MARKET
DEVELOPMENT
IN THE NIGER DELTA

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MAPPING OF OIL PALM CLUSTERS IN NIGER DELTA STATES OF NIGERIA

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ABBREVIATIONS AND ACRONYMS

BMP = Best management practices

CPO = Crude palm oil

CPKO = Crude palm kernel oil

FFA = Free fatty acid

FFB = Fresh fruit bunches

GAP = Good agricultural practices

Ha = Hectare

Kg = Kilogram

L = litre

LGA = Local Government Area

MT = metric tonne

MT/Ha = Metric tonnes per hectare

NIFOR = Nigerian Institute for Oil Palm Research

OER = Oil extraction rate

Pa = per annum

PK = Palm kernel

PKO = Palm kernel oil

Qty/pa = Quantity per annum

MT/ha = Tonnes per ha

MT/ha/yr= Tonne(s) per hectare per year

Yr = Year

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Executive Summary

Market Development for the Niger Delta (MADE), a project funded by the Department for International Development (DFID) commissioned this mapping of oil palm clusters to provide investment information and support the promotion of improved practices, both in field and post harvest and provide potential information for the improvement of the oil palm sector.

There was a high number of growers and producers in Edo, Rivers, Delta, Abia and Akwa Ibom states. Bayelsa state had the lowest number of growers and producers. Gender mix is predominantly masculine, indicating that there is opportunity for greater female participation. The predominant farm size in Abia, Akwa-Ibom, Bayelsa and Ondo was less than 2 hectares; this means that small operations in scattered locations may reduce efficiency but give prospective buyers of FFBs many options from which to buy at any point in time. Larger areas may not mean increased commercialization, but it increases availability of FFBs available for interested buyers.

Top FFB locations across the region are Ovia North East and Ovia South West in Edo State, others as identified in the survey are Ukwuapu Village, Ukwa West LGA of Abia State, Otuaba Village in Ogbia LGA of Bayelsa State, Eziorsu Village in Oguta LGA, Imo State, Etok Uruk Eshiet in Etim-Ekpo LGA of Akwa-Ibom State and Ogunmodede Camp in Owo LGA of Ondo State. In general from actual production of oil palm, Abia, Edo, Ondo, Rivers, and Cross River are leading; while the highest potential for yields from the survey responses were in Abia, Imo, Delta, Cross River and Edo states.

Group action varied with location and although number of cooperatives may not strongly affect investors' decision making because small-scale entrepreneurs quickly coalesce once they realize that there are potential benefits if they work in groups.

Farmers showed high willingness to be trained, provided the knowledge transferred would be relevant to their farming. Training was done by various parties including MADE partners; these are existing arrangements that could be tapped-into by potential investors. In the clusters surveyed, the willingness to pay for training varied from state to state (high in Cross River, Delta, Edo, Imo, Ondo and Rivers). In these clusters, the adoption of best management practices varied among states, with Ondo, Akwa-Ibom, Abia and Imo being high at 97.18%, 74.58%, 65.48% and 63.08% respectively.

There is a high dependence on manual on manual labour for land preparation among clusters surveyed. This is largely because of cost of mechanical land preparation and unavailability of the service as well as ignorance of susch service. The unmet need for agricultural mechanization represents a bundle of investment openings in the region.

Clusters in Abia, Akwa Ibom, Bayelsa and Rivers had dura variety because many of them relied on volunteer seedlings for the establishment of their farms and the high preponderance of natural and semi natural grove palms in these states. In Edo state oil palm farms are cultivated and in most cases with *tenera* variety, largely due to the presence of NIFOR and its activities, Okomu Oil palm Plc and Presco in the state. The most important factor that informed farmers' choice of varieties to plant was oil content, followed by short duration of maturity. The Single Pole & Cutlass (SPC) device was the most used in harvesting and most of the output (up to 97%) is sold either directly to a processor or through aggregators, who sell to selected processors.

Overall, the production of oil palm is highly profitable because net margin from palm oil ranged from 138% in Delta to 400% in Ondo, 451% in Rivers and 464% in Akwa-Ibom; lower margins resulted from the high cost of planting.

Most of the processing mills were very close to farming clusters because the mills are small, manual and labour-intensive businesses near the homestead. The semi-mechanized small and

medium scale mills process 1 – 5 Mt of FFBs per day while the fully automated line has an installed capacity of at least 10 tons per day. The Technology Adoption Grant (TAG) fund launched by MADE in November 2016 exemplifies an initiative that would catalyse access to improved palm oil processing technologies.

Processors, apparently due to poor linkage and insufficient market information, sell the bulk of their palm oil to dealers who aggregate the product in different markets for onward conveyance to other markets. Accordingly, any investor who establishes proper and efficient structures for the purchase of FFBs from farmers and palm oil from small-scale processors, especially if collections are well arranged and properly timed, would have developed a huge activity along the value chain.

Less than 2% of processing facilities are of industrial scale. Processing constraints include paucity of fabricated parts, poor technical know-how to handle maintenance, insufficiency of FFBs, poor market linkage and lack of power supply.

The mapping exercise revealed at least five support services necessary for development of the oil palm sector; the services, in decreasing frequency of mentioning by the farmers are access to finance, access to improved oil palm varieties, linkage to agro-dealers, mechanized and affordable land preparation services and improved transportation services. Others are extension services and linkage to processors.

Investment opportunities available include production of high quality seedlings, training for farmers (farmers in the clusters are willing to pay for training), private mechanization services, commercialization of extension services, sale of fertilizers and agrochemicals, financial services, transportation, machinery and services and lastly, activation of new marketing routes as well as outlets for the farmers.

INTRODUCTION

The oil palm is native to West Africa and has from time immemorial been exploited in Nigeria and, in particular, the Niger Delta region. Palm oil is a major part of the diet of the people of the region and is the major source of cooking oil. It is intertwined with the economy of the people of the region. Along with other cash crops such as cocoa, groundnut, palm oil was a major source of export revenue for Nigeria before the ascendance crude petroleum as the major foreign exchange revenue for the government of Nigeria in the 1970s

Nigeria was before 1965, the largest producer and exporter of palm produce. The country effectively lost this position following the civil war of 1967 – 1970, such that by 1974, Nigeria went out of the export market and became a net importer of palm oil. The bulk of palm produce in Nigeria during Nigeria's dominance of world production and trade, came from exploitation of the country's vast natural groves which abound in the Niger Delta. With the rapid expansion of the cultivation of the crop in estate plantations in South East Asia, notably, Malaysia, Indonesia and Thailand as against the low levels of investments at industrial scale as well as small and medium scale, Nigeria now ranks fifth in global production (Table 1.)

Table 1: Palm Oil Production ('000 MT) in the Top 11 producing Countries in 2017

Rank	Country	Production ('000 MT)
1	Indonesia	38,500
2	Malaysia	20,500
3	Thailand	2,700
4	Colombia	1,680
5	Nigeria#	1,250# 970 (IM)
6	Guatemala	740
7	Ecuador	593
8	Honduras	545
9	Papua New Guinea	530
10	Ghana	520
11	Cote d'Ivoire	415

Source IM = Index Mundi 2018 # Author's estimate

Although the oil palm industry in Nigeria has expanded significantly away from wild grove exploitation to small medium and industrial scale plantations since the 1970s, the country today contributes less than 2% of global palm oil production and has remained a net importer of cooking oils. Despite the country's ranking as one of the world leading producers of palm oil, Nigeria has since 1974 ceased to be an exporter of the product, except for the small quantities which is exported to Nigerians in the diaspora.

The dominant small producers are inefficient and are often not able to produce palm oil of the quality required for refining and industrial uses. Nonetheless they occupy a significant segment of producers of domestic cooking oil.

In a recent effort to stimulate the local oil palm industry in Nigeria, the Central Bank of Nigeria in 2015, as an incentive to local producers, included palm kernel, palm oil products and vegetable oils among the exclusion list of items not valid for foreign exchange at the Nigerian Foreign Exchange window (Emefiele, 2015). By this policy, importers of palm oil and its derivatives are required to independently source their foreign exchange for the purpose. This is in addition to the tariff of 35% on imported crude palm oil (CPO) in complement to the policy on prohibition of importation of refined palm oil and other vegetable oils.

Nigeria's local demand for palm oil (mostly for domestic use) far out strips production. Thus, the foreign market is no longer an incentive for growth of the industry. On the other hand, Nigeria imports significant amount of its demand for palm oil as shown in Table 2 below

Table 2: Estimated value (USD million) palm oil imports into Nigeria 2013 – 2016

Source of import	2013	2014	2015	2016
	Value in '000,000 US $			
Legal import	261.3	546.9	374.3	278.3
Grey import (unaccounted - estimated)	538.7	253.1	425.7	521.7
Total	800.0	800.0	800.0	800.0

Source: ITC. trademap.org

With a current production estimated at 980,000 – 1,250,000 MT per annum, Nigeria's palm oil production fall far short of its demand estimated at 2,500,000 MT (given a population of 194 million and consumption of 12.5 kg per caput, FAO STAT). This thus implies a deficit of about 1,250,000 MT.

Local demand for crude palm oil (CPO) is also driven by the huge refining capacities in the country (Table 1.3), which is not met by the quality of palm oil produced by the small and medium holders. The growing noodle industry in the country has also greatly driven the demand. The much of local production capacities of CPO that can meet the quality demanded for refining is produced by the large industrial estates such as Okomu Oil Palm Plc, Precso in Edo State, SIAT Nigeria Ltd in Rivers State, PZ Wilmar in Cross River State, Agri-Palm (FMN) in Edo State, IMC in Delta State, JB Farms in Ogun and Cross River State and Araromi-Aiyesan Estate in Ondo State. Given this scenario, most of the local refiners often resort to importation of CPO from Indonesia and Malaysia and sometimes along the land borders from neighbouring West African countries, which is thought to be transshipments from Indonesia and Malaysia. The Plantations Owners Forum of Nigeria (POFON) has been in the vanguard of fighting these importations which sometimes come from land borders as disguised transshipments. Some of these refineries such as Golden Oil Industries have capacities for refining other oils such as Soyabean Oil, and palm kernel Oil as well as margarine plants.

Table 3: Some Functioning Local Refining Capacity in Nigeria in 2018

		CPO CAPACITY (MT)	
Refinery	Location/State	Daily	Annual *
Presco	Benin City, Edo State	100	20,000
Golden Oil Industries Ltd	Onitsha, Anambra	650	130,000
Sudit	Ibadan, Oyo	100	20,000

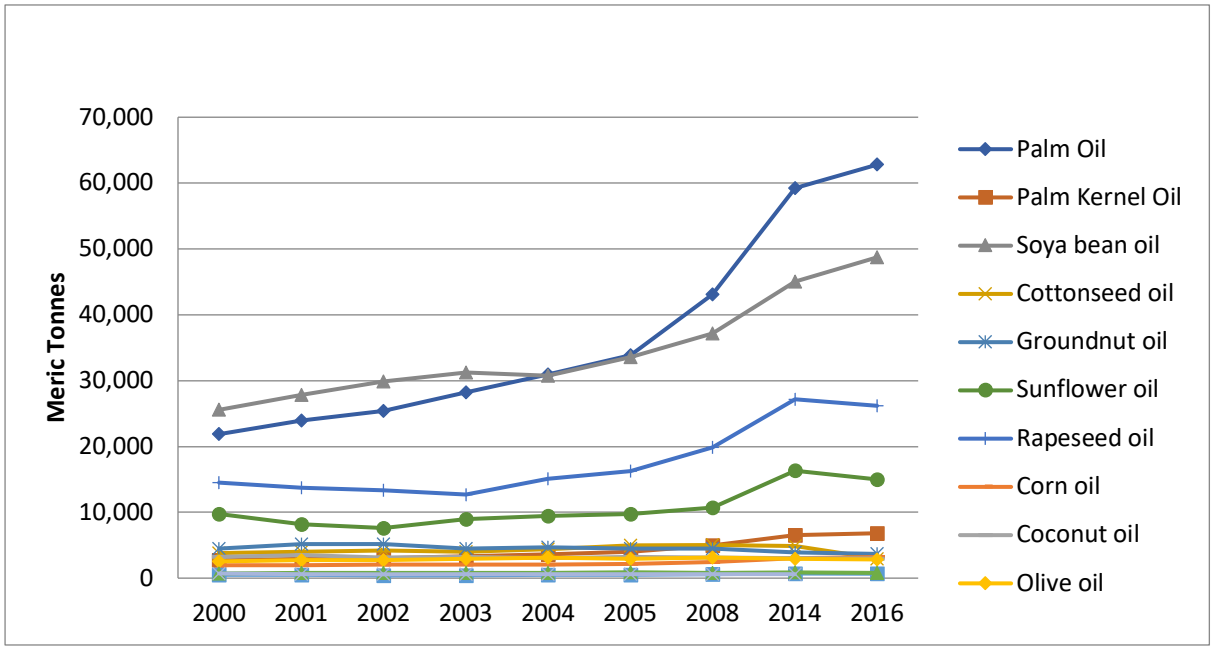
Dufil	Lagos	1,500	300,000
Rom Oil (FMN)	Ibadan	100	20,000
Nosak	Lagos	200	40,000
PZ	Ikorodu, Lagos	1,000	200,000
Total		3,650	730,000

*** Assuming 200 working days**

The Global Scene

The global palm oil production has grown tremendously since the mid to late 1990s with large scale expansion in Indonesia and Malaysia resulting in palm and palm kernel oils now dominating the world production and trade in the commodities. Palm oil is now the major cooking oil having overtaken soybean in terms of production and trade since 2004 (Fig 1).

Figure 1: Palm Oil Production Trend



In 2017, palm oil and palm kernel oil accounted for about 50 million metric tonnes of the about 85 million metric tonnes of total oil and fats traded against the about 12 million metric tonnes of soyabean oil traded in the same period. During the same period, palm oil and palm kernel oil had ratio of export to production of 70%, far higher than any vegetable oil.

The Oil World Annual Statistics and those of MPOB show that global production of palm oil doubled in a decade from 20.625 million in 1999 to 43.118 million tonnes in 2008 rising to 68 million MT in 2017 (Table 2). During the same period, production in Indonesia tripled from an annual output of 6.25 million tonnes in 1999 to 19.3 million tonnes in 2008 (Fig 2), thus consolidating the dominance of Asia in global output.

Africa contributed a mere 3.8% of global palm oil production in 2017 against Indonesia's share of 54.3% or Malaysia's share of 29.3% during the same year.

