Challenges to Adoption and Management Practices of Oil Palm Production Among Small-Scale Farmers in Rivers State, Nigeria

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DOI: 10.56201/ijaes.v10.no9.2024.pg75.90

Abstract
This research work investigated the challenges to adoption and management practices of Oil Palm production among small-scale farmers in Rivers State, Nigeria. Specifically, the study described the socio-economic characteristics of oil palm producers, identified the types of management structures, assessed the perceived benefits of oil palm production and management and identified the challenges faced by farmers in adopting these technologies. The study was conducted across the three agricultural zones in Rivers State, targeting a population of 2,500 registered oil palm producers. A sample size of 345 was used for the study. Data were collected using a structured questionnaire. The analysis was conducted using descriptive statistics, including frequencies, percentages and mean scores. The hypotheses were tested using the regression analysis and Analysis of Variance (ANOVA). The results revealed that a significant majority (82.8%) of the respondents was married, a male majority of 61.4%, an average age of 50 years and majority within 41-50 years, 65.6% had at least secondary education, and a significant portion (70.9%) had household sizes of 4 to 6 persons, and an average monthly income of ₦90,548. Majority (62.5%) operated a sole enterprise management system. Oil palm production has led to benefits like income generation ($\bar{X}$=2.67), Increased yield/output ($\bar{X}$=2.68), skills acquired by farmers ($\bar{X}$=2.19),, employment created ($\bar{X}$=2.45), and improved output ($\bar{X}$=2.56). Four challenges factors were extracted based on the responses of the respondents namely economic (factor 1), institutional (factor 2), technical (factor 3) and environmental (factor 4). The findings underscored the critical role of socio-economic factors in the adoption of oil palm production technologies as the test of hypothesis showed that age (.013), education (.000), household size (.000), farming experience (.000) and income (.000) were significant in enhancing technology adoption. The study also recommended enhancement of adoption of oil palm production technologies, so as to improve productivity and sustainability in oil palm production in Rivers State, Nigeria.
Keywords: *Management Practices, Oil Palm Production, Small-Scale Farmers*

INTRODUCTION

The people of River State over the decades because of abundance of wild grove oil palm in the region, imbibed the farming and business culture of oil palm business which involved planting, maintenance, picking, harvesting of fresh fruit bunches (FFB) for processing and cracking of Kernel seed for extraction of Kernel which is known for household usage. (Omereji, 2020). The activities practiced by the farmers in the region impressed the colonia masters in the Eastern Nigeria, who on arrival, recognized the potentials and decided to put in place management strategies to tap the resources for shipment of the palm produce through Port Harcourt. Bonny Rivers to Europe to service their industries (Amanyanabo, 2013).They did some reforms to enhance improvement in the sector to enable them get the raw materials for production. Some of the areas of reforms included management of wild groves, establishment of oil palm research centre, establishment or oil palm milling centres and formation of marketing boards. (Alien, 2017).These activities were predominant in the upland areas of the state while major marketing and shipment were along the coastal rivers to Europe. Most wealthy men were the palm oil merchants who traded with Europeans and became contact men for supply of needed raw materials for export. Some of the established oil palm by the then eastern Nigeria milling centres included the following: Isiokpo mills, Onudioga Alimim Rumuji/Ibaa, Ahoada, Chokocho, Umuaturu, Igbodo, Abuaz/Oduaz, Ebubu, Obiakwu in Oyigbo etc.

Risonpalm now Society Investment Agriculture Tropics (SIAT) a leading oil palm industry covering 16,000 hectares of oil palm is located in Ubima, and Elele in Ikwerre Local Government Area of Rivers State with over 5000 workforce (Omereji, 2020).The activities of the giant oil palm industry has greatly affected the adjoining communities which are major growers that supply palm bunches to the company mill. These communities are: Ubima, Elele, Akpabu, OmereluIsu, Elele Etche, Abara, Elele-Alimin, Rumuekpe, and Obelle etc. The Nigerian oil palm belt covers the following states: Anambra, Enugu, Abia, Imo, Ebonyi, Delta, Edo, Rivers, Akwa-Ibom, Cross-River, Bayelsa, Kwara, Kogi, Kaduna, Taraba, Osun, Ondo, Oyo, and Ekiti, Partnership Initiative in Niger Delta (PIND report, 2011), within the oil palm belt in Nigeria asserted that 80% of production comes from dispersed small holders who harvest the wild groves plants and use manual processing techniques. Several million smallholders are spread over estimated area ranging from 1.65 million hectares to 2.4 million hectares and a maximum of 3 million hectares. The estimate for oil palm plantations in Nigeria ranges from 169,000 hectares to 72,000 hectares of estate (Partnership Initiative in Niger Delta Report, 2011). The oil palm ownership can be classified into the following categories; Individual plantation managed as sole enterprise; Community or communal plantation managed as joint business enterprises; Government owned enterprise managed as a formal structure with bureaucratic characteristics; Private sector ownership like Presco - former Risanpalm now Society Investment Agriculture Tropics (SIAT), Okitikpakpa farm, Obasanjo oil palm, etc, have formal management structures with defined roles devoid of bureaucratic bottlenecks (Kiptot *et al*, 2015).

