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Palm Kernel Processing and the Livelihood Outcome of Rural Households in Abia State, Nigeria

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Abstract

The study assessed the effect of palm kernel processing on the livelihood outcome of rural households in Abia State, Nigeria. A multistage sampling procedure was employed to select one hundred and seventeen (117) palm kernel processors. Data were collected using structured questionnaire and analyzed using frequencies, percentages, and simple linear regression. Results showed that crop farming (81.3%), livestock rearing (70.0%), and processing palm kernels for oil extraction (68.8%) were the foremost livelihood activities engaged by the palm kernel processors. The grand mean of 2.34 indicated low participation in palm kernel processing activities, while collection of palm kernels ($\bar{x}$=2.99) and cracking of nuts ($\bar{x}$=2.72) were the activities mostly engaged. The coefficient of palm kernel processing (r= 0.293) was significantly related with the livelihood of the processors. The study concluded that despite low participation level, palm kernel processing significantly improves rural livelihoods. This study recommends improved infrastructure, credit access, and subsidized equipment for increased participation of rural households in palm kernel processing.

Keywords: Palm kernel processing, livelihood of rural households

Introduction

The oil palm (*Elaeis guineensis*) is a highly versatile perennial tree crop valued for its multiple products. It is widely cultivated for its fruit bunches and edible seeds, known as palm kernels. Processing of fresh fruit bunches yields three primary products: palm oil extracted from the mesocarp (fleshy pulp), palm kernel oil from the seed kernel, and palm kernel cake as the residual by-product after oil extraction from the kernel (Murphy et al., 2021).

Nigeria occupies a prominent position in the historical development of the global oil palm industry. Before the discovery of crude oil, the country was recognized as the world's leading producer and exporter of palm oil, accounting for about 43% of global palm oil exports. Back then, palm produce was a major foreign exchange earner and a backbone of the economy (Oyebode, Oyesola and Fadairo, 2025). However, following the discovery of petroleum in 1956, and the subsequent oil boom of the 1970s, Nigeria's economic priorities shifted from agriculture to the petroleum sector. This transition resulted in reduced investment in oil palm plantations, agricultural

research, extension services, and processing infrastructure, leading to a gradual decline in the sector's productivity and competitiveness (Sule, 2022).

Palm kernel constitutes an important source of both vegetable oil and dietary protein, making it highly valuable across many sectors. Recent estimates indicate that palm-derived oils (including palm kernel oil) contribute a substantial share of edible vegetable oil consumption in Nigeria, underscoring their economic and nutritional significance (FAOSTAT, 2023). Palm kernel oil is commonly refined into edible vegetable oil and is also utilised in industrial applications for industrial purposes, including the manufacture of confectionery, cosmetics, and pharmaceuticals. In addition, the residual product after oil extraction—palm kernel cake—serves as a vital input in livestock feed formulation due to its high protein content (Oloruntola et al., 2021; FAO, 2023). Globally, palm oil and palm kernel oil together remain dominant in the vegetable oil market, accounting for a significant proportion of production and international trade (OECD & FAO, 2022).

In Nigeria, palm kernel oil contributes substantially to the domestic edible vegetable oil supply and supports non-oil export earnings. The country's crude palm oil production reached approximately 1.57 million tonnes in 2025, reflecting steady growth, while palm kernel oil production remains a key component of the sector. Globally, palm oil and palm kernel oil together dominate the vegetable oil market, with palm oil accounting for around 35% of total world vegetable oil production and consumption in recent years, and palm kernel oil contributing significantly to the lauric oil segment (roughly 9 million tonnes produced annually) (Olalekun, 2026).

Palm kernel processing represents a viable agro-based enterprise with considerable socioeconomic benefits. It generates employment opportunities across the value chain, from harvesting and cracking to oil extraction and marketing. The activity also facilitates rural economic integration by promoting trade, skill acquisition, and knowledge exchange among participants. Its wide range of applications—including traditional medicinal uses—has further enhanced its acceptability and participation, particularly among rural women (Olagunju et al., 2021).

Livelihood refers to the capabilities, assets (both tangible and intangible), and activities required for a means of living. It encompasses access to essential resources such as food, income, shelter, healthcare, and education (Chambers & Conway, 1992; Scoones, 2015). Asset here can be physical capital (basic infrastructure such as roads, schools, markets, water and sanitation, and producer goods), human capital (knowledge, skills, and technical competence), financial capital (income earned, savings, credits, and trade), social capital (membership of groups, informal networks and other similar relationships that facilitate cooperation and economic opportunities), natural capital (land, soil, forest, water and fisheries) (Akinnagbe and Ipinmoye, 2022). In rural Nigeria, livelihood outcomes are closely associated with agricultural and agro-processing activities. Participation in palm kernel processing contributes to livelihood improvement through income diversification, enhanced food security, and increased access to productive resources such as land, credit, and markets (Afolabi et al., 2021). Furthermore, agro-processing enterprises such as palm kernel processing are recognized as critical drivers of sustainable rural livelihoods by strengthening resilience, reducing vulnerability to economic shocks, and improving overall household welfare (Omotayo & Aremu, 2021).

