Proceedings of the Annual Conference of the Agricultural Extension Society of Nigeria
Number: Twenty-Ninth Annual Conference
Theme: Leveraging the Dynamics of Agricultural Extension Policies and Practices for Sustainable Development
Date: 21-24 April 2024
Venue: Federal University of Technology Akure, Nigeria
ISSN: 1595 – 1421.
Website: https://info@ajol.org.
Email: agricultural.extension.nigeria@gmail.com ; editorinchief@aesonnigeria.org

Socio-economic Determinants of Adoption of Oil-palm Processing Technologies in Oguta Local Government Area of Imo State, Nigeria

https://dx.doi.org/10.4314/jae.v29i1.19S

Oduehie, ThankGod Chijioke[1*], Aboajah, Friday N.[2], Muhammad, Musa B.[3] & Amadi, Pearl E.[4]

[1]National Agricultural Extension and Research Liaison Services, Ahmadu Bello University, Zaria
[2,4]National Root Crop Research Institute, Umudike
[3]Samaru College of Agriculture, Ahmadu Bello University, Zaria.
*Correspondence and presenting author:
[1]E-mail: gentlecj4@gmail.com; Phone: +2347039661173;
[1] https://orcid.org/0000-0003-0714-6945
[2]E-mail: fridayaboajah@gmail.com; +2348056244336;
[3]Email: musabakomuhammad@gmail.com; +2348035871740
[3] https://orcid.org/0000-0001-6014-845
[4]Email: pearlamadi@gmail.com ; +2347060932831

Abstract

The study examined the socio-economic determinants of the adoption of palm fruit processing technologies in Oguta Local Government Area of Imo state. Purposive and multi-stage sampling procedures were used to select 60 palm fruit processors from whom primary data were obtained using a semi-structured questionnaire. Data were analyzed using frequencies, percentages, mean, Likert scale, and multiple regression model. All the processing technologies introduced to the palm fruit processors were adopted. Results of multiple regression analysis using linear functional form as lead equation posted an R^2 value of 0.740 and showed that household size, age, processing income, credit access, extension access and processing experience were significant determinants of adoption of processing technologies. Meanwhile, 91.67% and 86.67% of the processors were constrained by a lack of funds/financial incapacitation and inadequate credit access respectively. The study recommends that soft loans should be made available and accessible to palm fruit processors in other to equip them with the financial capacity to adopt relevant processing technologies that will not only reduce the drudgery associated with palm fruit processing but also enhance productivity.

Key Words: Adoption, oil-palm processing technologies

Introduction

Palm oil is an important ingredient in the diet of many Nigerians. It is rich in carotene and vitamin A which is frequently lacking in most diets in Sub-Sahara Africa including Nigeria (Ogunsola et al., 2022). Apart from the edible uses of palm oil, it also has wide industrial applications. For instance, palm oil is used in the manufacture of candles, margarine, cosmetics, soaps and other detergents (Hannah, 2021). Processing fresh fruit palm bunch (FFPB) to extract palm oil can be labour-intensive involving the following stages – threshing, picking, parboiling, digestion, extraction and separation. According to Nnabuife (2023), there are different techniques used in the processing of palm oil and these range from modern methods to traditional methods. Onu et al., (2022) stated that the modern methods and

technologies associated with palm oil processing are more efficient and effective in producing both quality and quantitative palm oil.

The traditional method of processing palm fruits is highly laborious, time-consuming and wasteful as about 25% - 35% of the potential palm oil and palm kernel oil are lost during processing (Ajayi & Adeyemi, 2022; FAO, 2022). Many palm fruit processors are still faced with a lot of problems including; inadequate finance, shortage of labour, scarcity of water and firewood and low adoption of effective processing techniques, irrespective of all the research efforts on improved palm oil processing methods over the years by research institutes (Bassey, Ajah & Nkeme, 2022; Premium Times, 2023). Mechanized processing of palm fruits is noted to be more efficient because it reduces drudgery and increases the quality and quantity of processed products (Ogunsola et al., 2022). Modern palm fruit processing technologies include mechanical press, separating machine, digester, sterilizing machine, threshing machine, Malaysian knife and rotary beater (Ogunsola et al., 2022)
According to Okonji and Awolu (2020) improved agricultural production and processing technologies cannot be adopted if the right information required for necessary adoption is not passed to the farmers or processors from the right sources. Adoption could be seen as the integration of new technology into existing practice and is usually preceded by a period of 'practice' and some degree of adaptation (Okonji, 2021).