Nigeria is among the highest producers of oil palm which is extracted from the fleshy mesocarp of the palm fruit and has been vital resource in the majority of Nigeria diets. (Butler, 2019) stated that Nigeria was a global leader or highest exporter of palm products before the discovery of crude oil in Niger Delta. The discovery of crude oil caused a shift to crude oil sector and a decline in agricultural production which affected export of palm oil to Europe. Nigeria could not export oil;

not even able to meet up domestic and industrial need of oil palm products in Nigeria. This necessitated importation of palm oil to fill this gap (Chiejina, 2019). According to Ojo (2019), the oil palm can be used in various forms. The material parts are used in making brooms and as roofing sheets in rural areas. The bark of the frond can be peeled and woven into baskets. The main trunk can be split like Sawn timbers as part of building materials. Palm wine can be obtained from oil palm tree. Red palm oil is readily obtained from the fresh fruit bunches. Red palm oil is used for cooking, soap making, candle and margarine. While the fruits are processed, the residue obtained can be used as fuel or cooking and fertilizing to improve soil nutrients. Palm kernel can be extracted from the nut. Other nonfood uses include: cosmetic, pharmaceutical, lubricants and grease, surfants, industrial chemicals, Agrochemicals, coatings, paints, lacquers, leather and biodiesel.

Oil palm production in Rivers State is dominated by uncoordinated wild grove. There is under investment in new technologies, slow adoption of existing improved technology, limited land for oil palm development, unavailability of skilled labour, low production/output as well as low yielding varieties of palm seedling planted at high maintenance cost Eze *et al* (2014). However, there are issues of low yield due to lower sunshine hours and solar radiation, unlike South-East Asia where the produce is high (Weli *et al.*, 2015). There is also the issue of increase in Potter (2015) noted that the dominance of wild groves which are characterized by uncoordinated and lack of proper maintenance account for low yield, for instance in Nigeria there are; Semi/wild groves 2,100,00 (ha); Smallholder 150,000 (ha) and Oil palm estate 95,000 (ha). The challenge identified in this study is the fragmentation of land tenure system which is in most cases communally owned. It is therefore not easy for prospective oil palm farmers to have access to enough land for oil palm production. There is also the issue of modern oil palm processing machines which are very expensive, compelling the smallholder farmers to operate in their traditional method with slow rate of oil palm technologies. The big private sector participation is low due to lack of incentives such as loans, grants, subsides among others. Most financial institution avoid granting loans due to long gestation period such as oil palm that will require four-six years, they would rather considered quick payback project (Omereji, 2020). In Rivers state, the government policies and programmes are not favourable to the agricultural sector which oil palm is inclusive. Supposedly, the oil palm would have been an alternative for diversification to non-crude oil sector to mop up the thousands of unemployed youths (Friends of the Earth, 2015).

Objective of the Study

The specific objectives were to.

i. describe the socio-economic characteristic of the oil palm producers in the study area;
ii. ascertain the type of organizational structure of oil palm management;
iii. determine perceived benefits of adoption and management practices on oil palm productivity; and
iv. identify challenges to the adoption of oil palm technologies by oil palm farmers in the study area.

Statement of Hypothesis

The null hypothesis was tested at 0.05 level of significance.

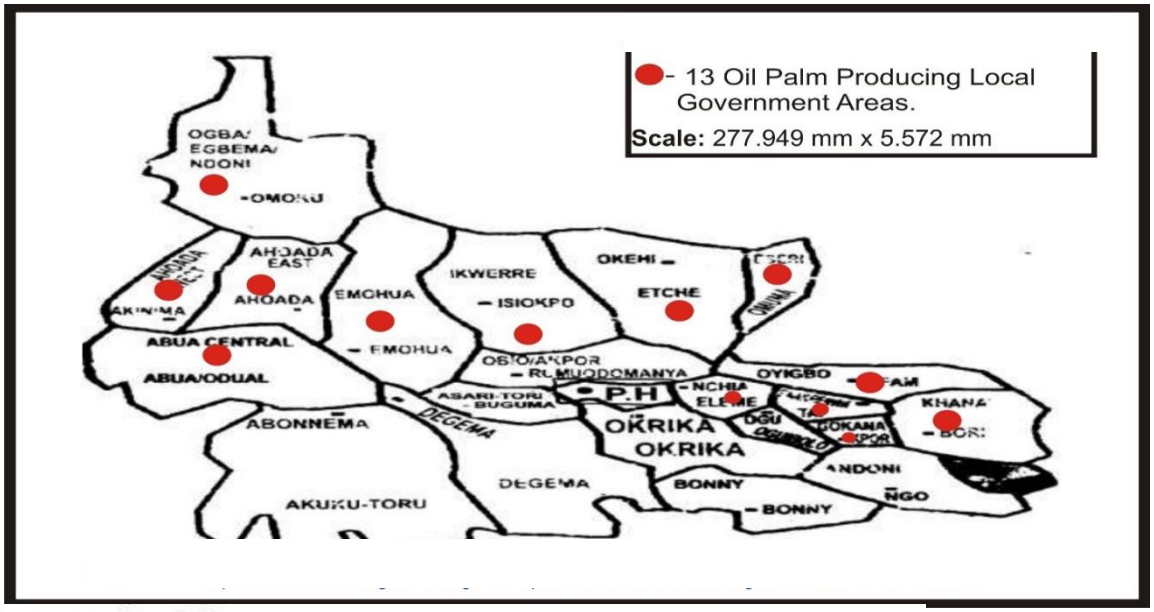
$H0_1$: There is no significant relationship between the socio-economic characteristics of oil palm farmers and adoption of oil palm technologies in the study area