Figure 2: Major Producers of Palm Oil 1999-2016

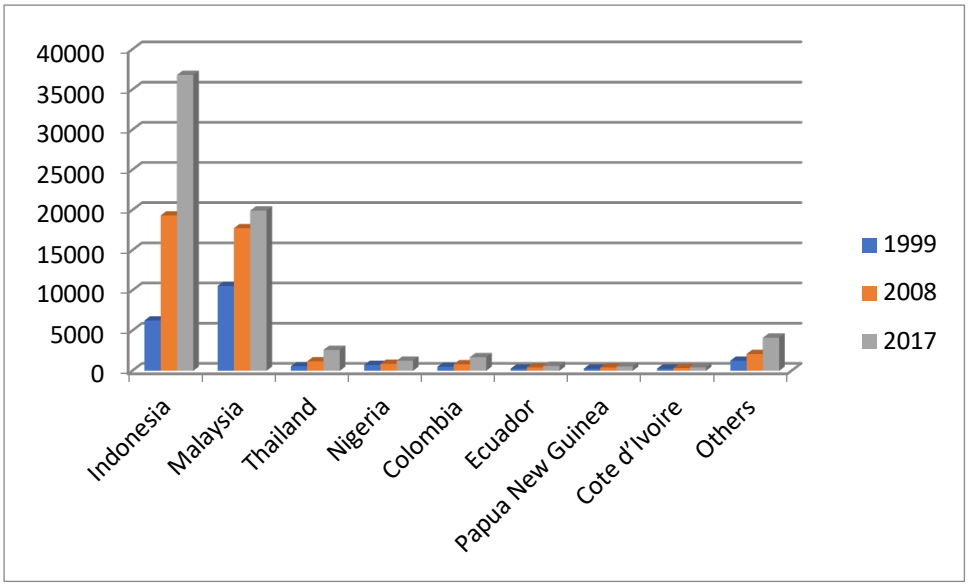


Table 4 Changes in Palm Oil Production in Some of the Major Producing Countries 1999-2017 ('000 tonnes)

Country	1999	2008	% Growth 1999 - 2008	2017	% Growth 2008 - 2017
Indonesia	6,250	19,330	209	38,500	99.2
Malaysia	10,554	17,734	68	20,500	15.6
Thailand	560	1,170	109	2,700	130.8
Nigeria	720	860	19.4	970 or 1,250#	12.8 or 45.3
Colombia	500	800	60	1,680	110
Ecuador	263	415	58	593	42.9
Papua New Guinea	264	400	51.5	530	32.5
Cote d'Ivoire	264	330	25	415	20.5
Others	1,250	2079	66.3	1702 or 1982	-18.1 or -4.7
Total	20,625	43,118	109	67,870 or 68,150	57.4 – 58.04

Palm oil is a very important part of the food culture of Nigeria and other West and Central African countries, where the people have since time immemorial utilized it in their food and exploited the

tree in their natural groves as part of the forest/ecosystem. In Nigeria as in other parts of West Africa, the greater part of the crop is still produced in the natural and semi natural groves and small holders than in large estates compared to South East Asia where it is largely produced in large estates.

Oil Palm and Environment in Nigeria

The rapid and continued expansion of the industry in Southeast Asia has attracted enormous environmental concerns globally, notably among environmental and climate change lobbyists (Koh and Wilcove, 2007, Danielsen et al 2008), and perhaps producers of other competing oils and fats who have vigorously highlighted and showcased the negative impact of oil palm development.

What must be noted is that the oil palm has traditionally been an exploited tree crop in the groves of the ecology of the oil palm belt in Nigeria. Its cultivation as a crop in monoculture in small, medium and industrial holdings in Nigeria is estimated to be less than 600 000ha. Given this scenario, oil palm as crop outside the natural and semi natural groves occupies less than 2.4% of the area under forest cover in Nigeria. However this must be weighed against the land area in the rain forest belt of the country which is the major area of oil palm production.

Table 5: Area ('000 ha) under arable and permanent crops, forests (2016) and planted oil palm (2016) some oil palm producing countries

Country	Land Use					
	Total	Forest	Arable	Permanent crop	Oil Palm in 2017	Oil Palm as % of Forest**
	'000 ha					
Indonesia	181,157	111,700			11,400	10.2
Malaysia	32,855	22,995			5,810	25
Cote d' Ivoire	31,800	10,435	2800	2,800	215	2.06
Ghana	22,754	5,286	4100	2,400	350	5.67
Nigeria*	91,077	10,269	36500	3,000	600	4.19

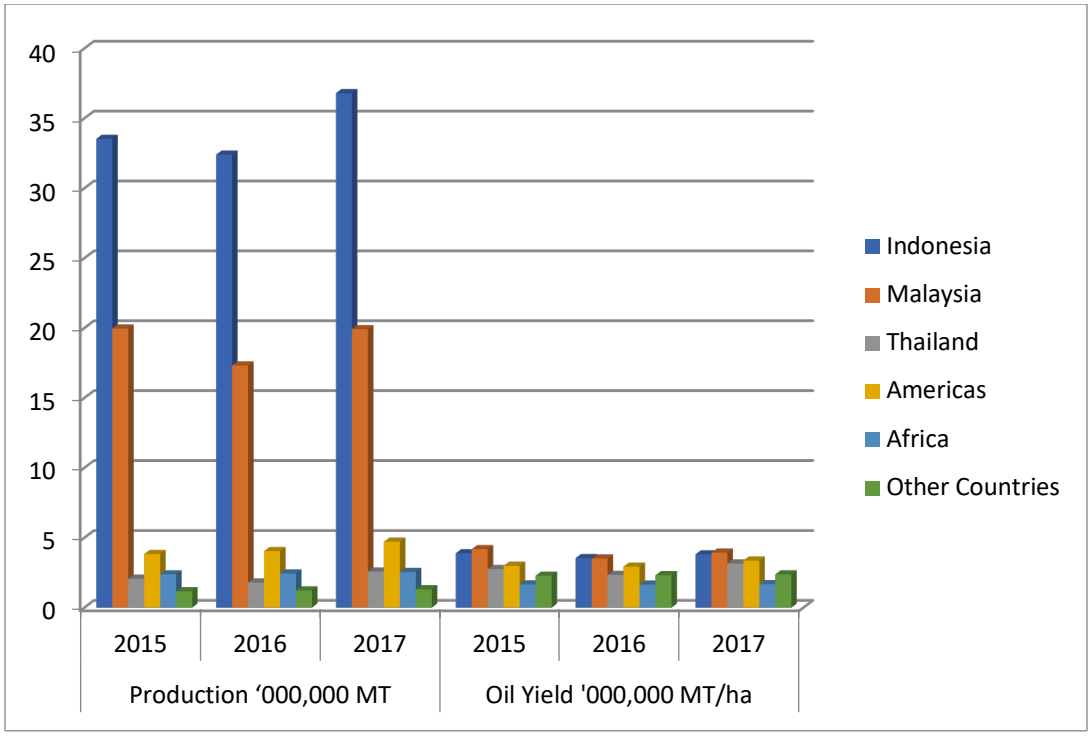
Source: FAO Statistics 2018, Nature Economy and People Connected 2018, World Data Atlas
*Outside the natural semi and wild groves, Authors computations.

Sometimes the contending issues of the negative environmental catastrophe brought on by the oil palm are overstated and do not consider the socio-economic benefit the crop has brought on to rural economies in producing countries. They also seem to overlook the seeming inbuilt environmental and energy efficiencies of the oil palm system highlighted by Basiron (2007). Ng (2009) for instance, contends that palm oil is a more earth friendly oil than soybean oil because to replace palm oil with soybean oil would require nine times more land to produce same amount of oil. In the contention of Ng, to do so would cause a greater deforestation of monumental scale. While the growth of the industry has remained slow and far less spectacular in Africa than in the South East Asia, global attention to the issues of forest depletion due to oil palm has nonetheless received the same wide attention it has received in South East Asia which seek to curb the expansion of the industry in Africa.

Oil palm yield and productivity

Benchmarked against South East Asian producing countries, productivity of oil palm in Nigeria and West Africa is low (see Fig 1.4) due mainly to use of unimproved planting materials by farmers, poor agronomic practices, and processing techniques. In the oil palm belt of Nigeria, the oil palm exists in home steads, wild and semi wild natural groves, small and medium scale and industrial plantation systems. Even where farmers use the right improved genetic materials, poor agronomic management result in their being unable to achieve the genetic potential of the materials.

Figure 3: Palm Oil Production and Yield



Generally it is difficult to measure the average productivity of the small holders, mainly due to poor record keeping among them and the source of materials they cultivate. Usually FFB output among them range between 6 – as high as 18 MT FFB/ha/year. In a case of best management, producers may attain as high as 18 MT FFB/ha/year. In other cases, where agronomic management is poor, and the materials planted are of doubtful source FFB output may be as low as 5 MT FFB/ha /year. The industrial plantations achieve as high as 15 – 25 MT FFB/year.

Oil palm in the Niger Delta

The Niger Delta Region lies within the major oil palm belt of Nigeria, accounting for about the greatest area under oil palm and the greatest volume of palm oil and palm kernel production in the country.

The major industrial scale plantation estates in the country are in the Niger Delta Region. These are listed in the Table below. The region also has the largest number of small and medium holder producers.

Table 6: Major Oil Palm Holdings in the Niger Delta

State	Estate	Size (ha)	Ownership
Edo	Okomu Oil Palm Plc	33,112	Publicly quoted
Edo	Presco	38,000	Publicly quoted SIAT
Edo	Agri-Palm (FMN)	4,574	Flour Mills Nigeria
Edo	A&Hatman	3,500	Private
Edo	Aden River	8,000	Private
Edo	Saturn	10,000	Private
Delta	Presco Cowan estate	0	Presco
Delta	IMC	3,500	Private
Delta	Rainoil	500	Private
Rivers	Risonpalm SIAT	16,000	SIAT
Bayelsa	Bayelsa Palm	1,483	Bayelsa State
Cross River	PZ Wilmar	26,500	PZ Wilmar
Cross River	JB Farms	7,000	Private
Cross River	Boki Oil Palm	1,735	State
Cross River	Nsadop	1,280	State
Cross River	Real Oil	2,000	Private
Akwa Ibom	Akwa palm	1,250	State
Abia	Abia palm	2,553	State
Imo	Ada palm	4,340	State
Ondo	Okitipupa Oil Palm	12,474	State + Publicly quoted
Ondo	Araromi-Aiyesan	3,500	Private
	Total area	**180,801**	

Market segmentation of palm oil in Nigeria

There are four palm oil and palm kernel products produced and marketed in Nigeria. They include

1. The low quality oil known as Technical Palm Oil (TPO), which is sold as unprocessed oil for traditional use, meaning it is essentially consumed by households. This is typified by the high free fatty acid (FFA) content. Usually palm oil with FFA higher than 5 - 6% is considered as TPO, because it is not easily amenable to industrial refining . TPO often results from storage of FFBs for a long time before milling, during which period enzymatic activities in the fruits result in build up of FFA;
2. The high quality oil called Special Palm Oil (SPO), which is usually produced by large mills and used by industries. SPO has low FFA content often less than 5 – 6 %. SPO is easily bleached and amenable to refining;
3. The Palm Kernel Oil (PKO) derived from the kernel of the fruit and used by industries; and
4. The refined, b;eached deodorized oil (RBD), which is refined palm oil from which colours and smells are removed by a refining and fractionation process

Effect of post-devaluation changes in the sector especially on price, processing, and production

Nigeria's deficit in pam oil supply of up to 1,250,000 MT in today's current international price of 650 – 700 US would amount to USD 812m to USD 875m. Assuming an importation of value of only USD 800m as shown earlier in Table 2, the country still incurs losses in huge foreign exchange. Before 2015 and 2016, the average price of CPO in the Nigerian market was about 240,000 to 280,000 naira per metric tonne. With the CBN policy in 2015 mentioned previously, and devaluation in the wake of 2015 and 2016, it has been shown that the industry witnessed higher profitability as exemplified by the financial reports of the country's two largest organized plantations. At some time during this period CPO price ranged between 400,000 – 600,000 naira per metric tonne. These plantations reported gross profit margin of more 50% and operating profit in the range of 30 – 40%. In 2016, these companies reported gross profit margin of more than 70%. This represents a gross margin of N280,000 per tonne of crude palm oil at a price of N400,000 per tonne. This is exemplified in Okomu Oil Palm Plc's reports of 2014 – 2017 as shown below

Table 7: Palm Oil Profitability Analysis

	Year							
	2014		2015		2016*		2017*	
		%		%		%		%
Income (N' billion)	6.63	100	9.73	100	14.36	100	20.26	100
Gross Profit (N' billion)	3.60	54	5.4	54	5.90	41	11.14	55
Net Profit (N' billion)	1.18	18	2.82	29	4.96	34	8.925	44

* Revenue from palm products and rubber are not disaggregated for 2016 and 2017 data.

Source: Okomu Oil Palm Plc, 2014, 2015, 2016 and 2017 Annual Reports and Accounts.

Market segmentation of Palm Oil and Palm Kernel Oil

Within Nigeria's palm oil market, four major palm oil products are recognized and they include:

1) The low quality palm oil known as Technical Palm Oil (TPO), which is sold as unprocessed oil for traditional use, meaning it is essentially consumed by households. This is typified by the high free fatty acid (FFA) content. Usually palm oil with FFA higher than 5 - 6% is considered as TPO, because it is not easily amenable to industrial refining. TPO often results from storage of FFBs for a long time before milling, during which period enzymatic activities in the fruits result in build up of FFA. This type of oil is accepted and prefered in the local cuisine;
2) The high quality oil called Special Palm Oil (SPO), which is usually produced by large mills and used by industries. SPO has low FFA content often less than 5 – 6 %. SPO is easily bleached and amenable to refining;
3) The Palm Kernel Oil (PKO) derived from the kernel of the fruit and used by industries; and
4) The Refined Bleached Deodorized Oil (RBD), which is refined palm oil from which colors and smells are removed[1].

Prior to field exercise, industry sources had highlighted the existence of an additional kind of palm oil, the crude palm kernel oil, which extracted from the kernels and is light yellow and crude; that is, the product is usually subjected to refining before usage. The main chemical composition is lauric acid.