Technology, on the other hand, is the application of knowledge for practical purposes, which is generally used to improve the condition of human and natural environment and carry out some other socio-economic activities (Tologbonse et al., 2019). It is a complex blend of material processes and knowledge. In many developing countries including Nigeria, the need for appropriate technological and scientific knowledge application limits agricultural and economic progress (UNCTAD, 2022). Technological efficiency can however, be achieved by employing improved processing technologies for the extraction of palm oil soon after the fruits are harvested by using some of these technologies including bunch receptor, thresher, sterilizer, digester, oil extractor and clarifier. Adopting these improved oil palm processing technologies is expected to increase the output and income of the adopters, which will subsequently help them improve their living standards by reducing their poverty level.

The adoption process depicts mental activities an individual experiences from the initial time/stage of learning about an idea to the final decision he exercises to use the innovation. Thus, the adoption process consists of a series of mental techniques through which an individual passes before his final conviction to use the innovation as an improvement over his farm practices. Individuals pass through five stages in the adoption of new ideas or innovations. These crucial adoption stages include the awareness stage: this is the first point when the individual finds the existence of new technology created over the radio, television, print media etc. The interest stage is the second stage where an individual is motivated to actively seek additional facts on the innovation to relate the new ideas to his existing practices. Following the interest stage is the evaluation stage; at this stage, the individual makes a mental trial to imagine the survivability and sustainability of the innovation in his local environment. Trial stage: this is the tentative period of acquisition of information on how to operate the innovation and also trying out the practices most of the people who go through this stage are those who decided to accept the innovation. The success of this stage convinces the individual to adopt the innovation while failure could discourage adoption. Finally, the individual decides to employ the new practice or innovation of full-scale and enterprising expansion on his farm, this is the adoption stage. Adoption does not imply indefinite use of the innovation but the farmer uses the new practice until something else comes up to make him dissatisfied with the innovation.

Based on this background, there is a need to ascertain the socioeconomic factors influencing the adoption of oil palm fruit processing technologies in Oguta Local Government Area of Imo state, Nigeria. The objectives of the study were to:

i. determine the level of adoption of palm fruit processing technologies;
ii. ascertain socio-economic determinants of the adoption of palm fruit processing technologies.
iii. identify problems militating against the adoption of palm fruit processing technologies.

Hypothesis: Ho1: Adoption of palm fruit processing technologies is not significantly influenced by the socioeconomic factors of the processors.

Methodology

This study was conducted in Oguta Local Government Area (LGA) of Imo State, Nigeria. Oguta LGA is located between latitudes 5^0 41' N and 5^0 44'N and 6^0 41' E and 6^0 50' E with an estimated population of 142,340 persons based on the proposed 3% annual population growth (NPC, 2021). It has a total land area of about 2,025.75 square kilometres with an annual rainfall range of between 1500mm and 3,100mm. Oguta LGA is predominantly an agrarian and hosts several palm fruit mills where palm fruits are processed into palm oil and palm kernel oil.

A multi-stage sampling procedure was employed to select a total of 60 respondents for the study. Firstly, five communities were purposively selected from the 27 communities that make up the LGA. The selection was based on the highest number of palm fruit processors in the LGA. Secondly, three villages were chosen at random from each of the five communities, these gave rise to 15 villages. 4 palm fruit processors were selected at random from each of the 15 villages to give a total of 60 palm fruit processors which constitute the sample size for the study

Data were collected by means of a structured questionnaire. Data on socio-economic characteristics and problems militating against the adoption of palm fruit processing technologies by palm-fruit processors were analysed using descriptive statistics such as mean, frequencies and percentages; adoption scale analysis was used to determine the level of adoption of oil palm processors in the study area, while data on socioeconomic determinants of adoption of oil palm processing technologies were analysed and inference is drawn using ordinary least square multiple regression techniques.

The level of adoption oil palm processing technologies was determined using seven (7) point Likert scale as follows: Unaware (0), Aware (1), Interest (2), Evaluation (3), Trial (4), Accept (5), and Satisfaction (6)**.** This is in accordance with Osondu *et al.* (2021).

To ascertain the socio-economic determinants of the adoption of palm fruit processing technologies and to test the null hypothesis which states that the adoption of palm fruit processing technologies is not significantly influenced by the socio-economic factors of the processors, ordinary least square multiple regression technique was used.