$H0_3$: There is no significant difference of the challenges encountered in the adoption of oil Palm technologies by farmers among the agricultural zones in the study area.

METHODOLOGY

The study area is Rivers State which is one of the states in the South –South region of Nigeria with its capital in Port Harcourt. The state was created in 1967 by General Yakubu Gowon administration when he was the Head of State of Nigeria. The state is the treasure base of the Nation and is blessed with oil and gas resource deposits. The state shares boundaries with Imo and Abia States by the North, Bayelsa and Delta by the West, Akwa Ibom by the East, and is bounded in the South by the Atlantic Ocean. The area has lowland geomorphology of below 52m above sea level. It is rainforest vegetation with a mean annual rainfall of 330mm and a mean temperature range of 24^0c (Wokoma, 2008). The area has two distinct seasons: rainy season (March-October) and dry season has a bimodal distribution pattern with distinct peaks in July and September. The soil is rich in mineral crude oil and natural gas deposits. The Rural people are predominantly farmers and fishermen. The population of Rivers State, according to 2006 census, was 6,185, 400 people, while 2015 estimate by National Bureau of Statistics put the number of residents in Rivers State at over7,000.000.

The study area is restricted to the main oil palm production zones in the following local government area of the state which include: Abua/Odua, Ahoada East, Ahoada West, Ogba/Egbema/Ndoni, Emohua, Ikwere, Etche, Omuma, Eleme, Tai, Khana, Oyigbo and Gokana. The state is divided into three agricultural zones made of zone I:- Port Harcourt, Obio/Akpor, Khana, Gokana, Oyigbo, Tai, Eleme and Ogu-Bolo. Zone II is made up of the following local government areas:- Abual/Odual, Akuku-Toru, Andoni, Asari-Toru, Degema, Okirika, Opobo/Nkoro and Bonny. Zone III comprises the following local government areas:- Ahoada East, Ahoada West, Emohua, Ikwerre, Oga/Egbema/Ndoni and Omuma.



Source: https://www.researchgate.net/figure/Map-of-Rivers-State-Showing-Local-Government-Areas.

Figure 1: Map of Rivers State Showing Local Government Areas

The study employed descriptive design. The population of the study consisted of all registered oil palm farmers in Rivers State. The population captured the oil palm farmers from the 13-core oil palm producing local government areas in Rivers State. There are 2500 oil palm producers in Rivers State (Oil palm Association of Nigeria, Rivers State branch, 2022). Multi-stage sampling procedure was employed in the selection of the samples for the study. Purposive sampling procedure was used to select the communities and respondents from the study area. Purposive sampling was used because oil palm production activities are more in three local government areas namely Ikwerre, Etche and Emohua, due to the proximity and influence of Societe Investment Agriculture Tropics (SIAT) a leading oil palm industry in the area. The respondents from these areas were as follows: Ikwerre, 50 respondents; Etche, 50 respondents and Emohua, 45 respondents. The other ten local government areas with less activity were represented by 20 respondents each. These local government areas include: Abua/Odual, Ahoada East, Ahoada West, Ogbe/Egbema/Ndoni, Omuma, Oyigbo, Tai, Eleme, Khana and Gokana. The total respondents from the more intensive area = 145 respondents, less intensive area = 200 respondents giving a total number of 345 respondents. There communities were selected from the less producing LGAs, with five communities from the more intensive area.

Data were collected for the research work using questionnaire and interview schedule (questionnaire for the literate respondents and interview schedule for the illiterates). The primary data were obtained from registered oil palm farmers. Data collated from the field were presented and analysed using descriptive and inferential statistical tools. Objective 1 was presented using frequency, tables, percentages, standard deviation and mean. Objectives 2 and 3 and 4 were achieved using a 4 point rating scales of strongly agreed (4); agreed (3); disagreed (2) and strongly disagreed (1). The vales were added to get 10, which was further divided by 4 to get 2,5. This serves as the decision rule; any variable that was equal to or greater than 2.50 was considered been accepted while variables that scored less than 2,50 were considered not accepted. Varimax rotation of only variables with factor loadings of 0.30 and above at 10% overlapping variance were used in identifying the challenging factors (Madukwe, 2004 cited in Albert-Elenwa, 2017). Variables that had factor loading of less than 0.30 were not used while variables that loaded in more than one inhibiting factors were also discarded. The first hypothesis which was on the socio-economic characteristics of the oil palm farmers and the adoption of technologies in the study area was tested using multiple regression. The second hypothesis which was on the significant difference in the

challenges to the adoption of oil palm production technologies among the agricultural zones in the study area was also tested using ANOVA. The model for the multiple regression is thus:

$Y= a+b_1X_1+b_1b_2X_2 + \ldots..+ b_nX_n$ 1

Where:

Y-is the dependent variable

X-is the independent variable

a-is the intercept (the value of Y when X is zero), a constant.

b-is the slope of the line or the coefficient.