Outlook

Nigeria's policy objective in the oil palm industry is to increase production in order to meet the domestic demand[2]. Half of total national output comes from the Niger-Delta Region; the sector is dominated by smallholders who account for over 80% of production and who harvest naturally-growing low-yielding mainly dura variety occupying 74% of area under production. However, while the wild and semi natural grove palms constitute 74% of area under exploitation, the other 26% is comprised of medium and small holders and industrial estate plantations, adopting mainly

[1]GAIN (2014): Global Agricultural Information Network Report, USDA Foreign Agricultural Service: Nigeria Provides Export Market for Oilseeds and Products; Prepared by Uche M. Nzeka, June 3, 2014

[2]Gourichon H, 2013. Analysis of Incentives and Disincentives for Palm Oil in Nigeria; Technical Notes Series, MAFAP, FAO, Rome

improvd tenera variety, even though many of the small holders have mixtures of improved and unimproved unselected varieties, which are low-yielding. Nevertheless, the region has clusters with a high concentration of improved oil palm varieties, which can potentially maximise the efficiencies of production and adopt improved technologies when deployed in such clusters, where they could positively impact the income of the smallholder farmers.

Market Development for the Niger Delta (MADE), a project funded by the Department for International Development (DFID) uses the 'making markets work for the poor' (M4P) approach to generate pro-poor and inclusive economic growth in the non-oil sectors of Nigeria's Niger Delta Region. MADE engenders change, improved performance, sustainability, and pro-poor growth in selected markets by: a) choosing and working in sectors where poor entrepreneurs of both genders are actively involved; b) motivating market actors to change their behaviour in a sustainable and catalytic way; and c) enabling access to new knowledge, information, services and/or technologies to small/medium-scale farmers and other entrepreneurs.

MADE commissioned the mapping of oil palm clusters and socioeconomic features of the oil palm value chain actors within clusters in the Niger Delta states. The mapping exercise was aimed at providing investment information and support the strategic promotion of the improved harvesting and processing technologies and Best Management Practices (BMP) that will impact economically and socially on the farmers and provide potential information for the development of the oil palm sector.

Objectives of the Mapping Exercise

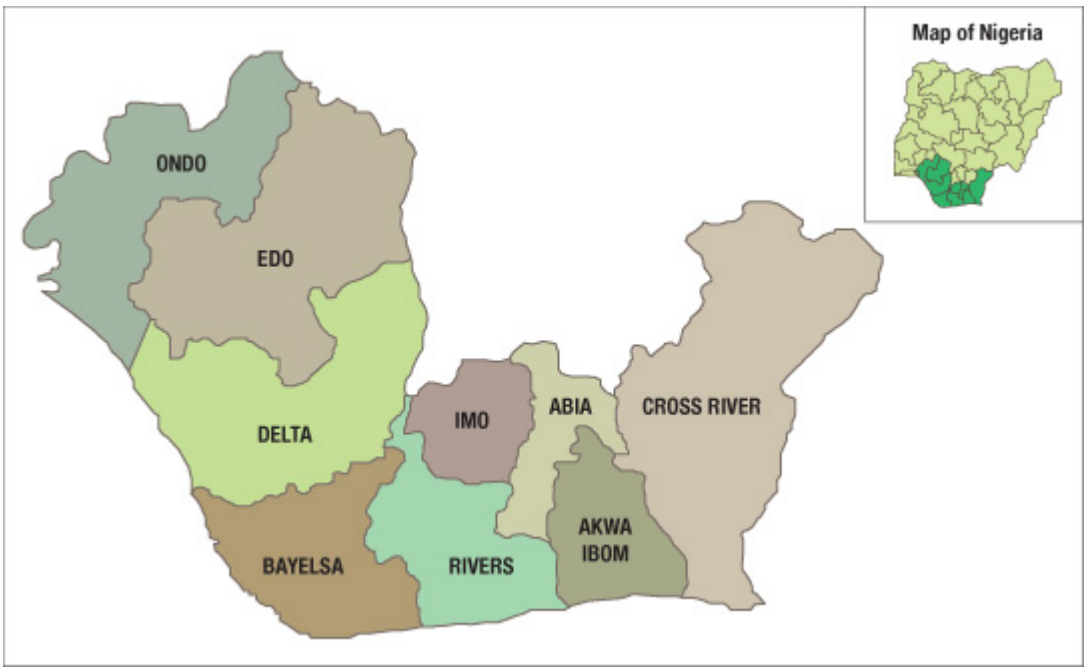
a) To identify and map-out all identifiable clusters within the nine states in the Niger Delta. The analysis should show the production structure across the states in terms of scale sizes (big, medium and small farms and farmers), contribution of women in terms of farm gate marketing mostly of small scale holders, and prominence of culture of the agricultural system;
b) To highlight the social and demographic features of key participants in the oil palm value chain
c) To ascertain the understanding of potential clusters to promote improved technologies covering best practices in field management, harvesting and processing
d) To identify essential processing facilities for intermediate oil palm products such as Crude Palm Oil (CPO) and so on, keeping in mind the production technology distribution in terms being modern or old, as well as their capacities in the Niger Delta and environs;
e) To locate critical market support services within the region and identify the perceived gaps and opportunities for investment in critical support services, which are essential to the development of the supply chain; and
f) To identify industrial end-users of oil palm products and derivatives within Niger Delta and environs

METHODOLOGY

Based on the need to develop oil palm production across the whole geo-political region and in line with the Scope of Work, in undertaking this mapping exercise, the following procedure was adopted:

Leading Oil Palm Producing States in the Niger Delta

The selected study area had a direct bearing on the research methodology adopted, especially in relation to the high level of oil palm value chain activities. The Nigerian oil palm belt covers twenty-four states, including all nine states of the Niger Delta[3]; therefore all the nine states in the Niger Delta were covered under the oil palm mapping exercise. The states are Abia, Akwa Ibom, Bayelsa, Cross River, Delta, Edo, Imo, Ondo and Rivers, as indicated on the map below.



Detailed Study on Location and Features of Oil Palm Clusters and Processing Facilities

a) Collection of secondary data by reviewing existing literature (largely from NIFOR) to garner important facts related to the palm oil value chain within the Niger Delta area;

b) Identification of various locations of high yielding oil palm variety in the nine states of the Niger Delta;

c) Train enumerators to properly administer the questionnaires and the GPS mapping devices;

d) Collection of primary data from farmers and processors, using structured questionnaires administered by trained enumerators in prescribed locations. These

[3]PIND (2011): A Report on Palm Oil Value Chain Analysis in the Niger Delta, page 1; Foundation for Partnership Initiatives in the Niger Delta

include demographics, yield, seasonality, variety grown and marketing information (who they sell to currently) and average income generated from current activity level;

e) Picking GPS positions of the clusters in various locations;

f) informant interviews with selected value chain actors;

g) Obtain data on the prices paid for various season, the method of getting the prices;

h) Obtain information on the method of delivery of palms fruits to the buyers; and

i) Collation, cleaning and analysis of data.

Preliminaries

The Survey Instruments

The core survey instrument was a structured questionnaire covering all the objectives of the mapping exercise. The questions focused on cluster location by LGAs in each state, number of oil palm farmers per cluster, farm size in hectares, membership of formal groups, networking under MADE intervention, varieties cultivated, seasonality and yield. The questionnaire also sought for the farmers' method(s) of tillage, agronomic and plantation management practices, harvest, conveyance of produce and sale outlets.

GPS-Based Data Collection

A local web-based mobile data capturing application was specifically deployed for collecting the data, its features are in the appendices.

Identification, Enlistment and Assigning of Personnel

Each of the nine states had three enumerators, who were selected from the pool of MADE's trained enumerators, based on their adequate knowledge of the targeted survey areas, individual hands-on experience in similar surveys and the ability to effectively administer the questionnaires.

A conscious effort was made to include a reasonable level of gender representation in the team of enumerators. Incidentally, females constituted 12 out of the 28 enumerators.

Capacity Building for Enumerators

Prior to field work, the enumerators were trained on the mapping exercise, contents of the questionnaires, identification of clusters and leaders, interviewing, intra-team experience sharing and handling interviewee objections. Also covered in the training are standards for measuring quantities, convertibility and uniformity of information gathered and locational differences. One staff of MADE participated in the training and highlighted the objectives of the MADE project and the significance of the mapping exercise, emphasizing the need for enumerators to properly apply the knowledge they have of their respective locations, in addition to the experience from previous MADE-related field work.

Due to the technical nature of the real-time data collection, the pre-survey orientation also included a session specifically focused on the use of android phones to collect the GPS-based data; this session, which was handled by the software/network engineer who designed the application, was a step-by-step practical training on signing-on, capturing locational coordinates, right through the processes of capturing, saving and uploading all data from the hand-held devices to the server.

Defining the Cluster

On this mapping exercise, a cluster refers to an aggregation or concentration of farmers cultivating the same crop over a location. The said collection is occasioned by factors, which may differ from state to state as follows:

a) Prevalence of oil palm cultivation in specific locations over a long period, due to suitable climatic and/or edaphic factors;

b) Design by an agency such as Ministry of Agriculture or River Basin & Rural Development Authority, which maps out specific plots of farm lands with supporting infrastructure (such as feeder roads and watering canals). The same or any other agency may also have encouraged the producers to coalesce into formal or semi-formal groups and

c) Influence of certain value chain activities such as specific crop interventions, out-grower schemes, notable markets and closeness to processing centres.

Most clusters evolved from a combination of two or all three of the aforesaid factors. Irrespective of how a crop cluster evolved, producers may or may not operate in contiguous fields and in most clusters there was someone, who could speak on behalf of all other farmers.

Identification of Clusters in the States

For correct cluster identification, we first checked with the states' Ministries of Agriculture & Natural Resources and Agricultural Development Projects (ADPs). In some cases the lists were not readily accessible. In some cases, the farmers on the lists could not be traced while in others, many of the listed names belonged to non-farmers. Therefore we also consulted reputable agro-dealers and other major value chain actors for locations of oil palm farmers. Our channels of communication with major actors in primary production of oil palm remained open throughout the mapping exercise.

During the mapping activities, continuous attempts were made to validate information on clusters, using the little amount of dependable secondary data from Ministries of Agriculture. Furthermore, in some states, we applied knowledge from interventions, for instance, USAID MARKETS (Maximizing Agricultural Revenue for Key Enterprises in Targeted Sites) the Foundation for Partnership Initiatives in the Niger Delta (PIND) and Nigerian Institute for Oil Palm Research (NIFOR). The enumerators validated from cluster heads, information on their clusters as well as other clusters in their neighborhood.

Sampling and the Basis for Selecting Respondents

The sampling was purposive as cluster leaders were the farmers selected for interviewing because they know the dynamics of their groups and are abreast with typical characteristics such as land size, inputs used, general agronomic practices, access to finance, average yields, successes attained and likely challenges facing the farmers. These vital facts would not ordinarily be available to a regular cluster member.

In each state, we targeted eighty one (81) farmers (cluster heads), drawing from our prior experience during the tomato mapping exercise for another project where we had an average of 57 clusters per state (in spite of the vastness of its cropping landscape). We projected an increase of at least 40% to arrive at number of targeted clusters for oil palm, given the wider production of oil palm. More so, since the census method of data collection was to be used, it was better to project to cover many existing clusters, however big or small.

The sampling technique, though non-probabilistic, remains most effective in cases where it is paramount to study a certain group that is adjudged knowledgeable about an issue. We

considered this approach as the most suitable if we were to practically capture more reliable records of the activities of the clusters from their members that have professional and administrative overview of their activities.

To strengthen the quality of data generated, in selected instances, the responses of the cluster heads were corroborated by gathering information from other cluster heads in a locality.

FIELD SURVEY/MAPPING OF CLUSTERS

The Mapping

As earlier highlighted, given the paucity of current data on farmers, we applied a combination of enumerators' knowledge of value chain activities in the states, secondary data from previous works and KIIs with selected personalities to identify the farmers for interviewing On reaching the field, each enumerator used the relevant entry techniques suitable for his/her place of deployment, after which the enumerator interviewed the cluster head. Real-time data (including pictures and videos) were captured after initial capturing of the GPS coordinates of each point of interview.

After transfer of information from the paper questionnaire to the web-based application using the mobile devices, it was routinely uploaded to the server. In addition, there was constant sharing of field experience and other relevant matters through the project's dedicated WhatsApp chat group for on-the-go referencing and monitoring. MADE staff included in the forum made very useful queries and provided worthwhile hints, guidance and clarifications during the field exercise.

Information on Processing Plants

Information was obtained (during the interviews and KIIs) about post-harvest value addition in each state, ownership, kinds of products, current state of operation, closeness to clusters, sources of raw materials, installed capacity and actual output (peak and off peak).

Estimating the Number of Farmers

Each oil palm cluster head was asked about the number of farmers in the cluster; information was also obtained from the cluster head on the gender composition of the total number of farmers within the cluster. Thereafter, the composition of males and females was compare with the total number he/she stated, in order to ensure that there was consistency in data collected. The summation of all the farmers per cluster for each state gave the number of farmers for the state.

Key Informant Interviews

These interviews were carried-out with selected entrepreneurs who are sufficiently experienced and knowledgeable about the palm oil value chain within their state and other parts of the Niger Delta.

Yield Analysis

The nine states in Nigeria's Niger Delta account for about 57% of total Nigerian palm oil production, a scenario that is dominated by the collection of fresh fruit bunches (FFBs) from wild groves (74% of area and about 50% of supply of FFB), followed by production from private plantations (small, and medium and large private estates, accounting for 19% of area and 34% of

fruit supply) and large corporate and government-owned plantations (about 7% of area and 25% supply of fruit)4.

Three categories of oil palm can be identified in the Niger Delta based fruit forms and output of FFBs; while the wild groves yield 1.5mt FFB/ha/year, the slightly improved estates (which consist of teneras and unselected materials), produce 3 – 5mt FFB/ha/year and in the few areas with improved tenera variety the annual production of FFBs 6.6 - 7.4/tons/ha although their potential production could reach between 15 – 18 MT FFB per ha per year . To estimate the actual yield, that is the weight of fresh fruit bunches (FFBs) of oil palm harvested in the most recent season), we took the average yield per hectare and multiplied by the total area (hectarage for oil palm only) in the cluster. In addition, we also verified inaccurate data independently from other participants in the value chain.

Post-Mapping Events

After the field work, uploading of data continued, followed by collation and cleaning; the latter exercise involved periodic communication with the field staff, re-visit to some locations, discussions with other value chain participants, corroboration with contemporary market indices and receipt of inputs from MADE officials.

The analyses undertaken were quantitative and qualitative and aimed at attaining the objectives of the mapping exercise. Prior to developing the report, preliminary results of the analyses were shared with MADE for comments.