The regression model is fitted as;

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

The four functional forms of OLS in explicit form is specified as;

Linear function:

$$Y = b_o + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_5x_5 + b_6x_6 + b_7x_7 + b_8x_8 + b_9x_9 + ei$$

Semi – log function

$$Y = b_o + b_1\log x_1 + b_2\log x_2 + b_3\log x_3 + b_4\log x_4 + b_5\log x_5 + b_5\log x_5 + b_6\log x_6 + b_7\log x_7 + b_8\log x_8 + b_9\log x_9 + ei$$

Double log function

$\text{Log } Y = b_0 + b_1 \log x_1 + b_2 \log x_2 + b_3 \log x_3 + b_4 \log x_4 + b_5 \log x_5 + b_6 \log x_6 + b_7 \log x_7 + b_8 \log x_8 + b_9 \log x_9 + ei$

Exponential Function

$\text{Log } Y = b_0 + b_1 x_1 + b_2 x_2 + b_3 x_3 + b_4 x_4 + b_5 x_5 + b_6 x_6 + b_7 x_7 + b_8 x_8 + b_9 x_9 + ei$

Where;

Y = Level of Adoption of the palm fruit processing technologies (%)

X_1 = Gender (male = 1; female = 0)

X_2 = Household size (number of people feeding from same pot)

X_3 = Age (years)

X_4 = Income from palm fruit processing (Naira)

X_5 = Education level of household head (years of schooling)

X_6 = Membership of cooperatives (Member = 1; otherwise = 0)

X_7 = Credit access (1 if yes; 0 if otherwise)

X_8 = Extension access (access = 1; no access = 0)

X_9 = Processing experience (years)

e = error term

Results and Discussion

Level of Adoption of Palm Fruit Processing Technologies

Table 1 shows that all the improved palm fruit processing technologies presented to the processors had mean score values that were greater than the Likert critical score of 3.0, implying that these technologies were adopted by the processors. Adoption of these technologies is expected to increase the shelf life, quality and quantity of palm oil (Ogunsola et al., 2022). The result lends credence to Ogunsola *et al*. (2022) who reported that the most predominant processing technology used by palm fruit processors was the hydraulic presser.

Table 1: Level of adoption of palm fruit processing by the processors

Processing Technologies	Mean Score	SD
Separating machine	8.57	4.53
Threshing machine	8.57	4.03
Sterilizing machine,	8.57	5.50
Motorised digester,	10.0	4.17
Hydraulic presser	8.57	4.12
Oil clarification machine	8.57	5.65
Rotary beater	8.57	2.60
Nut cracker and separator machine	8.57	4.00
Use of Malaysian knife	8.57	7.16
Electric heater motor	8.57	3.86

Source: *Field survey data, 2023*

Decision Rule: > 3.0 =Non adoption; 3.0 and above = adopted

Factors that Influence Adoption of Palm Fruit Processing Technologies

Table 2 shows that the linear functional form was chosen as the lead equation based on magnitude of F-ratio and R^2, as well as number of significant variables. The R^2 value of 0.740 indicates that 74.0% of the variations in the adoption of palm fruit processing technologies were accounted for by the variables included in the model. The F-ratio of 73.671 was

significant at 1.0% alpha level indicating goodness of fit of the model. Six variables were found to be significant at given alpha levels.

The coefficient of household size (-1.507) was negative and significant at a 1.0% alpha level, implying that an increase in the variable resulted in to decrease in the adoption of palm fruit processing technologies. Thus, the higher the number of household members the less the level of adoption. A similar result was obtained by Olapade-Ogunwole *et al*. (2019) who asserted that processors with large household sizes might not actually experience how tedious it is to process palm fruit as they are more likely to have to help hands..

Age had a positive coefficient (0.326) that was significant at a 1.0% alpha level. This implies that the rate of adoption of palm fruit processing technologies was higher among the older farmers. Although the result is at variance with expectation, it is plausible in the sense that the older processors were probably not energetic enough to meet the tedium associated with palm fruit processing compared to their younger counterparts, hence, the need to adopt technologies which will reduce the tedious nature of the enterprise. The result is at variance with Osondu *et al.* (2023) report that the rate of adoption of technologies is higher among younger farmers.