The three functional forms of the multiple regression model are as follows:

Linear Model

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_5 + e_1 \quad \ldots \quad \ldots \quad \ldots 2$$

Semi-log Model

$$LnY = \omega_0 + \boldsymbol{\omega}_1 X_1 + \boldsymbol{\omega}_2 X_2 + \boldsymbol{\omega}_3 X_3 + \boldsymbol{\omega}_4 X_4 + \boldsymbol{\omega} X_5 + \boldsymbol{\omega}_6 X_5 + e_1 \ldots \quad \ldots \quad \ldots 3$$

Double-log Model

$$LnY = \boldsymbol{\delta}_0 + \boldsymbol{\delta}_1 LnX_1 + \boldsymbol{\delta}_2 LnX_2 + \boldsymbol{\delta}_3 LnX_3 + \boldsymbol{\delta}_4 LnX_4 + \boldsymbol{\delta}_5 LnX_5 + \boldsymbol{\delta}_6 LnX_5 + e_1 \ldots \ 4$$

Socio-economic characteristics of oil palm farmers,

Where:

Y= Impact of socialization

X1 = Gender (Male=1, Female=2)

X2 = Age range in years (17-27 =1, 28- 38 =2, 39-49 = 3, 50-60 =4).

X3 = Marital status (single=1, married=2, divorced=3, separated=4, widowed=5)

X_4 = Educational level (No education =1 Primary =2, Secondary =3, Tertiary=4).

X_5 = Household size (1-3=1, 4-6=2, 7-9=3, 10-12=4).

X_6 – Farming experience (yrs)(less than 5=1, 6-10=2, 11-15=3, 16-20=4; 21-25=5).

X_7 = Types oil palm production (wild palm grove =1, improved oil palm (medium) =2, improved oil palm (large))

X_8 = Monthly income (1-20,000=1, 21,000-40,000=2, 41,000-60,000=3, 61,000-80,000=4).

X_9 = Secondary occupation (petty trading = 1, internet marketing = 2, civil servant = 3, livestock farming =4).

Ei = error term

RESULTS AND DISCUSSION

Socio-Economic Characteristics of the Respondents

The result indicates that the majority (82.8%) of the respondents were married, while 6.7% were single. About 6.3% and 4.2% were divorced and widowed, respectively. Specifically, majority of the respondents in each of the 3 agricultural zones were married; in agricultural zone 1 (76.8%), agricultural zone 2 (76.5%), and agricultural zone 3 (85.6%). This is an indication that oil palm production and management is handled by mature and responsible people. Married respondents are likely to have access to family labour, which is necessary in a labour-intensive enterprise like oil palm production and management. This reduces labour-cost and improve productivity (Lezorghia-Sinee *et al*, 2024). Majority were male (61.4%) while 34.4% were female. Also, in agricultural zone 1, agricultural zone 2 and agricultural zone 3, majority (63.6%), (63.6%), (63.6%), respectively, were male. This is an indication that oil palm production and management

is male dominated. More (36.5%) of the respondents were within 41 to 50 years with a mean age of 50 years. Similarly, the agricultural zone 1 had majority (24,2%) of the respondents between the ages of 41 to 50 years, agricultural zone 2 had majority (70.2%) of the respondents between 51 to 60 years, while agricultural zone 3 had majority (43.1%) of the respondents between 41 to 50 years. Majority of the respondents had secondary education (42.1%). Specifically, majority of the respondents in agricultural zone 2 (47.1%) and agricultural zone 3 (50%) had secondary education; while agricultural zone 1 had majority (45.5%) with primary education. Generally, 23.5% had tertiary education and 65.6% had at least secondary education. This implies that the respondents had the basic level of education, which enable them adopt and understand improve farming techniques and technologies (Weche & Elenwa, 2024). More (70.9%) had household sizes of 4 to 6 persons. This was uniform across the 3 agricultural zones as majority of the household size in agricultural zone 1 (62.1%), agricultural zone 2 (94.1%) and agricultural zone 3 (71.8%) had household size of 4 to 6 persons. The mean household size was 6 persons. The average monthly income was ₦78,000. However, the farm families according to the agricultural zones, zone 1 had an average monthly income of ₦70,000 with the majority (36.4%) earning ₦83,000 and above; zone 2 had ₦84,000 with the majority (58.8%) earning ₦83,000 and above and zone 3 had ₦80,000 with the majority (55.4%) earning ₦83,000 and above. This income range reflects a level of economic stability, enabling farmers to invest in improved farming inputs and technologies. More so, oil palm farmers in this income category have the potential to expand their businesses or diversify into other agricultural activities (Albert & Ekine, 2012; Albert *et al*, 2012). Agricultural zone 1 had an average farming experience of 28 years with the majority (30.3%) having 11-15 years; zone 2 was 29 years with the majority (52.9%) having 16-20 years and zone 3, 27 years with the majority (42.1%) having 16-20 years. The pooled average oil palm farming experience was 28years. This indicates that the farmers were experienced in the oil palm farming operation. This may have led to accumulated knowledge and understanding of the local environment and they may possess insight around the climate variations. This experience may center on familiarity with some existing technologies and practices within oil palm production and it may serve as foundation for integrating new advancement, leading to a smoother adoption process (Ajuwa *et al*, 2024).