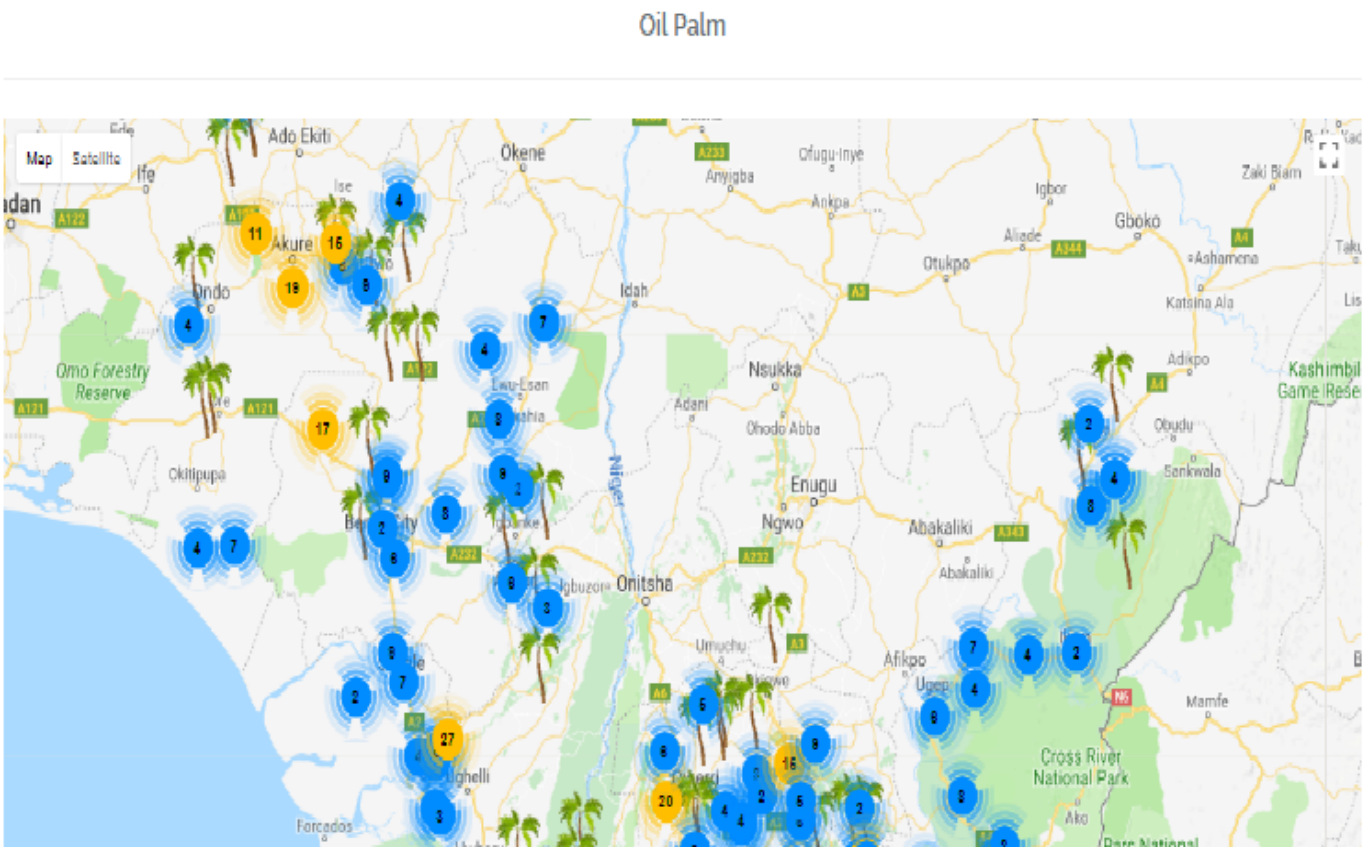
[4]PIND (2011): Palm Oil Value Chain Analysis in the Niger Delta; Foundation for Partnership Initiatives in the Niger Delta

DISCUSSION

Map of Oil Palm Clusters in the Niger Delta

The map below, which is the final product of the specifically designed web-based application, shows at a glance, the locations of oil palm clusters in the Niger Delta Region.

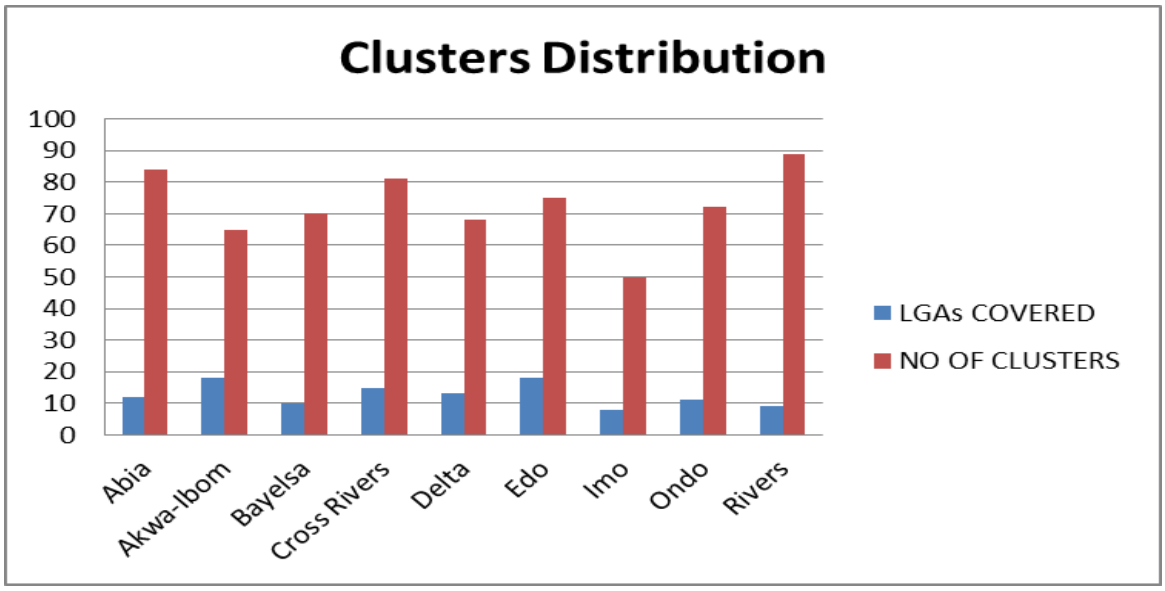
To access the page for probing, logon to www.crystalassociates.org the user ID is ganiat_tijani@dai.com with password admin@4400.



Given that a cluster denotes a collection of farmers cultivating oil palm over a location, the above cluster map shows location markers, with each marker indicating oil palm clusters. Accompanying this report is the zipped-up, specially designed web application, together with its read-me file detailing how to install and read its contents of the mapped locations.

Furthermore, the Fig. below shows on a state-by-state basis, the number of LGAs covered and total number of clusters mapped. The cluster map and the summary table jointly indicate that all the states without exception have high numbers of oil palm producers in the Niger Delta.

Figure 4: Cluster Distribution Across the Niger Delta



Invariably, the existence of farmers influences the evolution and development of a cluster. Thus, a key factor used to determine where to site a processing plant is availability of, and/or proximity to sources of FFBs. Therefore, it is availability of FFBs that attracts mills and not *vice versa.* The logical conclusion is that the existence of farm clusters in a place depends on the concentration of farmers (and plantations) in the locality.

Selected top oil palm producing clusters in the states are as follows:

Table 8: Selected Top Producers

Cluster	LGA	State	No of farmers			FFB Output/yr	Estimated area
			Total	Male	Female	MT	Ha
Ukwuapu	Ukwa West	Abia	240		0	12,000	1714
Otuaba	Ogbia	Bayelsa	3,600	3,384	216	32,400	4,630
Eziorsu	Oguta	Imo	110	60	50	13,200	1,885
Etok, Uruk Eshiet	Etim Ekpo	Akwa Ibom	25	15	10	1,500	215
Ogunmodede Camp	Owo	Ondo	75	50	25	1,350	193

For additional clarity, the tables in the appendices have been used to highlight the top five oil palm clusters in each of the nine Niger Delta states, noting the number of farmers, gender mix, land area cultivated and total yield.

An unaccredited oil palm nursery operator near NIFOR; sources of his seeds are doubtful (Auwalu, 2018).

Demography of Clusters of Oil Palm Producers in the Niger Delta States

Number of Farmers and Gender

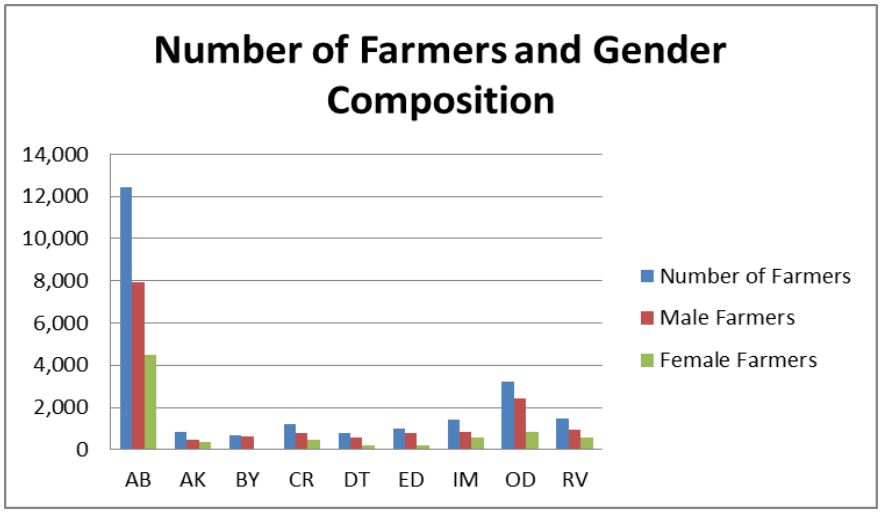
In each state, the number of farmers captured under the mapping is the sum of the farmers under each of the clusters mapped; this implies that (as reflected in the Table 4.1 below), the inter-state difference in the number of farmers per cluster resulted in the variation in total number of farmers per state.

Table 9: Number of Farmers and Gender Composition

	AB	AK	BY	CR	DT	ED	IM	OD	RV
Number of Farmers	12,434	811	659	1,210	793	996	1,431	3,226	1,491
Number of Clusters Mapped	84	59	84	81	76	78	65	71	91
Male Farmers	7,933	470	603	761	570	799	840	2,411	944
% Male Farmers	63.80	57.95	91.50	62.89	71.88	80.22	58.70	74.74	63.31
Female Farmers	4,501	341	56	449	223	197	591	815	547
% Female Farmers	36.20	42.05	8.50	37.11%	28.12	19.78	41.30	25.26	36.69

Of the clusters mapped, Abia state has the highest number of oil palm farmers (12,434) with a single LGA (Ukwa-West) accounting for 3 out of the top 5 clusters in the state. Although such a concentration is not peculiar to Abia alone, the long-existing adoption of technological innovations in oil palm could have encouraged the closely-situated farmers to continue sharing traditional knowledge and techniques and grow in numbers, albeit under conditions of inefficiency in resource use.

Figure 5: Number of Farmers and Gender Composition



In Ondo state, 3,226 farmers were recorded in the clusters mapped. The presence of such high number of farmers, may have been influenced by the existence of three major oil palm estates Okitipupa, Ore-Irele and Araromi-Ayesan). The Okitipupa Oil Mill for instance, was established in 1968 but after having virtually ceased production, there are now over 1,500 small-scale oil palm processing businesses across the state[5]. These small scale processors employ simple semi mechanized equipment comprising mainly cut out drums for cooking/sterilization of fruits, fruit screen, diesel engine powered digesters and curb presses. This state-wide market for FFBs could have encouraged the growth in the number of small-scale farmers who are the potential suppliers.

The clusters mapped in Edo, Akwa Ibom and Delta States had fewer farmers (996; 811 and 793 respectively) with Bayelsa having far less farmers (659). The only semi-mechanized oil palm mill owned by the Bayelsa state government has been idle and efforts to revitalize and expand the facility are being resisted by the local people that hitherto owned the acquired land[6]. Under such a scenario, small-scale farmers' zeal for oil palm cultivation may be stifled, since the anticipated major off-taker of FFBs is currently constrained, unless there is an intervention that is private sector-driven. Moreover, the terrain and land tenure system hamper large scale development of oil palm in the state, making it the plausible reason for the comparatively low number of farmers.

Gender composition of farmers was skewed in favour of males, as it is often found in many other activities of primary production in agriculture. Female composition in oil palm production ranged from 8.54% in Bayelsa to as high as 41.3% and 42.05% in Imo and Akwa Ibom states, respectively. The low participation of females in primary production in agriculture could be due to inability to secure land and the challenge of poor access to finance. The gender mix, which is predominantly masculine, indicates that there is room for employment of more females.

[5]The Guardian Sunday Magazine, 2016: 'Diversifying the Economy – Slow Race to Revive Nigeria's Oil Palm Production"; Tabloid Edition of May 15, 2016 accessed at https://guardian.ng/sunday-magazine/diversifying-the-economy-slow-race-to-revive-nigerias-oil-palm-production/

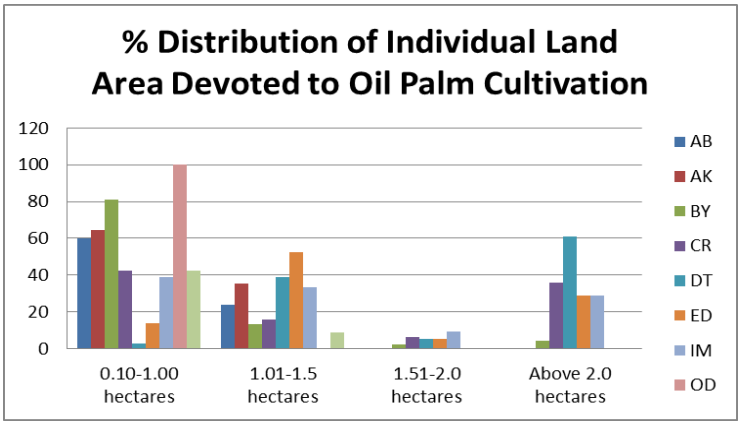
[6]The Vanguard Sunday Tabloid, 2015: Tabloid Edition of May 15, 2016 accessed at https://guardian.ng/sunday-magazine/d https://www.vanguardngr.com/2015/01/bayelsa-oil-palm-estate-waste/

Area Cultivated

The total area under cultivation for oil palm in the clusters studied was computed by multiplying farm size per cluster with total number of farmers in the cluster and the result summed-up for all clusters to get the total land area mapped per state. Abia had 9,581 ha (the largest area) under oil palm, followed by Imo (4,774ha) and then Delta (4,659ha) followed by Cross River (3,740ha) and Edo (3,472ha). These statistics show that the five states not only offer opportunities to address issues of low quality oil palm varieties but can also have widespread sources of FFBs and by extension, prospects for citing processing mills.