Similarly, processing income had a positive coefficient (0.019) that was significant at a 5.0% alpha level. This implies that the higher the income earned from processing palm fruits the higher the rate of adoption among the processors. Adequate finance is necessary to facilitate technology adoption. As the processors earn more income from the enterprise they will be more able to procure inputs perceived as enhancing productivity and reducing stress. This result agrees succinctly with Osondu *et al.* (2023) assertion that as income increases, the likelihood of farmers adopting improved production technologies also increases.

Data in Table 2 show that the coefficients of credit access (6.001) and extension access (7.629) were positive and significant at 10.0% and 1.0% alpha levels respectively. The sign of the coefficients implies that both variables had a direct effect on the adoption of technologies. Thus, palm fruit processors who had access to credit and extension services had a higher adoption rate. Obar & Adekoya, (2022) reported that having access to credit facilitates enhances the capacity of processors to adopt oil palm processing technologies.

Processing experience had a positive coefficient (1.960) which was significant at 10.0% alpha level (Table 2). This indicates that the higher the years of processing experience of a processor the higher his/her adoption of the processing technologies. According to Olapade-Ogunwole et al. (2019) the higher the number of years of processing experience, the more a processor will be exposed to modern technologies and this will give them more insight into best way of carrying out processing and invariably gear them into adopting the better means of processing palm fruit.

Based on these results, hypothesis which stated that adoption of palm fruit processing technologies is not significantly influenced by respondent's socio-economic factors such as gender, household size, age, farm income, membership of cooperatives, education level, extension contact, credit access, and farming experience was rejected with respect to the significant variables.

Table 2: Estimates of determinants of adoption of palm fruit processing technologies

Variables	Linear +	Semi log	Double log	Exponential
Constant	-6.014	-22.506	-0.990	2.068***
	(-0.801)	(-0.986)	(-1.553)	(7.899)
Gender	0.863	0.964	-0.003	0.086
	(0.346)	(0.270)	(-0.030)	(0.347)
Household size	-1.507***	-5.621**	-0.014	-0.034
	(-2.916)	(-2.530)	(-0.234)	(-1.745)
Age	0.326***	-0.660	0.121**	0.011
	(3.230)	(-0.375)	(2.469)	(1.144)
Processing income	0.019**	2.902	0.340***	1.214E-005***
	(2.099)	(1.322)	(5.618)	(3.812)
Education level	0.432	7.217***	-0.036	0.009
	(0.035)	(3.138)	(-0.600)	(0.377)
Membershipof cooperatives	-0.483	1.085	0.273***	-0.047*
	(-0.736)	(0.398)	(3.083)	(-1.944)
Credit access	6.001*	12.760***	0.257**	0.136
	(1.900)	(2.991)	(2.349)	(1.233)
Extension access	7.629***	29.452***	0.196***	0.166***
	(3.586)	(4.085)	(3.070)	(3.029)
Processing experience	1.960***	7.604**	0.216***	0.060**
	(2.501)	(2.634)	(2.848)	(2.183)
R^2	0.740	0.727	0.732	0.679
Adjusted R^2	0.727	0.713	0.718	0.655
F-ratio	73.671***	70.076***	69.530***	36.969***

****, ** and * = significant at 1.0%, 5.0% 10.0% alpha levels respectively*
Variables in parenthesis are t-ratio; + = *lead equation.*
Source: *Field survey, 2023*

Problems militating against the adoption of palm fruit processing technologies

Table 3 shows that lack of funds/financial incapacitation (91.67%), inadequate credit access (86.67%), lack of government support (85.00%) and high cost of technologies (85.00%) were constrained by processors in adopting improved palm fruit processing technologies. This finding implies that the processors are faced with numerous challenges in adopting palm fruit processing techniques. The result lends credence to Amusa, et.al, (2019) who reported that challenges faced by processors in adopting new technologies include low finance and access to credit.

Table 3: Problems constraining adoption of palm fruit processing technologies

Constraints	Percentage % (n=60)
Inadequate credit access	86.67
Lack of funds/financial incapacitation	91.67
Poor storage facilities	66.67
Lack of government support	85.00
Poor extension services	68.33
Complexity of technology	60.00
High cost of labour	43.33
High cost of technologies	85.00

Source: *Field survey, 2023*
*Multiple responses recorded

Conclusion and Recommendations

Few improved palm fruit processing technologies were adopted by the processors. Factors such as household size, age, processing income, credit access, extension access and processing experience were significant determinants of adoption of processing technologies. Soft loans should be made available and accessible to palm fruit processors in other to equip them with the financial capacity to adopt relevant processing technologies that will not only reduce the drudgery associated with palm fruit processing but enhance productivity. Palm fruit processing machines should be subsidized so that they can be affordable by the processors.

