International Journal of Applied Research

Oyibo F
Kogi State University,
Anyigba, PMB. Anyigba,
Nigeria

Ajibade YE
Kogi State University,
Anyigba, PMB. Anyigba,
Nigeria

Haruna OE
Kogi State University,
Anyigba, PMB. Anyigba,
Nigeria

Omieza MZ
Kogi State University,
Anyigba, PMB. Anyigba,
Nigeria

Comparative analysis of income of palm oil processors using modern and traditional methods in Ankpa local government, Kogi state, Nigeria

Oyibo F, Ajibade YE, Haruna OE and Omieza MZ

Abstract
The study described the socio- economic characteristics of palm oil processors in Ankpa Local Government area, Kogi State. The income generated by modern and traditional processors were estimated and factors that determined the income generated were examined. Also, the constraints facing palm oil processing were identified in the study. Primary data were collected from the respondents using structured questionnaire couple with interview. Multi- stage sampling technique were employed to elicit information from one hundred and forty respondents. Descriptive analysis and inferential statistics were used for data analysis. The results revealed that majority (73.6.0%) of palm oil processors in the study area were female. About 86.0% 0f the respondents were married and majorly (79.2%) were within the range of twenty to sixty years old. Above 50% had between 1-5 members in their households. Only about 19.3% have no formal education and the rest were literate with primary, secondary and tertiary education. Majority (73.6%) had their capital base from personal savings. The mean income from the mechanized method of processing was N156, 990:00k per month while that of traditional method of processing was N74, 700:00k per month and the difference in the mean of both modern and traditional processing method was N84, 960:00k per month. The regression analysis showed that palm oil output, educational status, household size and processing method had significant effects on the processors income at 1%, 5% and 10% respectively. Thus, more men should be encouraged to process palm oil, extension agents should educate the traditional processors to adopt modern method and financial aid should be made available to encourage more production by the government.

Keywords: Comparative, analysis, income, traditional, modern, palm oil, processors

1. Introduction
Oil palm is a perennial crop which grows in tropical rain forest in West Africa (Olagunju, 2008) [20-21]. It is indigenous to the coastal plain of Nigeria (Carrere, 2001) [5]. Ekine and Onu, (2008) [8] revealed that oil palm originated from the tropical rain forest region of West Africa and that the main belt runs through the southern latitudes of Cameroon, Togo, Code' voire, Ghana, Liberia, Sierra Leone and Congo. It spreads to South America in the 16th century and to Asia in the 19th century and Asia overtook Africa as the principal oil palm producing continent in the world during the 1970s (Olagunju, 2008) [20-21]. The tree grows up to 9m height and it has a crown of feathery leaves that can be up to 5m long. The flower cluster is on a short thick spike at the base of the leaves. Each fruit is approximately 3cm long and contains one to three seeds embedded in a reddish pulp. The palm oil is extracted from the fruit pulp. palm oil is extracted from the monocarp of the fruits of oil palm tree, the fruit a drupe that is spheroid in shape varies between 20-50mm in length and could be as large as25mm in diameter is found in bunches that are attached to the tree through a stalk (Orji and Mbata, 2008) [23]. Matthew (2009) [17], identified the two varieties grown in Nigeria as Dura and tenera. Dura is the common wild oil palm found all over Nigeria, the fruit has a thick shell and a large kernel. It gives a low amount of palm oil and begins to yield 6-7 years after planting. Tenera has a thin shell and small kernel. It produces high quality of palm oil. It bears fruit between three and five years after planting. Tenera is commonly grown in new plantations. Palm oil processing can be grouped into four methods according to the degree of their unit operational machinery complexity. These are traditional methods, small scale Mechanical units, medium scale mills and large industrial mills.