Fig. 4.3 below, shows an equally interesting set of statistics (average land area used in oil palm cultivation in each cluster). The predominant farm size in the clusters studied in Abia, Akwa-Ibom, Bayelsa and Ondo was 1 hectare-and-below at 60%, 64.41%, 80.9% and 100% respectively. This leads to the inference that there are many small farms scattered across locations, an indication that small operations may not allow for efficiency of individual farms, but would allow prospective buyers of FFBs have a wide range from which to select buyers at any point in time. On the other hand, Delta and Rivers had 61% and 42% in the 'above 2ha' category and while this may not necessarily mean a tilt towards commercialization, it creates openings for higher quantities of FFBs available for interested buyers.

Figure 6: Percentage Distribution of Individual Land Area Devoted to Oil Palm Cultivation



Generally, in a state with many small plantations, there may not be much room to leverage the benefits of scale economies when mechanization is contemplated, unless small technologies are deployed and formal cooperatives are increasingly strengthened amongst the farmers. In addition, while many small farms present challenges in the aggregation of FFBs, their high numbers also give a processor the convenience of staggered acquisition of raw materials over time from any sources.

The foregoing findings of the cluster mapping are in tandem with other conclusions that as many as 80% of oil palm estates in the Niger Delta are small and dispersed holdings of marginal farmers, a characteristic that precludes the farmers from enjoying the economies of scale attributable to large scale farming. This is one of the most significant challenges faced by Nigeria's oil palm industry[7].

Use of Improved (tenera variety) Seeds among producers in the Niger Delta

For purposes of this study, the size of a plantation has been estimated at 140 – 150 palms per ha. A farm size of 150 palms has been used to estimate farms where the owners have indicated.

The most reliable sources of improved seeds are NIFOR, Presco, Okomu and PZ Wilmar. Only NIFOR produces seeds in Nigeria. Although there is a group in Edo State that claims to produce seeds,that is Aliisee Ltd, its sources of seed trees are not too well known. The proprietor, Dr. F.

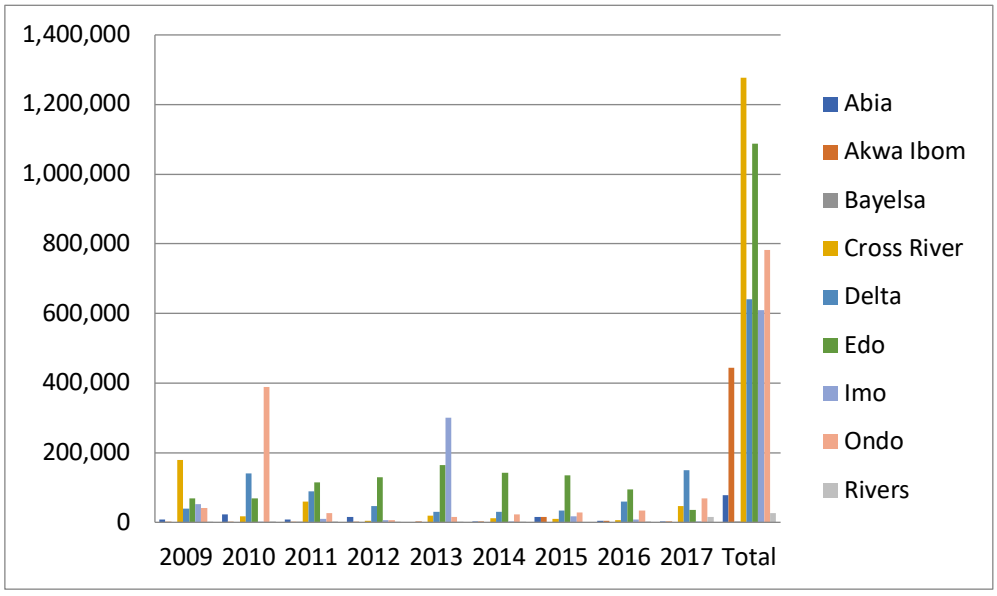
[7]BusinessDay (2013): Nigeria Oil Palm Industry Report, 2013, page 7; www.businessdayonline.com; Report Written by Ruchi Gupta and Teliat Sule

Aya retired from NIFOR in the late 1970s. It is clamed that he planted some materials obtained from NIFOR in his farm, from which he derived his seed trees. Presco, and Okomu Oil Palm Plc and other major plantations such as JB Farms, Weppa Farms, import seeds from various sources chiefly from ASD Costa Rica, Palm Elite, Ghana Sumatra, SOCFINDO Indonesia. These estates often also offer seedlings for sale to interested buyers. In 2019, Presco advertised its selling price of nusrsery seedlings at 900 naira per seedling (see *Vanguard* Newspaer of 18th March, 2019). Presco, Okomu and PZ Wilmar do not sell seeds. It is therefore unlikely that outside NIFOR and perhaps, Dr. Aya's, Allissee Global Ltd no other reputable group produces traceable seeds for the industry. However there is a multiplicity of nursery seedlings producers who obtain seeds from various sources . Largely the other possible sources of seeds are the grey markets which has proliferated around NIFOR, marketing illegitimate seeds.

Since the mid-1990s there has emerged in Nigeria a growing business on a very wide scale in oil palm sprouted seed and seedling production and marketing by quacks who cash in on the ignorance of the farmer or the unsuspecting customer to market cheap, unselected, undeveloped inferior and illegitimate planting materials. The consequence of this is that today several thousand hectares of land have been planted in Nigeria to oil palm materials which are low yielding and sometimes unproductive. It is therefore difficult to distinguish farms that cultivate the tenera variety from those that cultivate illegitimate seeds. This problem is very widespread in the Niger Delta.

In this study, farmers provided estimates of their farms as well as their years of planting. While the sources of seeds and seedlings may be doubtful, most of the respondents claim that their palms are improved materials which their suppliers claim comes from NIFOR (see the analysis in Sub-Section 5.2.4). This is buttressed by data from Seed Production of NIFOR on seeds sold and distributed across the Niger Delta states between 2008 and 2017 by NIFOR as shown in Fig. 4.4 below

Figure 7: No of Sprouted Seeds Supplied

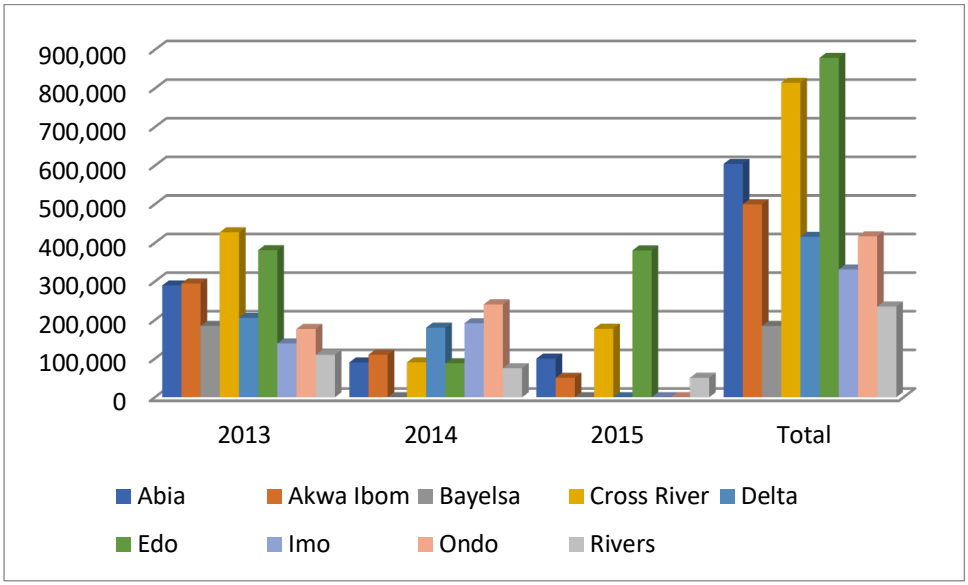


As seen from Fig. 8 (see also Table 4.1for details), Bayelsa State received the least number of seeds directly by customers with a total of only 2,700 seeds while the neighbouring Cross River State received the highest number of seeds of a total of 1,277,186 seeds within the 10 year period. During the same period a total of 4,952,186 seeds were sold directly to customers.

Assuming a 100 percent success rate to the field and a planting density of 140 palms per ha, a total of 35,373 ha would have been planted during that period. It would be safe to assume 50% success rate, hence, the new area planted would be 17,686 ha during the period.

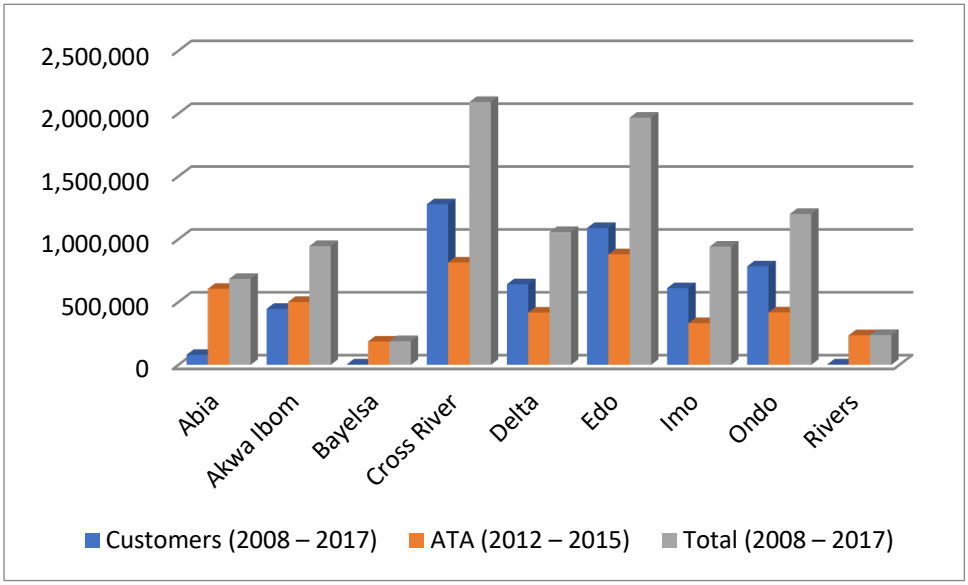
Besides the seeds sold directly to planters, the NIFOR also supplied a total of 4,378,736 seeds to major nursery operators including some plantations across the various states under the Federal Government's Agricultural Transformation Programme (ATA) from 2012 to 2015 as distributed in Fig. 4.5 below

Figure 8: Seeds Supplied Under the ATA to Major Nursery Operators



Thus, a total of 9,306,290 sprouted improved tenera seeds were supplied to the major nursery operators and private customers in these states between 2009 and 2018 as shown in Fig. 4.6 below

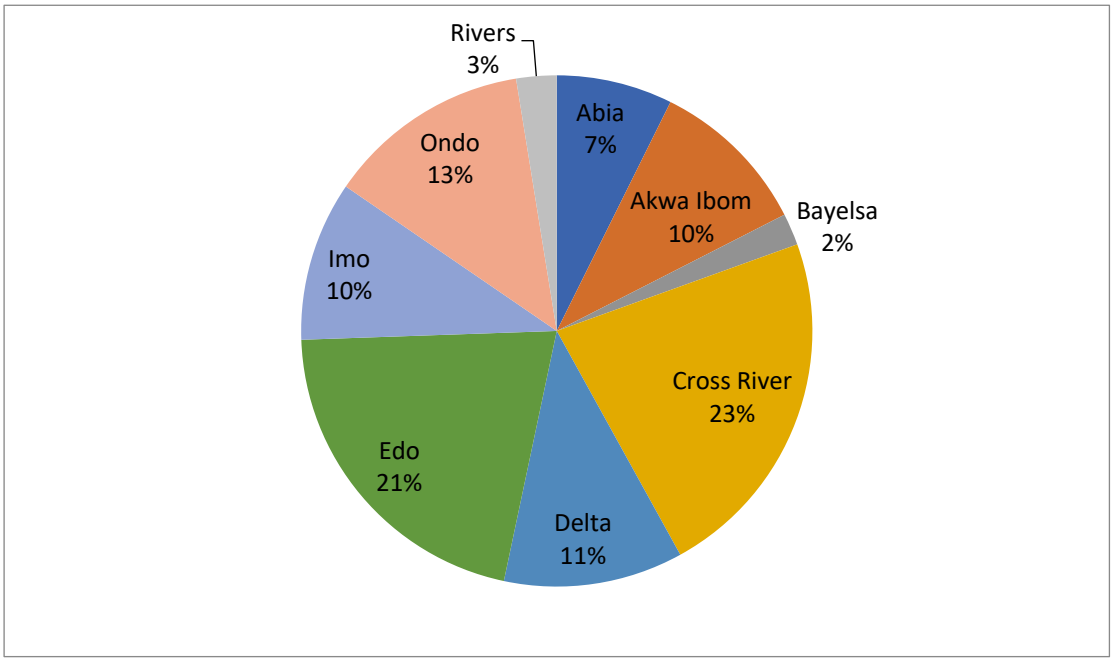
Figure 9: Combined Total Sprouted Seeds Supply to the Niger Delta



Assuming a success rate of 100% seeds to the field a total of 66,474 ha of oil palm would have been planted at a planting rate of 140 palms per ha in the region between 2009 and 2018 (Fig. 4.4). Assuming a 50% success rate a total of 33,237 ha would have been planted within the period. At maturity after 8 years of planting using the 2018 baseline assuming FFB yield of 15 MT per ha per year available FFB from these plantings would be 498,555 (see expected state by state distribution in Fig. 4.7 below). Cross River accounts for the highest estimated area to be planted

between 2009 and 2017 and consequently highest volume of FFB at maturity (after 8 years) using base year of 2018. Bayelsa State has the lowest area planted and also lowest expected FFB.