Engagement in palm kernel processing offers a vital pathway to improving the livelihood outcomes of rural households, providing them with an opportunity to diversify their income sources beyond primary crop production, thereby reducing exposure to agricultural risks, hence enhancing their food security and access to better social services (International Fund for Agricultural Development, 2021). Empirical evidence suggests that adoption of improved oil palm processing technologies enhances productivity, increases income, and creates employment opportunities, ultimately leading to improved standards of living among rural farmers (Akinola et al., 2020; IFAD, 2022).

Despite its substantial potential, palm kernel processing in many rural communities remains underdeveloped. Existing processing techniques are often rudimentary, labour-intensive, and inefficient, leading to low output levels and suboptimal value addition. These constraints limit income generation and reduce the overall economic benefits derived from the enterprise, thus damping the impact of palm kernel processing on livelihood of the processors (Yahaya & Kareem, 2021). In Abia State, many oil palm producers tend to sell palm kernels in unprocessed form, thereby foregoing the additional income that could be realized through value addition. Moreover, there is limited empirical evidence on the level of participation of rural households in palm kernel processing and its corresponding effects on livelihood outcomes in the state. While participation of rural households in palm kernel processing is expected to positively impact on the livelihood and welfare of the households, the magnitude and nature of this relationship remain insufficiently documented.

The broad objective of the study is to examine the effect of palm kernel processing on the livelihood of rural households in Abia State, Nigeria. The specific objectives were to:

1. ascertain the livelihood activities of the palm kernel processors;

2. determine the extent of rural households' participation in palm kernel processing, and

3. ascertain the challenges to participation in palm kernel processing.

Hence, the study examined the effect of palm kernel processing on the livelihood outcome of rural households in Abia State, Nigeria. Specifically, it ascertained the livelihood activities of the palm kernel processors; determined the extent of rural households' participation in palm kernel processing, and ascertained the challenges to participation in palm kernel processing.

Hypothesis

Palm kernel processing has not significantly influenced the livelihood of the palm kernel processors in the study area.

Methodology

The study was conducted in Abia State, one of the 36 states of Nigeria, with Umuahia as its administrative capital and Aba its major commercial hub. The state is located in the southeastern region of the country and is predominantly inhabited by the Igbo ethnic group. Geographically, it lies between latitudes 4°40′N and 6°14′N and longitudes 7°10′E and 8°00′E. It covers an estimated land area ranging between approximately 5,200 and 6,300 square kilometres (Abia State Planning Commission

[ABSPC], 2018; National Bureau of Statistics, 2022). The state experiences a humid tropical climate characterized by high rainfall (about 2,000–2,400 mm annually) and temperatures ranging from 20°C to 31°C. The vegetation is predominantly rainforest, which supports the cultivation of oil palm and other arable crops. The favourable agro-ecological conditions make the state suitable for oil palm production and palm kernel processing activities.

The study population comprised all rural households engaged in palm kernel processing (kernel cracking, oil extraction, and palm kernel cake production) in Abia State. A multistage sampling procedure was adopted in selecting the sample for the study. In the first stage, Umuahia Agricultural zone was purposively selected out of the three agricultural zones in the State, this was based on proximity and the intensity oil palm and palm kernel processing. In the second stage, three blocks were randomly selected from the selected zone. In the third stage, three cells known for palm kernel processing activities were purposively selected from each of the selected blocks, making a total of nine cells. In the final stage, thirteen (13) households engaged in palm kernel processing were randomly selected from among the list of palm kernel processing households, giving a total of one hundred and seventeen (117) palm kernel processors. Primary data used for the study were collected using structured questionnaire. Descriptive statistics such as means, and percentages and inferential statistics involving linear regression were used in analysing the data.

To determine the extent of rural households' participation in palm kernel processing activities, a 4-point rating scale was utilized. The points in the scale are very often (4), often (3), sometimes (2) and never (1). Given the above, the midpoint was obtained by adding 4, 3, 2, and 1 and dividing by 4, yielding a mean score of 2.5. For decision making, an upper limit was obtained 2.5+0.05 =2.55. This implies that any mean score response equal to or above the upper limit was deemed to indicate high participation, while a mean score below the upper limit was viewed as low participation.

Livelihood was operationalized using indicator effects such as income generation, employment opportunities, social status, access to market, family welfare, and skill development.

Respondents rated the contribution of palm kernel processing to their livelihood on a 5-point scale, 5 = very high, 4 = high, 3 = moderate, 2 = low, 1 = very low

A composite livelihood index was derived by calculating the mean score across the indicators.

