that farmers' access to credit increases financial resources of farmers and their ability to meet transaction costs associated with various adaptation options they might want to take.The coefficient of extension visits was significant and positively r elated to processors' willingness to engage in mechanized palm fruits processing at $p<0.05$. This is equally expected as extension visits to farmers is an important factors in technology spread and adoption among farmers. This finding is in agreement with that of Bekele and Drake (2003) whose findings showed that extension education was an important factor motivating increased intensity of use of specific soil and water conservation practices. Other studies that established positive influence of extension contact/services with adoption of agricultural technologies include: Birungi and Hassan (2010) that found positive relationship between agricultural extension and adoption of inorganic fertilizer as land management technology in Uganda; also Hassan and Nhemachena (2008) found out that extension contact had positive influence on adoption of multiple crops under irrigation, mono crop-livestock under dry land, mono crop-livestock under irrigation, multiple crop-livestock under irrigation and multiple crop-livestock under dryland as adaptation strategies employed by African farmers. Membership of cooperative was positive and highly significant ($p<0.01$) with processors' willingness to engage in mechanized palm fruits processing. This suggests that processors' involvement in cooperative societies could have positively influenced their willingness to engage in mechanized palm fruits processing.

Challenges Facing Palm Fruits Processors in Abia State

Table 5 presents the result on the challenges facing palm fruits processors in Abia State. The table shows that 13 out of the 20 items in the table had mean values that ranged from 2.52 to 3.54 which are all greater than the cut-off point value of 2.50 on 4-point rating scale.

Table 5: Mean Ratings of the Challenges facing Palm Fruits Processors in Abia State

SN	Challenges facing palm fruit processors	$\overline{X}$	SD	Remarks
1	High cost of processing input	2.80	0.78	**Serious**
2	High cost of transportation	2.73	0.69	**Serious**
3	Poor storage facilities for processed product	2.42	0.86	**Not Serious**
4	Fluctuation of prices of product in the market	3.26	0.63	**Serious**
5	Poor road network to facilitate movement of product	3.42	0.56	**Serious**
6	Labour intensive nature of palm fruit processing	3.16	0.74	**Serious**
7	Lack of technical know-how to adopt technology	3.54	0.59	**Serious**
8	Inadequacy of labour supplies for palm fruit processing	2.57	0.86	**Serious**
9	Poor quality of processed product in the market	2.35	0.95	**Not Serious**
10	Lack of access to extension and other supporting services	2.96	0.78	**Serious**
11	Old age of most of the processors	2.30	0.98	**Not Serious**
12	Lack of access to credit to expand processing enterprise	3.40	0.62	**Serious**
13	Unwillingness of processors to adopt modern technology	3.36	0.56	**Serious**
14	Insufficient knowledge on sources of credit	2.62	0.61	**Serious**
15	Lack of collateral security to secure formal loans	2.52	0.73	**Serious**
16	Household pressure for consumption of processed product	2.67	0.94	**Serious**
17	Lack of access to farm information by local processors	2.29	0.91	**Not Serious**
18	Fragile nature of palm oil after processing	2.42	0.98	**Not Serious**
19	Bulkiness of fresh palm fruits and processed products	2.40	0.90	**Not Serious**
20	Shortage of water for palm fruit processing	2.34	0.89	**Not Serious**

Note: $\overline{X}$ = Mean; **SD =** Standard Deviation
Source: Field Survey, 2017.

These items are interpreted as serious challenges facing palm fruits processors in the study area. The identified serious challenges with their corresponding mean values include: high cost of processing input (2.80), high cost of transportation (2.73), fluctuation of prices of product in the market (3.26), poor road network to facilitate movement of product (3.42), labour intensive nature of palm fruit processing (3.16), lack of technical know-how to adopt technology (3.54), inadequacy of labour supplies for palm fruit processing (2.57), lack of access to extension and other supporting services (2.96), lack of access to credit to expand processing enterprise (3.40), unwillingness of processors to adopt modern technology (3.36), insufficient knowledge on sources of credit (2.62), lack of collateral security to secure formal loans (2.52) and household pressure for consumption of processed product (2.67). The findings of this study supported that of Soyebo, Farinde and Dionco-Adetayo (2005) who found that majority (81%) of the farmers were confronted with the problem of land, 34.2% had fund problems, 5.1% claimed that they faced climatic problems while 53.2% complained of inadequate information and cultivation knowledge about oil palm. About 54% of the farmers indicated the problem of improved planting materials and government support whereas none of the farmers had marketing and processing technique problems. Similarly, Onoh and Peter-Onoh (2012) found that the major constraints to adoption of improved oil palm production was lack of fund (75%), closely following that was poor extension contact (50%), poor access to land (37%), scarcity of farm inputs, (29%) and unawareness of farm improved technology (15%), that these constraints pose very serious problem to the adoption of improved technologies. In conformity with processing input as a challenge, Nwajiuba and Akinsanmi (*no date*) found that one of the problems of palm fruits processing is scarcity of fuel wood as source of energy. Another problem mentioned by 60% of the processors in palm fruits processing in the study of Nwajiuba and Akinsanmi (*no date*) is scarcity of water for parboiling. Although, this disagreed with the findings of this study as shortage of water for palm fruit processing (2.34) was not considered as a serious challenge in Abia State.

The remaining seven challenging items in the table, that is, poor storage facilities for processed product (2.42), poor quality of processed product in the market (2.35), old age of most of the processors (2.30), lack of access to farm information by local processors (2.29), fragile nature of palm oil after processing (2.42), bulkiness of fresh palm fruits and processed products (2.40) and shortage of water for palm fruit processing (2.34) with their mean values less that the cut-off point value of 2.50 on 4-point rating scale indicate that the seven items are not serious challenges facing palm fruits processors in Abia State.

Conclusion

Palm fruits processing enterprise in Nigeria is still widely carried out with the use of traditional methods by homestead and small processors who contribute over 80.0% of national palm oil and palm kernel output. Hence, the engagement of mechanized processing techniques will significantly impact on national palm oil and palm kernel output thereby increasing processors income and the food security situation in the country. This study examined the factors influencing processors' willingness to engage in mechanized palm fruits processing using Abia State as case study. The study confirmed that, traditional technologies are widely practiced among palm fruits processors in Abia state than mechanized processing. The study revealed that palm fruits processing enterprise in the state is profitable. Variables that significantly influenced processors' willingness to engage in mechanized processing include education, household size, experience, income, extension visits and membership of cooperative. The challenges facing the processors in the state include high cost of processing input, high cost of transportation, fluctuation of prices of product in the market, poor road network to facilitate movement of product, labour intensive nature of palm fruit processing, lack of technical know-how to adopt technology and inadequacy of labour supplies for palm fruit processing among others. Based on these findings, the study recommended provision of soft loans to processors for acquisition of modern processing machines, creation of awareness and capacity building training for palm fruits processors in the use of modern processing machines.

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