Figure 10: Estimated FFB Output



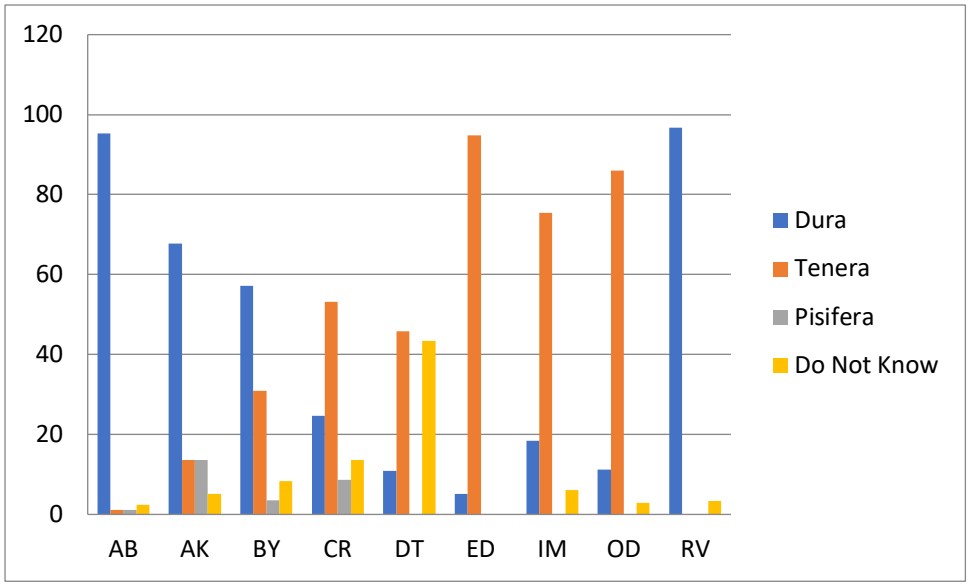
State by State Output and Milling Analysis

Oil Palm Varieties and Expected Output

Typically, yields from wild harvest (corresponding to the Dura variety) are about 1.5 tonnes of fresh fruit bunches (FFBs) per hectare. Pisifera and Tenera are the other two varieties available in Nigeria. Oil palm farmers prefer Tenera, a crossbreed between Dura and Pisifera because it can yield 30% more oil than the equivalent fruit weight of Dura[8]. During the mapping, the states with reasonable densities of tenera variety include Edo, Ondo and Imo (Fig. 4.8) due to the impact of NIFOR, while Cross River and Delta states as a result of the farmers obtaining the Seedlings from government supported programs resulting in medium scale density. However most of the producers in the other states may have sourced their seedlings from unknown sources who pass them for tenera variety. This is further analyzed in details in Sub-Section 5.2.4 below.

[8]PIND (2011): Palm Oil Value Chain Analysis in the Niger Delta; Foundation for Partnership Initiatives in the Niger Delta

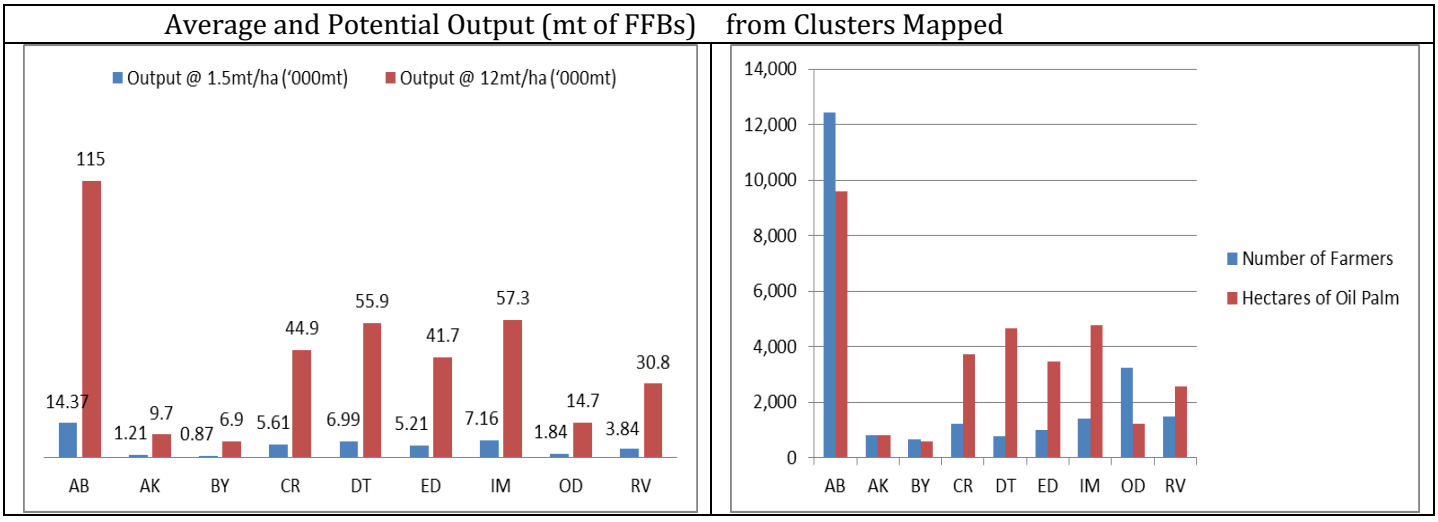
Figure 11: State by State Choice of Varieties



Oil palm plantations with slight improvement in yield (a mixture of Dura and Tenera) produce 3 – 5mt FFB/ha/year while at the peak performance, trees in the Niger Delta produce 6.6 - 7.4mt/tons/ha and above. A matured improved variety (Tenera) easily produces 12 FFBs a year weighing between 15 to 35 kg; for 150 tree stands per hectare, this is 27 – 54 MT FFB/ha/year. These yield expectations are based on normal standard of field management practices (e.g. with little or no annual application of fertilizers and other chemicals). Adoption of best practices in oil palm management is discussed in Sub-Section 5.2.5. However, in reality, farmers hardly achieve this level of yield, because of inadequate harvesting practices as well as poor agronomic practices. It is generally safe to assume that they achieve 15 – 20 MT FFB/ha/year.

Under this mapping exercise, the actual yield for the year was calculated as total hectarage under oil palm multiplied by 1.5MT. But beyond this level, yields from well-established Tenera plantations where recommended practices are being implemented can yield 15 – 25MT /year; therefore the potential yield under this mapping exercise was computed as total hectarage multiplied by 12MT (close to the lower point of the range of yield under sustained and proper adoption of good management practices) as presented in the following Fig.:

Figure 12: Average and Potential Output (mt of FFBs) from Clusters Mapped



The above figures indicate that Abia, Imo, Delta, Cross River and Edo states have the highest potentials for yields of FFBs in the Niger Delta Region, as there is a high level of activity in the oil palm value chain in these states. The figures all underscore the following potentials:

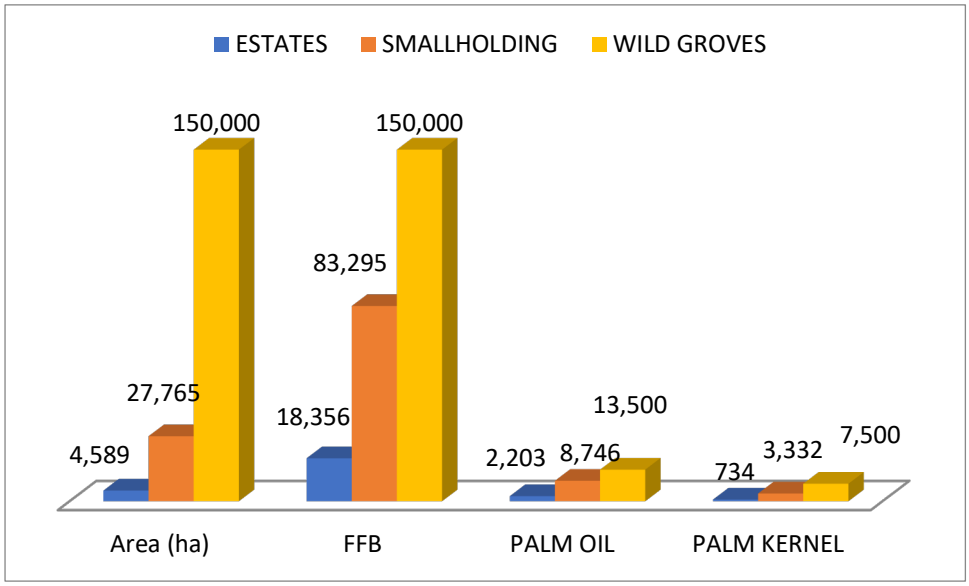
a) Critical numbers of farmers through whom intervention programmes for improved output can be carried-out;
b) Business opportunities for suppliers of various inputs;
c) Business opportunities for institutional financiers;
d) Major supplies of raw materials from the region; and
e) Opportunities for establishment of processing plants.

Output and Milling Analysis

Major Oil Palm Growers/Mills in Abia State

Using the 2009 baseline, the existing literature on oil palm production in the Niger Delta, the estimated distribution of oil palm plantings in Abia State as at 2009 is as shown in Fig. 4.10 below.

Figure 13: Abia Total Area, FFB, PO and PK Estimates



Key Assumptions

1. FFB Yields, Estates 4 Tonnes/Ha/Yr, Smallholders 3 Tonnes/Ha/Yr and Wild Groves 1 Tonne/Ha/Yr;
2. Extraction Rates: Estates 12 % Oil/Bunch, Smallholders 9-12 % Oil/Bunch and Wild Groves 9 % Oil/Bunch; and
3. Palm Kernel: Estates 4 % Kernel/Bunch, Smallholders 4 % Kernel/Bunch and Wild Groves 5 % Kernel/Bunch.

From the baseline data of 2009, it is estimated from seeds supplies to Abia State that at least 2,440 ha of new plantings would have been added in Abia State between 2009 and 2018 to the 32,354 ha of improved plantings which existed in 2009. This estimate does not take cognizance of the seeds and seedlings supplies from unknown sources. There is a high preponderance of farmers who plant volunteer seedlings from their farms and those who source their seeds and seedlings from unknown sources and quacks.

The average oil palm holding from the recent survey conducted in October/November 2018 show an average farm size of about 6 ha of plantings in the last 30 years, with a preponderance of plantings between 1998 and 2016 as shown in Table 4.2 below

Table 10: Some Oil Palm Holdings in Abia State

Name	Gender	L. G. A	Village	Farm ha	Age	FFB/Ha	Mill#
Ikenga Oil Ltd	Male	Ukwa West	Obeute	6.5	1998	13.5	6 HP
No Name	Male	Obingwa	Umuobiakwa	1.5	1993	13	NA
No Name	Male	Isialangwa South	Umuwocha-Nrosi	2	1998	13.4	NA
Mr Uche	Male	Bende	Etitiulo	5	1990	13.2	8HP
D. C. Nwele	Male	Ukwa West	Obehie	5	1999	12.5	6HP
Abia State Govt	Male	Ukwa East	Ohambele	3.5	1988	15	8HP
S.N.D. Ogwuma	Male	Isialangwa North	Ihie	6.5	2000	12	6 HP
Dr. Mrs Ojike	Female	Umuahia North		6.6	1988	14	8HP
No Name	Male	Arochukwu	Abam	5	2000	12.5	8HP
No Name	Female	Bende	Ozuitem	20	2010/2016	14.2	8 HP
			Total	61.6		133.3	8

Source: Field survey, October/ November 2018

All farms own and operate locally fabricated mills obtained from Aba, Abia State

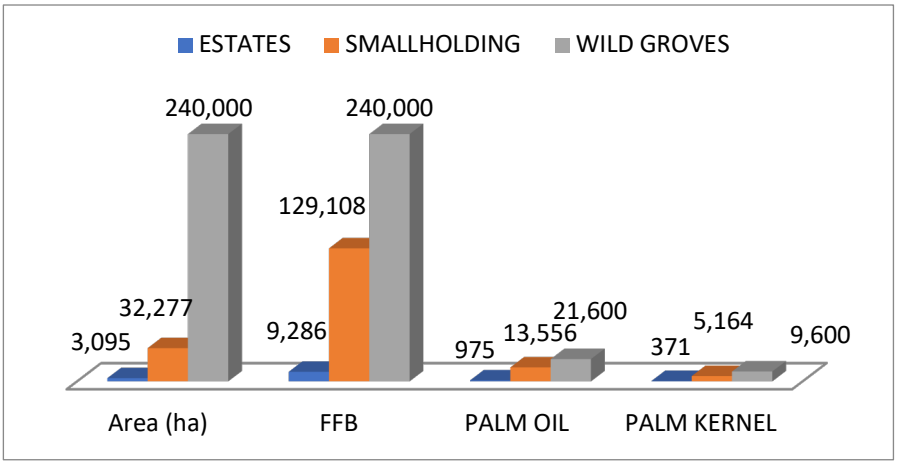
The farms surveyed in the state obtain FFB yields ranging from 12 – 15 MT/ha/year. They also buy FFBs from other growers prices ranging from N35,000 – N40,000 per metric tonne. The farms surveyed own mills which run on 6 – 8 HP diesel engines with capacities of lose fruits of about 1 MT/hour depending on th enumber of drums cooked at sterilization. The limiting factor is the capacity of the screw curb press used for presing the oil.

Harvesting of bunches from tall palms in the old farms with mature trees as common in Ukwa East and Bende Local Government Areas is by skilled climbers.

Major Oil Palm Growers/Mills in Akwa Ibom State

The estimated distribution of oil palm plantings and estimated FFBs and palm produce output from the various production systems in Akwa Ibom in 2009 is given in Fig. 4.11 below

Figure 14: Akwa Ibom total area, FFB, PO and PK estimates



Assumptions:

1. FFB yields for Estates, 3 tonnes/ha, Smallholders 4 Tonnes/ha and wild groves 1 Tonnes/Ha/Yr;
2. Palm oil extraction rate, estates and smallholders 9 -12% Oil/Bunch wild groves 9% Oil/Bunch; and
3. Palm Kernel extraction Estates and Smallholders 4% Kernel/Bunch and wild groves 5% Kernel/Bunch.

The low levels of maintenance and poor harvesting schedules account for the assumptions in estimating the total fresh fruit bunch supplies.

As indicated in Fig. 4.11 above, from seeds supplies to the state between 2008 and 2017, it is estimated that at least 3,372 ha of new plantings would have been added to the small holders system in the state as at 2018 assuming no re-plantings were made. This is also outside the seedlings supplies and unknown sources of seeds supplies to the state. While the dynamics of the production systems may not have changed significantly, there is still a high reliance on FFBs from homestead and wild groves. The major centre of wild groves FFBs and loose fruits is the Itam market.