Correspondence Author:
Oyibo F
Kogi State University,
Anyigba, PMB. Anyigba,
Nigeria

(Ataga, Ilechie and Omoti, 1993; FAO, 2004) [4, 10]. Processing procedures include sterilization of bunches, stripping the fruits from bunches, milling, pressing (use of hydraulic in large mills and use of foots in traditional method), clarification and storage. Oil palm fruits can be processed into two distinct oils; palm oil from the mesocarp and palm kernel oil from the kernel. Notable products gotten from fresh fruits bunches of oil palm includes palm kernel, palm wine, brooms, palm kernel oil, palm oil, storage baskets and climbing ropes. The bulk of palm oil that is produced goes into food applications therefore its nutritional prospects have been extensively studied (Ibekwe, 2008) [12]. Palm fruits is naturally reddish in colour due to the present of high beta carotene content (Poku, 2002) [24]. Palm oil is one of the few highly saturated vegetable fats and it is semi-solid at room temperature. Palm kernel oil is different from palm oil in terms of its fatty acid composition. The increasing demand for palm oil as a result of increased population and income growth, relative to the low productivity of the oil palm sector, has made Nigeria to become a net importer of palm oil (Olagunju, 2008) [20-21]. At the same time, the rapid devaluation of the nature combined with high transportation costs from ports to internal market put imported oil in a competitively disadvantaged position. Palm oil is currently the second largest traded edible oil and accounts for one quarter of the world fats and oil supply, (Ibekwe, 2008) [12]. In the 1960s before oil became the dominant income earner for Nigeria, palm oil from the south eastern region of Nigeria was one of the tripods on which the economy of Nigeria stood (Adetola, 2015). Nigeria became a net importer of palm oil even from Malaysia that took the seedlings from her after the discovery of crude oil and the role of agriculture as a whole and palm oil in particular dwindled. Palm oil is a common cooking ingredient in the tropical belt of Africa, Southeast Asia and parts of Brazil. It is used in commercial food industry, in other parts of the world, because of its lower cost and high oxidative stability (Matthaus, 2007) [16]. Apart from this dietary role, it is also largely used industrially especially in soap making, margarine, candles, fuel for internal combustion engines and greases and lubricants (Armstrong, 1998) [3]. Palm oil processing creates employment opportunity in terms of palm fruits value addition (Rebecca and Divine, 2017) [25]. In their study palm fruits processors employed average number of eight people for processing one tonne of palm fruits with the assistance of some household members. In Nigeria, Enugu, Imo, Ondo, Edo, Cross river, Delta, Akwa ibom, Ekiti, Bayelsa, Rivers, Anambra, Oyo, Abia, Edo, Ogun, and Kogi States are the major palm oil producers. According to Carrere (2010) [6], oil palm plantations in Nigeria ranges from 169,000 hectares to 360,000 hectares. The oil palm provides one of the leading vegetable oils produced globally, accounting for one-quarter of global consumption and approximately 60 percent of international trade in vegetable oils (World Bank, 2010). Palm oil marketing is concerned with all stages of operation that aid movement of the produce from the producer to the final consumer which include assemblage, storage, transportation, grading and financing (Ezealaji, 2012). Inputs cost, labour cost, transportation cost, processing cost, etc. determine the price of palm oil. Orji (2006) [22], reported that mechanized palm oil mills is capital intensive and this may be one of the reasons why very few mechanized palm oil mills exist in Nigeria. Until the early years of the twentieth century, palm oil was produced only by traditional method by which loose fruits were collected from the ground or a few bunches were cut from the tree. Furthermore, Aghaino (2010) 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, palm oil processing is considered as a traditional source of revenue for people. Gunn (2014) [11] 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 after 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. It has been observed that processing activities is dominated by traditional method in the study area, thus, it is necessary to compare the revenues of the processors using traditional and modern methods of processing of oil palm fruits in Ankpa local government area Kogi State, Nigeria. The study focuses on comparative analysis of income of palm oil processors who use traditional and modern method of processing respectively. The socio-economic characteristics of respondents were described, the income of both traditional and modern processors were compared and the determinant of their incomes were identified.