Table 1: Socio-economic characteristics of the respondents

S/N	Socioeconomic Characteristics	Agricultural Zone 1 (n=66)			Agricultural Zone 2 (n=17)			Agricultural Zone 3 (n=202)			Pool (n=285)		
		F	%	$\bar{X}$	F	%	$\bar{X}$	F	%	$\bar{X}$	F	%	$\bar{X}$
1	**Marital Status**												
	Single	12	18.2		1	5.9		6	3.0		19	6.7	
	Married	50	75.8		13	76.5		173	85.6		236	82.8	
	Divorced/Separated	4	6.1		1	5.9		13	6.4		18	6.3	
	Widowed/Widowered				2	11.8		10	5.0		12	4.2	
2	**Gender**												
	Male	42	63.6		8	47.1		125	61.9		175	61.4	
	Female	24	36.4		9	52.9		77	38.1		110	38.6	
3	**Age (Years)**												
	21-30	6	9.1					9	4.5		15	5.3	

	31-40	14	21.2		4	23.5		16	7.9		34	11.9	
	41-50	16	24.2	48 yeas	1	5.9	50 years	87	43.1	50 yeas	104	36.5	50 years
	51-60	15	22.7		12	70.6		53	26.2		80	28.1	
	61 and above	15	22.7					37	18.3		52	18.2	
4	**Educational**												
	Non-formal Education	6	9.1					1	0.5		7	2.5	
	Primary Education	30	45.5		7	41.2		54	26.7		91	31.9	
	Secondary Education	11	16.7		8	47.1		101	50.0		120	42.1	
	Tertiary Education	19	28,8		2	11.8		46	22.8		67	23.5	
5	**Household Size (Persons)**											100.0	
	1-3 p	17	25.8	6	1	5.9	6	19	9.4	6	37	13.0	6
	4-6 p	41	62.1	persons	16	94.1	persons	145	71.8	persons	202	70.9	persons
	7-9 p	8	12.1					38	18.8		46	16.1	
6	**Experience (Years)**												
	Less than 5												
	6-10	0	25.8					9	9.4		9	3.2	
	11-15	4	30.3		1	5.9		10	17.8		15	5.3	
	16-20	7	21.2		1	52.9		21	42.1		29	10.2	
	21-25	9	10.6	28 years	2	35.3	29 years	24	8.4	27 years	35	12.3	28 years
	26-30	17	9.1		4	5.9		36	10.4		57	20.0	
	Above 30	29	3.0		9			102	11.9		140	49.1	
7	**Monthly Income (₦)**												
	20,000-40,000	6	9.1					12	5.9		18	6.3	
	41,000-61,000	18	27.3					12	5.9		30	10.5	
	62,000-82,000	18	27.3	70000	7	41.2	84000	66	32.7	80000	91	31.9	78,000
	83,000 and above	24	36.4		10	58.8		112	55.4		146	51.2	
8	**Type of Oil Palm Production**												
	Wild Palm Grove	40	60.6		12	70.6		162	80.2		214	75.1	
	Improved Oil Palm Estate (Medium scale)	24	36.4		5	29.4		37	18.3		66	23.2	
	Improved Oil Palm Estate (Large scale)	2	3.0					3	1.5		5	1.8	
9	**Other sources of income**												
	Petty trading	30	45.5		14	82.4		122	60.4		166	58.2	
	Internet marketing	1	1.5					1	0.5		2	0.7	
	Civil servant	9	13.6		1	5.9		13	6.4		23	8.1	
	Livestock farming	13	19.7		2	11.8		38	18.8		53	18.6	
	Fish farming	13	19.7					28	13.9		41	14.4	

Source: Field Survey, 2023.