The majority of the estimated 464 ha of improved tenera oil palm holdings surveyed range from 1 – 5 ha per holding (Table 4.3). These palms are relatively young, with the oldest being 12 years old and in the peak of production, while the youngest is 4 years and in the immature phase of yield. One of the farms operates a mill facilitated by MADE.

Table 11: Major farms surveyed in Akwa Ibom

Name of Farm	LGA	Village/Town	Coordinate	Gender	Size Ha	Age	Type
Imperial	Esit	Etebi	8.1033E 4.674N	M	450		Tenera
Samco Mills	Etinan	Ekpene Obom	7.8338E 4.8709N	M	1	10	Tenera
Slawd Peters Mill	Etinan	Ikot Ekong	8.0259E 4.8517N	M	3	10	Tenera
Okutama MPCS Ltd	Ini	Mbioabong	7.6932E 5.3450N	M	5	12	Tenera
Udom Mills	Ikot Ekpene	Abak okor	7.7429E 5.138N	M	3	10	Tenera
Michael	Essien	Ikpe Annang	7.6453E 5.1068N	M	1	4	Tenera
Joshua Idiong	Atim Ekpo	Obong Ntak	7.8558E 4.8427N	M	1	5	Tenera
Total					464		

Source: Field Survey, October, 2018

Table 12: An example of improved mill in Akwa Ibom State

Mill	Type & capacity	Source	Cost N	Fabricator	OER# %	Palm oil output /year MT
Imperial Farm	SSPE 1MT/hr	MADE	750,000	G-Tech	12	30

OER = Oil extraction rate

Loose palm fruit market at Itam-Itu, Akwa Ibom State, Coordinate: Lat 5.12.016 Long 7.58.39

Constraints of Small holder Farmers in Akwa Ibom State:

i. Weak access to improved seeds and seedlings and existence of many unknown seeds and seedlings producers
ii. Lack of access to and high cost of inputs such as fertilizers especially muriate of potash (MOP)
iii. Ineffective agricultural extension services
iv. Weak access to credit

Constraints of Palm Oil Processors

There are a large number of palm oil mill fabricators and processors. These fabricators are adept at fabricating curb presses, digesters and ancillary nut crackers. These fabricators are concentrated at Ikot Ekpene.

The constraints among the small and medium processors are the high cost of diesel, and down time in processing, labour shortage and cost. Inadequate access to capital and credit is also a constraint.

1.1.1.1 Major Oil Palm Growers/Mills in Edo State

Edo State is home to a large number of oil palm producers including large, medium and small players distributed across the state with a high concentration in Ikpoba Okha, Egor, Ovia South West and Ovia North East. Others are Uhumwode, Igueben, Esan South West and Esan Central as wel as Esan South East, Owan, Etsako West and Etsako Central and Akoko Edo Local Government Areas.

Ovia North East, Ovia South West, Uhunmwode and Orhiomwon local Government Areas are the areas of the highest concentrations of oil palm in the state. Ovia South West, Ovia North East LGAs has three major oil palm estates in the state today namely Okomu Oil Palm Plc, Flour Mills and Aden Oil Palm. Ikpoba Okha, Oredo and Uhunmwode LGA has two major plantations namely, Presco Plc and A & Hatman. These local government areas also have many small and medium oil palm farms.

The area under improved oil palm in the state has expanded significantly since 2009. As at 2009, the state had about 25,341 ha under large state holdings (Table 4.9). As at 2018, Okomu Oil Palm Plc alone has about 19,230 ha under oil palm. Outside its holdings in Cowan Estate in Delta state Presco has a total planted area of about 15,222 ha of oil palm in Oredo, Ikpoba Okha LGAs. It also has a total new concession area of 16,900 ha in Orhionwon LGA, which it is already developing. Thus these two estates alone as at 2018 had 34,450 ha which are about 10,000 ha more than the total estate holdings in the State as at 2009.

Figure 15: Production System

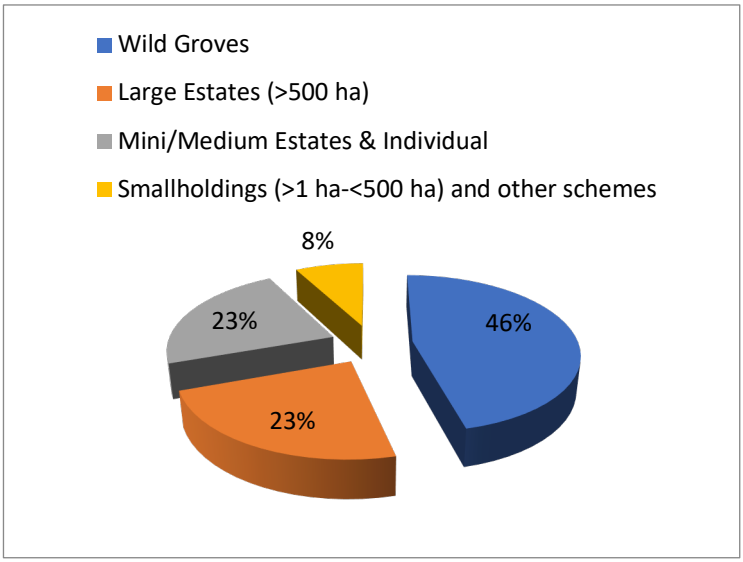
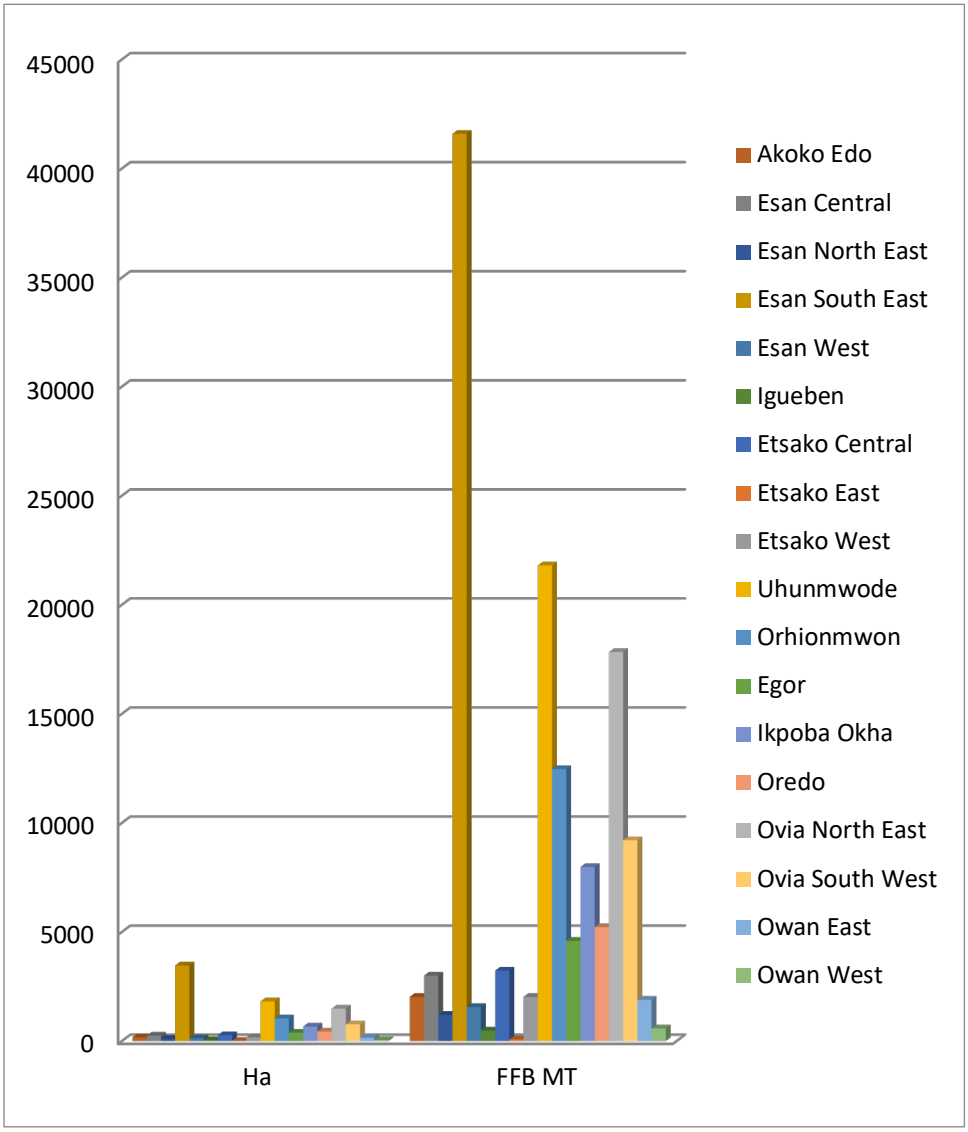


Table 13: Area under oil palm in Edo State

Production System	Hectarage
Wild Groves	50,000.00
Large Estates (>500 ha)	25,341.29
Mini/Medium Estates	24,526.21
Smallholdings	8,475.00

Small holder farmers in Edo State operate side by side the large estate holdings in the state. These small holders operate independently and the majority of them are organized in the National Oil Palm Producers Association of Nigeria (NPPAN) which has a registered membership of about 1020 who hold about 8,475 ha. Some of these members of NPPAN are also organized by the Oil Palm Growers Association of Nigeria. Oil palm growers organized in the OPGAN hold a total of 11,397 ha of oil palm as shown in the Table 4.6 below. Assuming FFB yield of 12 MT per ha per year, these clusters will potentially produce about 136,700 MT FFB per year.

Figure 17: Oil Palm Growers in Edo State organized in OPGAN



Oil Palm Clusters within 50 – 100 km radius of Okomu Oil Palm Plc

There is an estimated 767 ha of oil palm farms with estimated annual FFB output of 9,200 MT within 50 km radius of Okomu Oil Palm Plc location of Okomu Udo and about 4,501 within 80 km of Okomu Extension2 Uhiere as shown in the Tables 14 and 15

Table 14: Oil Palm farmers around 50 km radius of Okomu Udo in Ovia South West

S/N	Name	Location	Farm Size (Ha)	Telephone
1	Oviasah Stanley	Ora	50	08035826312
2	Rev. H. O. Ogienebo	Iguobazuwa	5	09030729336
3	Peter Akpokona	Gbelebu	5	08036946040
4	Chief A. P. Ebelo	Gbelebu	5	08027476926

5	Bineru Thankgod	Gbelebu	5	07051680385
6	Owuh Matthew	Gbelebu	5	08116317499
7	Johnson Adeyemi	Gbelebu	4	09050729336
8	Elkenah Duro	Iguobazuwa	4	0705279695
9	Ogienebo Eligory	Iguobazuwa	2	08111712520
10	Billy Isah	Iguelahor	400	08073366099
11	Chief Austine Macauley	Cabelebu	5	08085320070
12	Monday Okorodoe	Cabelebu	7	08061229337
13	Florence Eghonegbe	Iguobazuwa	25	08161220337
14	Dr. Isaac Imaro	Ugbogui	25	08051752444
15	Alfred Iyamu	Udo	5	08037220320
16	Ogie Mudia	Udo	30	08037220320
17	Sumy Ososohe	Iguoriakhi	10	07038912709
18	Ihama Francis	Udo	10	08060048082
19	Ebueku Osagie	Ugbogun	16	08023579335
20	Osagiede Sunday	Umaza	7	08038710568
21	Oviasah Stanley	Ora	40	08035826312
22	Chris Nehikhare	Ekenwan Village	10	08056405672
23	Owuh Michael	Gbelebu	10	08155711403
24	Binieru Ebimini	Gbelebu	7	08075726514
25	Owhe Philip Oghenefegor	Gbelebu	3	08037386512
26	Ogbaudu Francis Jonah	Okpponha	5	08166652265
27	Edegbe Omozuwa	Okpponha	6	08165396944
28	Johnbull Ajayi	Iguobazuwa	18	07064239504
29	Glorious Agbontaen	Iguobazuwa	25	07062435384
30	Iyobosa Imaribe	Okoro 1	5	08057705432
31	Akinugba Rotimi	Iguatakpa	3	08035802911

32	Vincent Eduwuirofo	Udo	5	08034381991
33	Patrick I. Ugiagbe	Udo	5	08083961133
	Total		**767**	

Source: OPGAN Edo State and Field Survey 2018

Table 15: Oil Palm Farms and Plantations within 60 km of Okomu Extension 2 Uhiere and 100 km of Okomu Udo

1	Name	Location	Phone No	GPS Coordinates	Size Ha
2	Prince Eweka	Agemopa	08161743209	N06^0 37.664' E005^0 34.354'	20
3	Mr F.A. Iyamo	Emah	08052048929	N06^0 33.134' E005^0 35.691'	8
4	Mr Anthony Otabor	Emah	08167917815	N06^0 36.029' E005^0 34.833'	80
5	Mr Enabulele	Okokhuo	07064454770	N06^0 35.746' E005^0 33.634'	40
6	Mr Osazuwa Efe	Okokhuo	08059401641	N06^0 35.860' E005^0 38.535'	1.6
7	Mr Josiah Aigbedion	Agemopa	08076792232	N06^0 37.993' E005^0 35.666'	10
8	Mr Imafidon Osemwengie	Okokhuo	08072536352	N06^0 38.356' E005^0 39.503'	6
9	Ganiyu Alimi	Agemopa	08130417056	N06^0 37.441' E005^0 34.511'	15
10	Mr Christopher Abada	Emah	08102573213	N06^0 36.004' E005^0 34.642'	2
11	Mr Cyril Erhunmwun	Okokhuo	08130957946	N06^0 36.329' E005^0 38.934'	8
12	Sunday Umukoro	Agemopa	07064454770	N06^0 35.843' E005^0 33.242'	20
13	Paul Ojo	Agemopa	08130417056	N06^0 37.723' E005^0 34.699'	4
14	Mama Dorothy	Okokhuo	08025639755	N06^0 35.842' E005^0 38.342'	8
15	Chris Odigie	Emah	07064793006	N06^0 35.614' E005^0 35.784'	50
16	Mr Fredrick Uyinmwen	Okokhuo	08024677405	N06^0 35.470' E005^0 36.579'	2
17	Mr Goddey	Okokhuo	08179744096	N06^0 37.290' E005^0 34.560'	0.8
18	Mr Efosa Uyinmwen	Okokhuo	09026312596	N06^0 35.354' E005^0 38.604'	2
19	Mr Osamudiamen Airose	Okokhuo	07084322163	N06^0 35.773' E005^0 36.393'	4.4
20	Edema Khatami	Emah	08070940066	N06^0 35.513' E005^0 32.142'	6
21	Papa Jerry	Okokhuo	08151686465	N06^0 35.819' E005^0 34.501'	5
22	Micheal Oghagbon	Emah	08167917815	N06^0 35.614' E005^0 35.784'	6.4
23	Ede Aniroro	Agemopa	07064454770	N06^0 36.329' E005^0 38.934'	4
24	Mr Sylvester Iyamu	Ugbogui	08095507259	N06^0 38.778' E005^0 18.527'	100
25	A and Hatman (Umoru Celestine)	Ighuiye	08057168068	N06^0 34.171' E005^0 28.395'	1000
26	Mr Samuel Akwa	Ugbogui	08037434438	N06^0 40.030' E005^0 15.778'	1000
27	Mr Samson	Ugbogui	08033210206	N06^0 42.992' E005^0 10.030'	2000
28			Total		4501.6