2. Methodology

The research was carried out in Anpka Local Government Area (LGA) of Kogi State, Nigeria. It coordinates are: 7° 22' 0" North, 7° 38' 0" East. It has an area of 1200km^2 and a population of about 267,353 at the 2006 census. Ankpa LGA falls within the eastern senatorial district of Kogi State with Bassa, Dekina, Ibaji, Idah, Igalamela-Odolu, Ofu, Olamaboro and Omala LGA. Ankpa LGA also forms a federal constituency together with Omala and Olamaboro LGAs. The is bounded to the north by Omala LGA, to the east by Benue State, to the south by Olamaboro LGA, and to the west by Ofu and Dekina LGAs. Ankpa LGA has thirteen wards and is inhabited mainly by the Igala speaking tribes and other tribes such as Igbos, Yoruba, Ebiras, Bassa, Hausas and Idoma. Ankpa LGA is known for the cultivation of a number of crops which include yam, cassava, okra, cocoyam and sweet potato, beans, maize, guinea-corn, and oil palm. The area is rich in mineral resources and coal is the most common. Commerce is also a lucrative economic enterprise in Ankpa with markets such as the Enjema and the Ikebe central markets which usually attract hundreds of customers. Ankpa experiences extreme seasonal variation in monthly rainfall. The raining season lasts for nine months, from February 21 to November 22. The hot season lasts for two and half months, from February to April, with an average daily high temperature above 87°F. The cool season lasts for four months, from June to October. A multistage sampling method was used. In the first stage seven wards were randomly selected from the study area. In stage two, one community each was randomly selected from the seven wards making a total of seven communities. Thirdly, one hundred (100) modern and forty (40) traditional palm oil processors were randomly selected across the seven communities based on their population making a total of one hundred and forty (140) respondents. Primary data were

used for this study and the data were collected using a well-structured questionnaire coupled with personal interview. The information collected include: socio-economic characteristics of palm oil processors, effect of the socioeconomic characteristics on household income of processors, income of modern and traditional processing in the area. Descriptive and inferential statistics were used to analysis the data in order to achieve the objectives of the study. Objective one was achieved by descriptive statistics such as mean, mode, and frequency distribution. Objective two was achieved using gross margin analysis, and objective three was analyzed using multiple regression.

2.1 Model specification
Gross margin

GM = GI – TVC

Where, GM=Gross margin (₦/annum)
GI=Gross income (₦/annum)
TVC=Total variable cost (₦/annum)

2.2 Ordinary least square (OLS) multiple regression model

$Y = a+b_1x_1+b_2x_2+b_3x_3+b_4x_4+b_5x_5+b_6x_6+b_7x_7+e$

Where;
Y = Average Revenue (naira)
X_1= Age of the farmer (years)
X_2 = Family size (number)
X_3 = Level of education (years)
X_4 = Years of experience (years)
X_5 = Palm oil output (litre)
X_6 = Sex (male/ female)
X_7= Processing method (modern =1, traditional = 0)
e = Error term (which is assumed to have zero mean and constant).
a = constant term
$b_1. b_7$ = Coefficients of the variables

3. Results and Discussion
3.1 Socio-economic characteristics of respondents
Table 1 revealed the socioeconomic characteristics of the respondents. The results showed that female (73.6%) dominated palm oil processing in the study area while

26.4% were male. This could be attributed to the nature of work done during palm oil processing such as cooking palm fruits, manual fibre separation, washing of equipment and containers, cooking of crude oil for clarification, packing of oil fibre and nuts, which are socially regarded as female responsibility in our society. This is in line with the findings of Ibitoye and Onje (2013) [14] who reported that more female (88%) were found in palm oil processing than males (12%). However, Emokaro (2014) [9] had a contrary findings in Ovia and Ikpoba-okah of Edo State where the majority (81.7%) of palm oil processors were male and few (18.3%) were female. The result showed that 43.57% of the respondents were in their active age of 41-60 years with the mean age of 47 years. The implies that the respondents were able to carry out the tedious activities involved in palm oil processing which is in line with the findings of Okolo *et al.* (2015) [19]. Majority of the respondents (85.7%) were married and others were either single, divorce or widowed. Thus, they were responsible and able to make ends meet in order to care for their children. This is in consonant with the findings of Ibitoye (2014) [13], who stated that majority of palm oil sellers were married (88.8%). The result revealed that the study area had major household size of 1-5 (51.08%), and 6-10 at 33.8%, and above 10 members at 15.11% with mean household size was 6. This result agrees with the findings of Agwu (2006), who opined that majority of the oil palm processors have a household size ranging from 5 - 9 persons with an average household size of s person. It was discovered that 19.3% of the respondents had no formal education, 32.9% had primary education, 27.9% had secondary education and 20.0% of the respondents had tertiary education. The study is supported by the findings of Adaigo and Nwadiolu (2018) [1]. They reported that 60% of the oil palm fruit producers had one level of education or the other while 40% had no formal education. This implies that their high literacy level could have positive impact on the adoption of innovations (Dongondaji and Baba, 2010) [7]. This result shows that 42.1% of the respondents had experience of 1-20 years, and 52.9% had 21-40 years and 5.0 had experience of 41-60 years. The long years of processing experience is an important factor which can determine both the productivity and the production level in oil palm processing. Thus, the more experience in oil palm processing, the greater the technical efficiency (Karki, 2004) [15]. Nwaliejie and Ojike (2018) also reported a mean processing experience of 18.25 years at 40%.