The influence of palm kernel processing on livelihood was tested using simple linear regression analysis.

Model specification

Simple linear regression model

$Y = b_0 + bX + ei$
Where:

Y = Respondents' livelihood (mean score of the livelihood outcome form palm kernel processing)

X = respondents' participation in palm kernel processing (mean score of respondents' involvements in palm kernel processing activities)
e = error term

Results and Discussion

Livelihood Activities of the Palm Kernel Processors in the Study Area

The distribution of the processors by livelihood activity is shown in Table 1.
The result in Table 1 shows that crop farming (81.2%), livestock rearing (70.1%), processing palm kernels for oil extraction (68.4%), and selling processed palm oil and palm kernel cake (51.3%) were the foremost livelihood activities engaged by the palm kernel processors in the study area. However, transportation (13.7%), craftwork (10.3), and engaging in transportation or logistics related to palm kernel processing (2.6%) were the least engaged livelihood activities among the palm kernel processors. This result indicates that farming remains the dominant livelihood activity among palm kernel processors in the study area, confirming that agriculture continues to constitute the primary economic activity of most rural households in Nigeria. Rural households often combine crop production with agro-processing and livestock activities as livelihood diversification strategies aimed at improving income and reducing vulnerability (Odozi et al., 2021; Makuachukwu et al., 2021).

Table 1: Livelihood activities of the palm kernel processors

S/N	Livelihood activities	*Percentage (n=117)
1	Crop farming (e.g. cassava, yam, maize etc.)	81.2
2.	Livestock rearing	70.1
3.	Processing palm kernels for oil extraction	68.4
4.	Selling processed palm oil and palm kernel cake	51.3
5.	Providing palm oil and kernel cake processing services for others	48.7
6.	Selling palm oil and kernel cake at local markets	42.7
7.	Petty trading	35.0
8.	Conducting repairs or maintenance of processing equipment	16.2
9.	Operating or working in a palm oil mill	15.4
10.	Transportation	13.7
11.	Craftwork	10.3
12.	Engaging in transportation or logistics related to palm kernel processing	2.6

Source: Field survey, 2024
* = Multiple responses recorded.

Extent of Rural Household's Participation in Palm Kernel Processing

Table 2 shows the distribution of the rural households according to their extent of participation in palm kernel processing.

The result in Table 2 revealed that the most frequently performed palm kernel processing activities include collection of palm kernels ($\bar{x}$ = 2.99), scaling and bagging of palm kernel ($\bar{x}$ = 2.76), cracking of the palm kernel nuts ($\bar{x}$ = 2.72) and separation of the palm kernel from the shell ($\bar{x}$ = 2.64). However, activities such as extraction of palm kernel oil ($\bar{x}$ = 1.78), boiling ($\bar{x}$ = 1.73), and marketing ($\bar{x}$ = 1.73) recorded lower participation levels. The grand mean of 2.34 which is below the bench mark mean of 2.50 implies low level of participation in the palm kernel processing activities among rural households in Abia State. This could be associated with the fact that most of the palm kernel processors were engaged in it on part-time basis, hence they may not fully participate in the processing activities. Moreover, the low participation recorded in palm kernel processing activities such as oil extraction and marketing could be attributed to the associated labour-intensive nature mostly from the traditional processing methods, inadequate access to modern equipment, and financial constraints faced by rural processors. Similar findings were reported among rural households engaged in oil palm processing in Southeast Nigeria, where participation in mechanized processing activities remained low due to high operational costs and limited access to improved technologies (Onu et al., 2021).

Table 2: Extent of participation in palm kernel processing activities in the study area

Activity	Mean	Std. Dev.
Collection of palm kernels	2.99	0.864
Scaling and bagging	2.76	0.945
Cracking of nuts	2.72	0.914
Separation from shell	2.64	0.903
Extraction of palm kernel oil	1.78	1.232
Boiling process	1.73	1.19
Marketing and selling of palm kernel products.	1.73	1.147
Bench mark mean	**2.50**	
Grand mean	**2.34**	

Source: Field survey, 2024

Challenges Faced by Rural Households Involved in Palm Kernel Processing

The result in Table 3 shows the challenges faced by rural households involved in palm kernel processing in the study area.