Types of organizational structure of oil palm management

Table 2 shows that the majority (62.5%) operates a sole enterprise management system. This result indicates that most oil palm producers run their businesses as sole proprietorships which suggest that their management style is quite customised. This type of management system allows complete control over their business operations and decision-making. Managing larger operations alone might be difficult, sole companies may be indicators of smaller-scale activities. Regrettably, sole owners may have trouble accessing finance, resources, and knowledge, which could have an effect on their efficiency and production. However, 24.9% of the respondents operate commercial management system. The existence of a sizable percentage with a commercial management system suggests the existence considerably organized and perhaps larger-scale activities (6%) operate as partnership management. Higher productivity is projected to result from commercial enterprises improved access to capital, cutting-edge technology, and skilled labour. Accordingly, 3.9% operated as public sector management, while 2.8% operate as cooperatives. Also, 49.8% of the oil palm producers had individual land ownership. This suggests that support in the form of loan access; training and technology adoption can help individual farmers enhance production and sustainability and 18.9% communal land ownership. Clearly, programs supporting community-based management practices and dispute resolution can boost the success of communal land use. The method of oil palm processing adopted was the semi mechanized (88.1%) while 11.9% adopted the manual method. The minimal government and public sector ownership imply a need for more active involvement in providing infrastructure, research and extension services to support all land ownership arrangements. The government can adopt policies that facilitate land access, give subsidies, and encourage sustainable behaviours across diverse ownership types. The result in overall, demonstrate the necessity of focused interventions and systems of support that take into account the various management structures used in Rivers State's oil palm production. Greater efficiency, sustainability, and growth can be achieved by the industry by attending to the distinct demands and potentials of each model (Dallinger, 2011 cited in Albert, 2013).

Table 2: Types of organizational structure of oil palm management in the study area

Organizational Structure	Agricultural Zone 1 (n=17)		Agricultural Zone 2 (n=66)		Agricultural Zone 3 (n=202)		Pool (n=285)	
	Freq	%	Freq	%	Freq	%	Freq	%
Management System								
Sole enterprise management system	30	45.5	11	64.7	137	67.8	178	62.5
Communal management system	26	39.4	5	29.4	40	19.8	71	24.9
Public sector management system	5	7.6	0	0.0	6	3.0	11	3.9
Partnership management system	3	4.5	0	0.0	14	6.9	17	6.0
Cooperative society	2	3.0	1	5.9	5	2.5	8	2.8
Type of Land Ownership								
Individual land ownership	27	40.9	10	58.8	105	52.0	142	49.8

Communal land ownership	15	22.7	4	23.5	35	17.3	54	18.9
Joint land ownership	5	7.6	1	5.9	35	17.3	41	14.4
Government land ownership	5	7.6	1	5.9	12	5.9	18	6.3
Private sector (company land)	14	21.2	1	5.9	15	7.4	30	10.5
Type of Oil Palm Processing Adopted								
Manual method	4	6.1	0	0.0	8	4.0	12	4.2
Semi mechanized.	54	81.8	15	88.2	182	90.1	251	88.1
Mechanized full mechanized	8	12.1	2	11.8	12	5.9	22	7.7

Source: Field Survey, 2023.

Farmers' Perceived Benefits of the Oil Palm Management and Production among the in study area

The result in Table 3 indicates that all items were agreed upon excluding increased revenue to government ($\bar{X}$=1.84). This could be due to the fact that the result had shown earlier that government is poorly involved in oil palm production and management in the study area. The result on operational and ownership structures in table 4.5 reflected from the type of land ownership that government was the least with 6.3%, it also reflects from the management system that public management of oil palm production was 3.9%. There is consequently a serious necessity for government increased involvement in oil palm production and management so as to increase its revenue from oil palm production. Furthermore, it shows that increased yield had the mean score of $\bar{X}$=2.68. This is not far-fetched from the high adoption of Tenera which is known for its high output level. Table 3 also showed that employment generation had the mean score of $\bar{X}$=2.67, improved quality of produce ($\bar{X}$=2.56), improved food security and reclaiming water land both ($\bar{X}$=2.47) and increased farmers' income ($\bar{X}$=2.45). These were all accepted as benefits of oil palm production and management in the study area. The result indicates great benefits hence oil palm production and management has benefited the people in the study area (Anyandiji *et al*, 2014).

Table 3: Farmers' Perceived Benefits of the Oil Palm Management and Production

Perceived Benefits of the Oil Palm Management and Production	Agricultural Zone 1 (n=17)			Agricultural Zone 2 (n=66)			Agricultural Zone 3 (n=202)			Pool (n=285)		
	TS	MS	RM	TS	MS	RM	TS	MS	RM	TS	MS	RM
Increased yield/output	17	2.7			2.6		54	2.6		76	2.6	
	9	1	A	45	5	A	1	8	A	5	8	A
Improved quality of produce	16	2.5			2.5		51	2.5		72	2.5	
	9	6	A	44	9	A	6	5	A	9	6	A
Increased farmers income	15	2.4			2.3		49	2.4		69	2.4	
	9	1	A	40	5	NA	9	7	A	8	5	A
Improved standard of living	15	2.2			2.1		47	2.3		66	2.3	
	0	7	A	37	8	A	3	4	A	0	2	A

Revenue generation to government	130	1.97	NA	30	1.76	NA	363	1.80	NA	523	1.84	NA
Employment generation	167	2.53	A	42	2.47	A	553	2.74	A	762	2.67	A
Reclaiming of waste lands	149	2.26	A	38	2.24	A	518	2.56	A	705	2.47	A
Improvement of food security	159	2.41	A	39	2.29	A	507	2.51	A	705	2.47	A
Improved management skills	156	2.36	A	37	2.18	A	432	2.14	A	625	2.19	A

Source: Field survey, 2023.