Table 1: Distribution of respondents according to socioeconomic characteristics

Socioeconomic variables	Frequency	Percentage	Mean/Mode
Gender			
Male	37	26.4	Female
Female	103	73.6	
Age (in years)			
20-40	50	35.71	
41-60	61	43.57	48 years
>60	29	20.71	
Marital status			
Single	4	2.9	
Married	120	85.7	Married
Divorced	7	5.0	
Widow	9	6.4	
Household size			
1-5	71	51.08	
6-10	47	33.81	8 members
>10	22	15.11	

Educational status			
No formal education	27	19.3	Primary education
Primary education	46	32.9	
Secondary education	39	27.9	
Tertiary education	28	20.0	
Farming experience (in years)			
1-20	59	42.1	23 years
21-40	74	52.9	
41-60	7	5.0	
Palm Oil output (liters)			
1-50	50	35.7	15 litres
51-100	16	11.4	
101-150	5	3.6	
151-200	14	10.0	
>200	55	39.3	
Processing method			
Modern	100	71.4	Modern
Traditional	40	28.6	
Sources of labour			
Family labour	40	28.6	Family and hired labour
Hired labour	30	21.4	
Both	69	49.3	
Friends	1	0.7	
Amount Generated Per Season			
<50000	42	30	147746.5
51000-100000	27	19.29	
101000-150000	22	15.71	
>150000	49	35	

Source: Field Survey, 2018

3.2 Effect of socioeconomic characteristics on the processors income

Regression analysis showing the effect of socioeconomic characteristics on processors income is presented in Table 2.

Table 2: Effect of socioeconomic characteristics on processors' household income

Variables	Coefficient	standard error	t values
Constant	-9450.483	4546.910	-2.078**
Palm oil output	0.970	0.337	2.877***
Education	2539.240	529.843	4.792***
Household size	1404.701	418.429	3.357***
Age	-221	1.057	-209
Gender	1962.754	1888.398	1.039
Processing experience	73.208	57.124	1.282
Processing method	3161.510	1751.954	1.805*
R^2	0.757		
Adjusted R^2	0.717		
F-ratio	9.018***		

Source: Field Survey, 2018
Key: *,** and ***= significance at 10%, 5%, and 1% respectively.

Table 2 showed the results of the regression analysis used to determine the effects of socioeconomic characteristics on processors income. The adjusted R^2 was 0.717 means that 71.7% of changes in household income of the oil palm processors can be explained by the independent variables included in this model and the remaining 28.3% could be embedded in other variables of interest which were not captured in the model specified.

Palm oil output has a coefficient of 0.97 which is significant statistically at 1% and has a positive relationship with the household income of the processors. This implies that the household income of the processors will increase by a magnitude of N0.97 as output increases by 1 unit. Probably because of change in the quantity of palm oil produced or change in technology used. Educational status was found to have significant relationship with processors household income and was statistically significant at 1% and had a positive coefficient. The coefficient of 2539.240 implies that the household income of processors will increase by a magnitude of N2539.240 as the number of years spent in school increases by 1. Education plays an important role in palm oil processing operations since it will facilitate the adoption of innovations that will improve oil palm fruit processing. In line with this finding is Ibitoye and Onje (2013) [14] which revealed that number of years spent in school revealed a positive relationship in oil palm processing output but the relationship was not significant. Household size was found to be positively related with household income of oil palm fruit processors at 1% level of significance. The coefficient 230.834 implies that as household size increases by one person, there will be an increase in household income of oil palm fruit processors at magnitude of N230.834. This means that larger household size also aids the total labour supply of the processors household and thereby enhance their income generating ability. This implies that, family labour will continue to serve as an important component of labour in oil palm fruit processing. Processing method was positively signed and found to be significant at 10%, the estimated coefficient 3161.510 implies that every change in the processing method is accompanied with N 3,161:510k increase in the processors household income. Meaning that as the processors move toward the mechanized processing method, their income increases. This could be attributed to the efficiency in production method and the likelihood of more quantity of the output. This finding negates the result of Ibitoye and Onje (2013) [14] who reported that processing method has a negative relationship on palm oil output.