The result revealed that the most critical constraints to palm kernel processing include inconsistent power supply ($\bar{x}$ = 3.09) and lack/ inadequate storage facilities ($\bar{x}$ = 3.09). These were closely followed by high cost of processing equipment ($\bar{x}$ = 3.07), and

difficulty accessing credit or financial support ($\bar{x}$ = 3.06). Palm kernel processing sometimes extend till night. The inconsistent power supply subject the processors in spending more in buying fuel and diesel for their generators. Lack/ inadequate storage facilities predispose the palm kernel to spoilage and loss in quality which reduces the monetary value. The high cost of processing equipment makes them unaffordable to most of the palm kernel processors. According to Obalola et al., (2024), high capital requirements and limited access to affordable modern processing equipment remain major constraints to efficient palm kernel processing among rural households in Nigeria. Small-scale processors often depend on rudimentary technologies because mechanized processing facilities are expensive and difficult to acquire. Other challenges faced by the processors include poor infrastructure (e.g., inadequate roads for transportation) ($\bar{x}$ = 2.96), low market prices for processed products ($\bar{x}$ = 2.79), and labour shortage ($\bar{x}$ = 2.74). The grand mean of 2.85, which exceeds the benchmark of 2.50, indicates that constraints to palm kernel processing are generally high in the study area. These findings suggest that infrastructural deficiencies, financial constraints, and high capital requirements significantly hinder effective participation in palm kernel processing in Abia State. This aligns with Yahaya and Kareem (2021), who identified similar structural and financial barriers affecting agro-processing enterprises in rural Nigeria.

Table 3: Distribution of palm kernel processors according to challenges faced in palm kernel processing in the study area

S/N	Challenges	Mean	Std. Dev.
1	Inconsistent power supply	3.09	0.363
2	Lack/ inadequate storage facilities	3.09	0.363
3	High cost of processing equipment	3.07	0.265
4	Difficulty accessing credit or financial support	3.06	0.401
5	Poor infrastructure	2.96	0.284
6	Low market prices for processed products	2.79	0.544
7	Labour shortage	2.74	0.244
8	Lack of technical knowledge and skills	2.48	0.628
9	Limited access to modern processing equipment	2.38	0.363
	Bench mark mean	**2.50**	
	Grand mean	**2.85**	

Source: Computed from field Survey, 2024

Influence of Palm Kernel Processing on the Livelihood of the Palm Kernel Processors

Table 4.4 shows the linear regression analysis result of the influence of palm kernel processing on the livelihood of the processors in the study area.
From Table 4, the coefficient of determination value of 0.421 implies that 42.1% of the variations in the livelihood of the palm kernel processors were explained by their involvement in palm kernel processing. The F-ratio of 22.178 which was significant at 1% shows the goodness-of-fit of the model.

From the result, the coefficient of palm kernel processing (0.293) was positive and significant at 1% significant level. This implies that participation in palm kernel

processing have significant positive relationship with the livelihood of the processors in the study area. The positive influence of palm kernel processing on livelihood outcomes may be attributed to increased income generation, employment creation, and livelihood diversification opportunities associated with agro-processing enterprises. Agro-processing activities have been widely recognized as important pathways for improving rural welfare and reducing household vulnerability in Nigeria (Makuachukwu et al., 2021). Hence, as the processors participate in palm kernel processing, their livelihood improves which could be due to increased income realized which translate to improved expenditure patterns, improved access to quality food, improved dietary diversity, acquiring of new assets and other livelihood indicators.

Conversely, Yahaya and Kareem (2021) showed that there is no significant relationship between involvement in palm kernel oil processing and the well-being of the processors. According their study, a lot of things are needed to be done in order to achieve satisfactory level of well-being of the palm kernel processors.

Table 4: Simple linear regression analysis of the influence of palm kernel processing on the livelihood of the processors

Model	Coefficient	Std Error	t-value
Constant	2.486	0.153	16.273***
Palm kernel processing	0.293	0.062	4.709***
R-Square	0.421		
Adjusted R-Square	0.393		
F-ratio	22.178***		

Source: Field survey, 2024.

Conclusion and Recommendations

Collection of palm kernels and scaling and bagging of palm kernel were thepalm kernel processing activities mostly engaged in the study area. Inconsistent power supply, lack/ inadequate storage facilities, and high cost of processing equipment were the major constraints to palm kernel processing. Hence, palm kernel processing significantly influenced the livelihood of the processors. The therefore recommended that efforts should be made towards improving and expanding the oil palm and palm kernel sector through improved seedlings and technology, improved production and marketing system. This will help in encouraging greater participation in palm kernel processing. The Government should intensify its efforts towards providing basic infrastructure such as electricity and motorable roads in the palm kernel processing catchment areas so as to enhance the efficiency of processing and marketing of palm kernel products. Government and Non-governmental organizations should establish well-developed modern processing outlets within the palm kernel catchment areas. Also, the cost of processing equipment should subsidized for processors who may want to acquire them, in order to promote their use among the palm kernel processors, as well as enhance the income of the processors. There is need to formulate financial policies which makes it easy for processors to obtain soft loans. Also, the palm kernel processors should be encouraged and guided to form cooperatives to ensure easy access to loan, and also enable them gain other benefits associated with such cooperatives such as joint processing ventures, warehouse, market information etc.

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