References

Ajayi, V. O., & Adeyemi, A.O. (2022). Assessment of adoption of improved processing techniques among palm oil processors. African Journal of Agricultural Research, 17(30), 421-432. Retrieved from https://www.ajol.info/index.php/ajar/article/view/217321/07/2024

Amusa, T. A., Anugwo, S. C. & Esheya, S. E., (2019). Factors influencing processors willingness to engage in mechanized palm fruits processing in Abia State, Nigeria. *Nigeria Agricultural Journal*, 48: 236-247.

Bassey, A., Ajah, E., & Nkeme, C. (2022). Analysis of credit access and utilization among oil palm fruit processors. *American International Journal of Contemporary Research*, 4(8): 1-10.

FAO. (2022). Traditional techniques and innovations in small-scale palm oil processing. Food and Agricultural Organization. Retrieved from https://www.fao.org/3/y4355e/y4355e04.htm 21/07/2024

Hannah Ritchie (2021) - “Palm Oil” Published online at OurWorldInData.org. Retrieved from: 'https://ourworldindata.org/palm-oil' [Online Resource]

NPC (2021) Natioanal Population Commision Census report

Obar, E.E.,& Adekoya, A. E. (2022) Sustainability likelihood of community and social development project in southern Nigeria. *Journal of Agricultural Extension,* 26(1):88-103

Ogunsola J. O., Alarape A. B., Adesida O. A., Ojo-Fakuade F. F., Marizu J. T. & Anifowose T. O (2022). Assessment of adoption of improved processing techniques among palm oil processors in Ife North Local Government Area, Osun State, Nigeria. *Global Journal of Agricultural Sciences*, 21: 119-125.

Okonji, C. J. & Awolu, O. T. (2020). Factors Influencing Adoption of Improved Technology Among Maize Farmers In Ekiti State Nigeria. *Agrosearch*, *20(2):102-112.* https://dx.doi.org/10.4314/agrosh.v20i2.7.

Okonji, C. J. (2021). Factors Influencing Adoption of Improved Technology among Maize Farmers in Ekiti State Nigeria. *Agrosearch*, *20(2):102-112.* https://dx.doi.org/10.4314/agrosh.v20i2.7.

Olapade-Ogunwole, F. T., John O. & Kayode, O, I. (2019). Factors Affecting Adoption of Improved Oil Palm Production Technologies by Women in Ife-South Local Government Area of Osun State, Nigeria. *International Journal Of Agriculture, Environment And Bioresearch,* 4(4): 92-99.

Onu, S. E., Ekwe, K. C., Aguaguiyi, F. N. & Ufomba, V. U. (2022).Comparative Analysis of Use
of Traditional and Modern Methods of Palm Oil Processing among Rural Farmers in Abia State, Nigeria. *Journal of Community & Communication Research*, 7(1): 136-144.

Osondu, C. K., Ogbonna S. I. & Udah, S. C. (2023). Impact of adoption of cassava value added

Technologies on women cassava farmers' welfare in Abia State, Nigeria. *Global Journal of Agriculture and Veterinary Science,* 1(2): 1-11.

Osondu, C. K., Onwusiribe, C. S. & Udah, S. C. (2021). Impact of National Root Crop Research Institute on Yam Production in Abia State Nigeria. *Journal of Food and Fibre Production,* 3 (2): 40-51.

Premium Times. (2023). Special report: Nigeria's oil palm sector struggling as demands surge. Retrieved from https://www.premiumtimesng.com/investigationspecial-reports/604438-special-report-nigerias-oil-palm-sector-struggling-as-demands-surge.html 21/07/2024.

Tologbonse, E.B. & Adekoya, A.E. (2019). Adoption and Diffusion of Innovation. In: Adedoyin, F. S. (eds), Agricultural Extension in Nigeria. Agricultural and Rural Management Training Institute (ARMTI), Illorin: Kwara.

UNCTAD. (2022). Harnessing science, technology, and innovation for inclusive and sustainable development in the fourth industrial revolution. United Nations Conference on Trade and Development. Retrieved from https://unctad.org/system/files/official-document/tcsdtlinf2022d4-en.pdf 21/07/2024