3.3 Income comparison among modern and traditional palm oil processors

Table 3: Z-statistics showing income comparison of modern and traditional oil palm fruit processors

Variables	Observation	Mean	Std error	Std dev	95% conf.	Interval)
Modern income	100	159660	14697.84	146978.4	130852.8	188467.2
Traditional income	40	74700	11997.98	75881.9	51184.39	98215.61
Difference		84960	18973.09		47773.43	122146.6

Source: field survey, 2018

z= 4.4779

Ho: diff= 0, ha: diff! = 0

pr (|Z| > |z|) = 0.0000

From table 4.3 above, the mean income from the mechanized method of processing is N156,990:00k while that of traditional method of processing isN74,700:00k. The difference in the mean of both modern and traditional processing method is calculated to be N84,960:00. This was statistically tested using z-test statistics with a value of Z=4.4779 which is statistically significant at 1%. This implies that the mean income difference is statistically significant which leads to the rejection of null hypothesis. Consequently, there is a significant difference in the income of the mechanized and traditional palm oil processors in the study area. This could be a function of output disparity among the modern and traditional processors. Though mechanized method is associated with high volume of output as seen in the income of the method. This is in line with Ukpabi (2004) [26] who stated that mechanized method of oil palm processing increases the quantity of palm oil available for consumption and trade. The traditional method is known for quality when compared with modern or mechanized processing method.

4. Summary, Conclusion and Recommendations
4.2 Conclusion and Recommendation
From the major findings, oil palm fruit processing in the study area is dominated mainly by women, there is a sharp adoption of mechanized method of oil palm fruit processing even though traditional method is not totally forgotten. Palm oil output, educational status, household size and processing method had statistical positive relationship with processors household income. Also, there is a significant difference (N84, 960) in the income of the modern and traditional processors. Oil palm fruit processing is a profitable venture in the study area although it is plagued by problems of high cost of processing machines, lack of contact to extension services, high cost of labour, and lack of infrastructure among others. Men should be encouraged to partake effectively in palm oil processing in the study area through the agencies of extension workers and other communication channels. The processors can pool their resources together to overcome financial constraints and government should also provide financial assistance to processors through loans. Good road networking and provision of other basic amenities will solve the problem of bad road, price instability and enhance ease of marketing of palm oil.