Decision rule Means score ≥ 2.0 = Accepted (A); Means score < 2.0 = Not Accepted (NA)

Factor analysis result on the challenges faced by oil palm producers in Rivers States regarding the adoption of technologies in oil palm production

Table 4 shows the results of extracted factors of the rotated component matrix based on the responses of challenges faced by oil palm producers in Rivers States regarding the adoption of technologies in oil palm production. Four challenges factors were extracted based on the responses of the respondents namely economic (factor 1), institutional (factor 2), technical (factor 3) and environmental (factor 4). Loaded high under economic factor (1) are: high cost of land (0.376), lack of access to credit and loan (0.489) and poor funding of the agricultural sector (0.588). Oil palm production requires massive landmark, urbanization and the acquisition of land by estate evaluates has led to high cost of land in the state. Moreover, access to credit and loan from financial; institutions such as banks and monetary houses require collateral which is a big challenge to oil palm farmers. Loadings under institutional factors (factor 2) include inadequate extension service rendered (0.557) and poor institutional backing (0.452). Poor institutional backings like good government policies taxa reduction could encourage oil palm farmers to remain in the business and also attract more farmers into the business. factor 3 (technical factors) were: lack of improved seeds and seedlings (0.358), lack of storage facilities (0.501), high cost of agro-chemicals (0.461), high cost of processing machines (0.477) and lack of skill to manage modern machines by farmers (0.417). Based oil palm production equipment such as storage facilities, improved seeds and seedlings, agro-chemicals to prevent pests and processing machines; including managerial skills is necessary for the sustainability of the industry. Finally, the loading under factor 4 (environmental factors) was Infestation of pest and diseases (0.477).

Table 4: Factor analysis result on the challenges faced by oil palm producers in Rivers States regarding the adoption of technologies in oil palm production

challenges Factors	**Factor 1** (Economic Factors)	Factor 2 (Institutional Factors)	**Factor 3** (Technical Factors)	**Factor 4** (Environmental Factors)
Inadequate extension Service rendered	0.201	**0.557**	0.289	0.099
High cost of land	**0.276**	0.283	**0.451**	0.296
lack of access to credit and loan	**0.489**	0.211	0.211	0.047
lack of improved seeds and seedlings	0. 219	0.147	**0.358**	0.205
Lack of storage facilities	0. 222	0.156	**0.501**	0.041
High cost of Agro-Chemicals	0.224	0.159	**0.461**	0.182
High cost of processing machines	0.239	0.121	**0.477**	0.041
Infestation of pest and diseases	0.212	0.223	0.210	**0.377**
Lack of skill to manage modern machines by farmers	0.223	0.219	**0.417**	0.159
Poor funding of the agricultural sector	**0.588**	0.102	0.032	- 0.015
Poor institutional backing	0.218	**0.452**	0.233	0.038

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
Rotation converged in 7 iteration
Source: Field Data, 2023

H_{O1}: Socio-economic characteristics of the respondents do not significantly affect the adoption of oil palm technologies

The result in table 5 shows the multiple regression analysis on the effects of the socio-economic characteristics of the respondents on the adoption of oil palm technologies. The result showed that the Coefficient of Determination (R^2) was; 0.758, 0.612, and 0.652 for the linear model, semi-log model and double log model, respectively. Consequently, the linear model was chosen ahead of the semi-log model and the double-log model. The result of the linear model showing a coefficient of determination (R^2) = 0.758 shows that a 75.8% variation in the adoption of oil palm technologies

was explained by variation in socio-economic characteristics. The remaining 24.2% were explained by other variables not included in the model. This shows a good fit. Additionally, the test of significance conducted and presented in table 4.9 shows that: Sex had a probability value = 0.411 > 0.05 level of significance. Consequently, the null hypothesis is not rejected, meaning that sex had no significant effects on the adoption of oil palm technologies. The fact that sex was not a major factor would implies that both male and female farmers had similar levels of technology adoption. This could suggest gender neutrality in the perception and application of agricultural technologies in the region. Age had a probability value = 0.021 < 0.05 level of significance, consequently, the null hypothesis is rejected, and concluded that age significantly affected the adoption of oil palm technologies. The significance of age shows that different age groups have varying levels of technology adoption. Younger farmers might be more open to adopting new technologies due to better experience with current tools, whereas older farmers might rely more on traditional approaches. Table 5 also showed that marital status had a probability value = 0.582 > 0.05 level of significance. Therefore, the researcher cannot reject the null hypothesis and concluded that marital status had no significant effect on the adoption of oil palm technologies. The insignificance of marital status shows that being married or single does not significantly influence a farmer's decision to adopt new technology. This shows that family structure does not play a key impact in technology adoption decisions. Education had a probability value = 0.000 < 0.05 level of significance. Consequently, the null hypothesis is rejected and concluded that education significantly affects the adoption of oil palm technologies. The significance of education implies that farmers with greater levels of education are more inclined to accept new technology. This underscores the significance of educational initiatives and training to boost technology adoption rates (Ademola, 2015). Household size had a probability value = 0.003 < 0.05 level of significance. Accordingly, the null hypothesis is rejected and concluded that household size had a significant effect on the adoption of oil palm technologies. A larger household sizes with family members not available for farming activities can lead to the adoption of non labour intensive technologies. This factor's significance shows that family labour dynamics play a role in technology adoption (Danquah and Amankwah, 2017). The farming experience of the respondents had a probability value = 0.000 < 0.05 level of significance; therefore, the null hypothesis is rejected and concludes that farming experience had a significant effect on the adoption of oil palm technologies. Experienced farmers might be more willing to accept innovations as they have a greater awareness of the possible benefits and are more proficient at integrating new approaches into their activities. Monthly income had a probability value = 0.000 < 0.05 level of significance; thus, the null hypothesis is rejected and concluded that monthly income had a significant effect on the adoption of oil palm technologies. The significance of income suggests that financial capacity is vital for adopting new technology. Farmers with higher incomes are better positioned to invest in new technology, indicating a need for financial support or subsidies for lower-income farmers (Eleawa *et al*, 2022). Type of oil palm production had a probability value = 0.000 < 0.05 level of significance; thus, the null hypothesis is rejected and concluded that type of oil palm production had a significant effect on the adoption of oil palm technologies

Table 5: Multiple Regression analysis results on the effects of socio-economic characteristics of the on the adoption of oil palm technologies

	Linear Model			Semi-log Model			Double-Log Model		
Variables	Coeff	t-cal	PV.	Coef	t-cal	PV.	Coef	t-cal	PV
(Constant)	-1.278	-6.513	.000	-.230	-5.080	.000	-.218	-4.517	.000
Sex	.047	.824	.411	.009	.721	.471	.039	.940	.348
Age	.127	2.321	.021	.025	1.959	.051	.183	2.493	.013
Marital Status	.036	.551	.582	.009	.626	.532	.054	.698	.486
Educational Level	1.172	17.047	.000	.174	10.989	.000	1.260	11.997	.000
Household Size	-.159	-2.976	.003	-.033	-2.706	.007	-.267	-3.674	.000
Farming Experience	-.104	-6.273	.000	-.024	-6.279	.000	-.168	-7.363	.000
Monthly Net Income	.246	10.168	.000	.057	10.150	.000	.342	12.288	.000
Type of Oil Palm Production	.131	4.386	.000	.035	5.041	.000	.089	3.402	.001
R	0.871			0.783			0.808		
R-Square	0.758			0.612			0.652		
F-Cal	108.2			54.51			64.69		
Sig F-	0.000			0.000			0.000		

Source: Field Survey, 2023

a. Dependent Variable: Adoption of oil palm technologies

*=Significant difference (P≤0.05), NS = Not significant (P > 0.05)

H_{O2}: There is no significant difference in the challenges to the adoption of oil palm production technologies by farmers in the three agricultural zones in Rivers State

Table 6 presents the summary of the analysis of variance results on the challenges to the adoption of oil technologies among the three agricultural zones in Rivers State. The results showed F-calculated = 1.272 with a corresponding PV = 0.282 > 0.05, therefore, the null hypothesis cannot be rejected. It is consequently concluded that there is no significant difference in the challenges to the adoption of oil technologies among the three agricultural zones in Rivers State. The implication is that the farmers in all three agricultural zones experienced similar hurdles to technology adoption. This shows that the issues are systemic and pervasive rather than restricted to specific places**.** Al**so,** since the issues are similar throughout the zones, interventions and policies developed to address these challenges can be standardized and executed uniformly across the entire state. This facilitates the design and deployment of solutions uniformly as solutions that work in one zone are likely to be effective in the others, making successful programs easily scalable. This could lead to faster and more extensive improvements in technology adoption rates (Nwafor *et al*, 2013).

Table 6: Analysis of Variance Results on the Difference in the Challenges to Adoption of Oil Palm Production Technologies among the Three Agricultural Zones in the Study Area

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.254	2	.127	1.272	.282
Within Groups	28.182	282	.100		
Total	28.437	284			

Source: Field Survey, 2023

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CONCLUSION AND RECOMMENDATIONS

This study concludes that there are oil farmers who are involved in oil palm production. Their involvement is influence by monthly income, years of experience, household size and type of oil palm production. The study identified that the management of the oil business showed ownership structure of individual and partnership pattern. Oil palm producers' involvement in oil palm production has led to benefits like income generation, household domestic usage; skills acquired by farmers, employment created and market opportunities. However, the adoption oil palm production technologies and production of oil palm in the study area are faced with some challenges such as land ownership system, farm input supply patterns, finance, etc. Based on the findings, the study recommends that state and local governments should make favourable policies and programmes on oil palm industry as aiding input support incentives, improved seeds, fertilizer subsidy, and granting of single digit loan to oil palm farmer with long term moratorium or payback period.

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