5. References
1. Adaigho D, Nwadiolu R. Adoption of Recommended Palm Oil Processing Technology in Isoko North Local Government Area, Delta State, Nigeria. Asian Journal of Agricultural Extension, Economics & Sociology. 2018; 24(1):1-8.
2. Aghaino SO. British Colonial Policies and the Oil Palm Industry in the Nigeria Delta Region of Nigeria. African Case Study: Palm Oil and Economic Development in Nigeria and Ghana, 1900-1960-2000.
3. Armstrong R, Palm oil. The Australian National University, URL: Retrieved, 1998-2013. From http://www.anu.edu.au/forestry/wood/nwfp/palmoil.html.
4. Ataga DO, Ilechie CO, Omoti U. Small-scale palm oil processing technology in Nigeria. Seminar paper presented to Burotrop-Afopda on Small and Medium Scale Palm and Coconut Technologies, Accra, Ghana, 1993.
5. Carrere R. Overview of the oil palm issues world rainforest movement, Uruguay. Retrieved, 2001. fromhttp://www.wrm.org.uy.plantations/material oilpalm4.html.
6. Carrere R. Oil palm in Africa: past, present and future scenarios. World Rainforest Movement. Bulletin, 2010, 14.
7. Dongondaji SD, Baba KM. Incomes distribution in large scale irrigation projects: A case study of dry season rice farmers at the Bicolor irrigation project, Zamfara state, Nigeria. Proceeding of the 24th Annual National Conference of the Farm Management of Nigeria held at the Adamawa State University, 2010, 1-50.
8. Ekine DI, Onu ME. Economics of small-scale palm oil processing in Ikwere and Etche Local Government Areas of Rivers State, Nigeria. Journal of Agriculture and Social Research (JASR). 2008; 8(2):150-158.
9. Emokaro CO, Ugbekile PC. Economic Analysis of Oil Palm Processing In Ovia North East and Ikpoba-Okha Local Government Areas of Edo State, Nigeria. Nigerian Journal of Agriculture, Food and Environment. 2014; 10(2):70-78.
10. Food, Agriculture Organization (FAO). Small-scale palm oil processing in Africa. FAO Agricultural Services Bulletin, 2004, 148.
11. Gunn P. Problem and prospect of small scale palm oil processing in Delta – State, Nigeria. Journal of Biology, Agriculture and Healthcare, 2014.
12. Ibekwe UC. Role of Women in Oil Palm Fruit Processing and Marketing in Imo State. Federal University of Technology, Owerri, Nigeria. Med well Journals. 2008; 4(2):101-109.
13. Ibitoye SJ. Economic Analysis of Palm Oil Marketing in Dekina Local Government Area of Kogi State, Nigeria. Asian Journal of Social Sciences, Arts and Humanities. 2014; 2(1):1-19.
14. Ibitoye Stephen J, Onje SO. Economic Analysis of Oil Palm Fruit Processing in Dekina Local Government

Area of Kogi State, Nigeria. Academic Arena. 2013; 5(11):65-73.

15. Karki IB. The Impact of Project Intervention on Rural Household in Nepal. Assessment of Socioeconomic and Environmental Implication. A Ph.D Thesis Submitted To The University Of Gussen. Institute of Project and Regional Planning, Gussen, Germany, 2004.

16. Matthäus B. Use of palm oil for frying in comparison with other high-stability oils. European Journal of Lipid Science and Technology. 2007; 109(4):400. doi:10.1002/ejlt.200600294. Retrieved 09/03/15.

17. Mathew O. Edible Oil Today Section of Manufacturer Association of Nigeria; Nigeria Palm Oil Today and Future Outlook. Paper presented at Nigerian Institute for Oil Palm Research Workshop, 2009.

18. Nwalieji HU, Ojukwu O. Characteristics of Small-Scale Palm Oil Production Enterprise in Anambra State. Journal of Agricultural Extension. 2018; 22(1):27.

19. Okolo CC, Solomon S, Igene L. Analysis of Women Participation In Oil Palm Processing In Dekina Lga of Kogi State, Nigeria. Nigerian Journal of Agriculture, Food and Environment. 2015; 11(2):157-160.

20. Olagunju F. Economics of palm oil processing in Southwestern Nigeria. International Journal of Agricultural Economics and Rural Development, Nigeria. 2008; 4(8):125-133.

21. Olagunju FI. Economics of Palm Oil processing in Southwest Nigeria. International Journal of Agricultural Economics & Rural Development. 2008; 1(2):69-77.

22. Orji MU. Microbiological and Chemical Studies on Nigerian palm oil with particular reference to the effect of extraction methods on oil quality. PhD dissertation, Nnamdi Azikiwe University, Awka, Nigeria, 2006.

23. Orji MU, Mbata TI. Effect of extraction methods on the quality and spoilage of Nigerian palm oil. African Journal of Biochemistry Research. 2008; 29:192-196. Retrieved on 23rd March, from http://www.academicjournals.org/AJBR.

24. Poku K. Origin of oil palm; small-scale palm oil processing in Africa. FAO Agricultural Services Bulletin 148. Food and Agriculture Organization, 2002.

25. Rebecca S, Divine OA. Analysis of palm fruit value addition for socio-economic development in the Kwaebibirem District, Ghana. International Journal of Development and Sustainability. 2017; 6(4):149-167.

26. Ukpabi UJ. Sustainable Post Harvest Technologies for the Major Food Crop and Flesh. A Paper Presented At The Workshop for Abia State Local Government Agricultural Officers, NRCRI, Umudike. 2004; 10(12):1-13.