Source: Field Survey, October/November 2018

Plate: A curb press used by processors at Obareren, Ovia North East LGA Edo State

Plate: Discussions with a processor at Osasimwonba Ovia North East LGA, Edo state

Table 16 Oil Palm farms around Okomu Extension 2 Uhiere

Area around Extension 2 of Okomu Oil Palm Plc					
Name	Village	Phone no	GPS co-ordinate	Age	Size (Ha
Omoarukhe Mike	Uhuere	8096440132	N 06° 43.867' E 005° 46.819'	37	6
Aigbogun Otaniyeke	Uhiere	8171518548	N 06° 43.701' E 005° 46.752'	42	12
Aigbogun Osaasere	Uhiere	9098359110	N 06° 43.812' E 005° 47.298'	38	3
Ayebo Kole	Uhiere	9084208449	N 06° 43.794' E 005° 47.312'	45	4
Sunday Uwagboe	Uhiere	8074443526	N 06° 43.820' E 005°46.792'	42	5
Obanor Francis	Uhiere	8182731748	N 06° 43.792' E 005° 47.301'	37	5
Bello Ugbe	Oke	8109666363	N 06° 43.790' E 005° 47.321'	38	2
Tony Jimoh	Oke	8068008449	N 06° 42.005' E 005° 53.926'	42	5
Iyebor Kelvin Osadolor	Oke	8068549119	N 06° 43.812' E 005° 47.298'	40	6
Peter Atohengbe	Oke	7060538123	N 06° 42.451' E 005° 53.245'	68	500
Johnbull Ehigie	Oke	8130679009	N 06° 42.005' E 005° 53.826'	62	12
Julius Agbonhifo	Oke	9034187868	N 06° 42.555' E 005° 54.036'	55	5

Pius Imafidon	Uhiere	8182971138	N 06^0 43.812' E005^0 47.812'	58	20
Godwin Okon	Irhue	8064852278	N 06^0 41.472' E005^0 56.472'	47	2
Emmanuel Ehigator	Irhue	8064852278	N 06^0 41.432' E005^0 56.295'	44	1
Sam Okotie	Ekpan	8136268234	N 06^0 43.180' E005^0 56.660'	52	4
Osifo Vincent	Ekpan	8131944956	N 06^0 43.180' E005^0 56.660'	67	4
Stanley Onaiwu	Ekpan	8165872081	N 06^0 43.180' E005^0 56.600'	54	2
John Enadeghen	Irhue	8165872081	N 06^0 41. 475' E005^0 56.195'	45	2
Mr V.O. Omoregbe	Umokpe	9077773153	N 06^0 44.567' E005^0 57.403'	66	2
Richard Omorotionmwn	Orua	9060724018	N 06^0 46. 251' E005^0 59.086'	62	1
Aigbogie Amos	Umokpe	8074522954	N 06^0 44.567' E005^0 57.403'	57	1.5
Glory Ituah	Umokpe	7074522954	N 06^0 44.567' E005^0 57.403'	60	2
Fredrick Ehiarinmwian	Udiguetue	8091746172	N 06^0 39.985' E005^0 45.785'	48	24
Dr Ododo Akporike	Owan	8060320289	N 06^0 45. 603' E005^0 46.134'	56	2
Eyituoyor Believe	Owan	8036884504	N 06 45.603' E005^0 46.134'	52	26
Eider Godwin Odibo	Owan	8039471855	N 06^0 45.663' E005^0 46.134'	48	170
Onosigho Gaius	Owan	8066892296	N 06^0 45.605' E005^0 46.157'	44	17
Onosigho Luke	Owan	7068293387	N 06^0 45.611' E005^0 46.129'	46	10
Imonide Peter	Agbanikaka	8030813423	N 06^0 46.867' E005^0 46.589'	57	13
Dr Babatunde Segun	Owan	8030813423	N 06^0 45.621' E005^0	48	15
Babatunde Sunday	Owan	8062610309	N 06^0 45.599' E005^0 46.487'	43	10
Oviagbede Philip	Owan	8060127420	N 06^0 45.599' E005^0 46.144'	38	10
Oviagbede Abiodun	Owan	8038284369	N 06^0 45.621' E005^0 237'	40	10
Christian Efe	Owan	7058855457	N 06^0 45.618' E005^0 46.141'	45	10
Prosper Avoro	Owan	7032800900	N 06^0 45.567' E005^0 46.207'	35	10
Ekundayo Ohion	Owan	7032800900	N 06^0 45.605' E005^0 46.147'	42	10
Babatunde Bode	Owan	8034406221	N 06^0 45. 605' E005^0	48	5
Paul Oke	Owan	7063159698	N 06^0 45. 589' E005^0 46.121'	53	10
Total					958.5

A majority of producers in the state source their seeds and seedlings from NIFOR. However, there is high number of producers whose sources of seeds and seedlings are from grey markets which are unknown and untraceable. Although these grey market producers claim to obtain seeds from NIFOR, there are no records in NIFOR to show that they obtained the seeds from the Institute. With further interogation they claim conflicting sources of seeds such as Costa Rica, Indonesia, or Malaysia or Palm Elite. Given that the procedures for importing seeds and National Agricultural Quanrantine Service, these producers do not have such capacities to go through the process and none of them claim to know that Quarantine permits are required to import seeds nor do they know the process of obtaining the certificate or permit. Many patronize fake dealers of seeds and seedlings and also plant volunteer seeds from their farms which they think are from productive palms. They therefore often have mixtures of dura and tenera palms in their farms. The fake dealers often pose as agents of NIFOR to unsuspecting buyers and farmers. These many fake dealers abound around the precincts of NIFOR, where they operate by hijacking intending buyers. They also directly hawk their seeds and seedlings to farms even far beyond Edo State However, there is a growing awareness among nursery operators of the activities of these fake dealers, following senistization and training by NIFOR, and actors such PIND, MADE and SOLIDARIDAD

Most farms own some form of processing equipment made up of cut out drums for cooking and sterilization of loose fruits, diesel engine powered digesters and hand operated curb presses. Some few farmers use locally fabricated copies of the NIFOR type small scale processing equipment. Some others have also purchased their equipment directly from NIFOR. In some cases processors use a combination of some components of the NIFOR type SSPE and cut out drums and sometimes complement their NIFOR type digester- screw press with curb-press for oil extraction after cooking the loose fruits

1.1.1.2 Major Oil Palm Growers/Mills in Delta State

There are many oil palm clusters of farms and processors in Delta State, most of whom are concentrated in Agbor, Ekuku Agbor, Akumazi, Idumesa and Owa in Ika North and Ika South Local Government Area, Ukuani Local Government. Oil palm holdings surveyed across the four local government areas is 516 ha. Using an estimated FFB yield of 12 MT per ha, the expected FFB per annum among these producers is about 6200 MT (Table 17).

While many of these farms sourced their seeds or seedlings directly from NIFOR and seedlings from the state government's Small holder tree crop unit of the Ministry of Agriculture a great majority of them use their own volunteer seedlings from their farms or patronize doubtful sources. These doubtful sources often pose as agents of NIFOR to unsuspecting farmers.

Many of these farms process their FFBs into palm oil using locally fabricated mills side by side with other processors organized in Cooperatives as shown in Table 4.8

Table 17: Some clusters of oil palm farms and processors in Delta State

LGA	Famers	Estimated farm size ha	Range of size ha	Estimated FFB MT
Aniocha	17	147	0.7 - 29	1,764
Ika South	48	126	0.2 - 20	1,512
Ika North East	25	176	1 – 30	2,112

Ukuani	14	67.3	1.7 - 13	807.6
Total	104	516.3		6,195.6

Table 18: Cooperatives and Individual Palm Oil Milling Clusters in Ika South LGA of Delta State

S/No	Name	Location	LGA	Capacity MT	Activity
1	Mike Iruh	Ekuku Agbor	Ika South	40	Palm Oil Milling
2	Bienike Theresa	Ekuku Agbor	Ika South	40	Palm Oil
3	Onyeoghai MPCS LTD	Ekuku Agbor	Ika South	40	Palm Oil
4	Onyeson Ibe MPCS LTD	Abavo	Ika South	40	Palm Oil
5	Our Saviour MPCS LTD	Abavo	Ika South	40	Palm Oil
6	Chosen Farmers MPCS	Ihu Ozomor	Ika South	40	Palm Oil
7	Ekueze Palm Oil Millers	Abavo	Ika South	40	Palm Oil
8	Mr. Onyeijen Kenedy	Alihame Agbor	Ika South	40	Palm Oil
9	Mrs. Helen Aghedo	Reliance Road Agbor	Ika South	40	Palm Oil
10	Aniemeke Philip C.	Ekuku Agbor	Ika South	220	Palm Oil
11	Emuebie Festus C.	Ekuku Agbor	Ika South	416	Palm Oil
12	Clement Onyemarin	Ekuku Agbor	Ika South	354	Palm Oil
13	James Okor	Ekuku Agbor	Ika South	309	Palm Oil
14	Onwuemeri Moses Ogor	Ekuku Agbor	Ika South	400	Palm Oil
				2059	

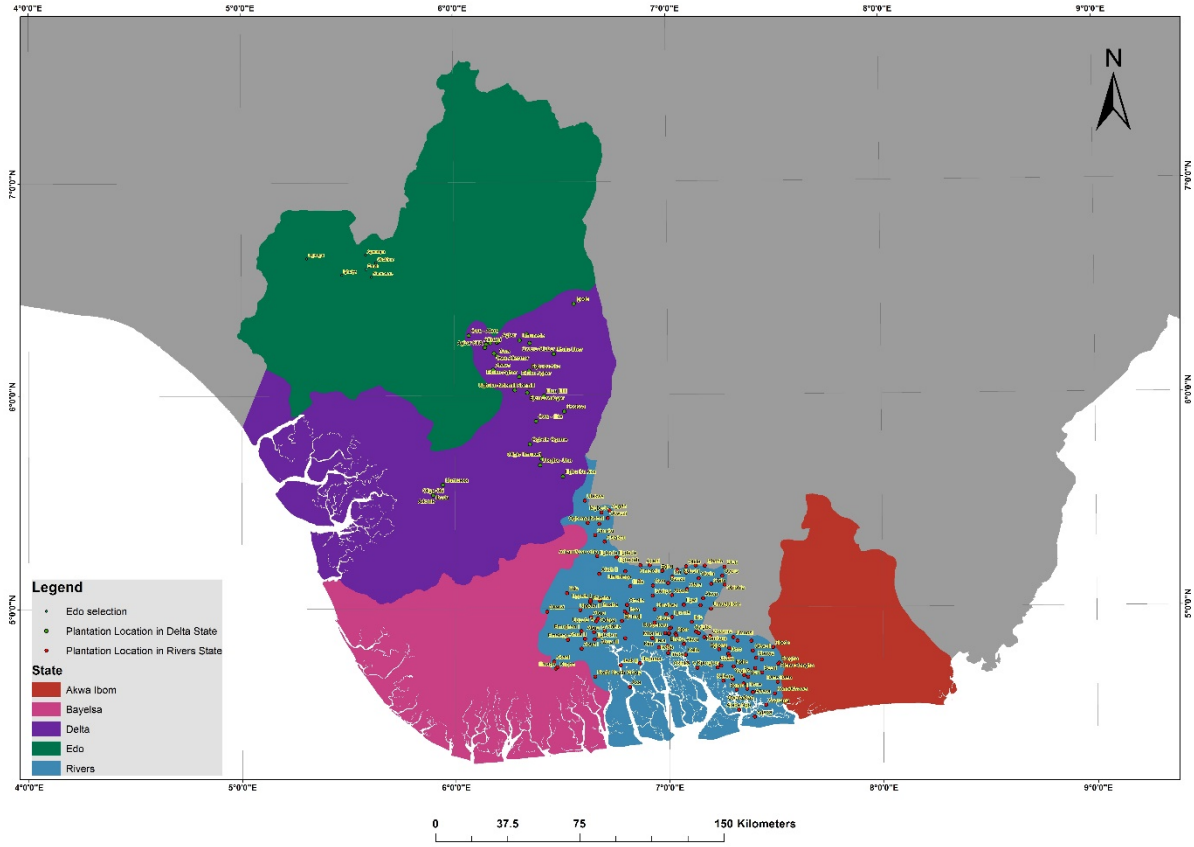
Table 19: Some individual Palm Oil millers in Agbor and Owa Areas of Ika South Local Govt Area Delta State

S/No.	Name	Location	Capacity MT	Activity
1	Samuel Onyecha	Agbor	95	Palm Oil Milling
2	Anthony Igbedion	Agbor	95	Palm Oil Milling
3	John Eyenimohu	Owa	95	Palm Oil Milling
4	Mrs. Oriahi Glory	Agbor	95	Palm Oil Milling
5	Mrs. Hope Egbon	Agbor	90	Palm Oil Milling
6	Mrs. Stella Owabor	Agbor	90	Palm Oil
7	Iyekotor Bose	Agbor	100	Palm Oil
8	Ottah Faith	Agbor	150	Palm Oil
9	Utomi Joel Chuks	Owa	90	Palm Oil
10	Andrew Eledu	Agbor	100	Palm Oil

11	Azuka Ayogbe	Agbor	100	Palm Oil
12	Obu Michael	Agbor	95 1195	Palm Oil

The palm oil output by millers in these clusters surveyed is over 3,300 MT. The milling equipment used typically consist of cut out drums for cooking fruits, horizontal open digesters driven by 6 – 8HP diesel engines and manually operated curb press.

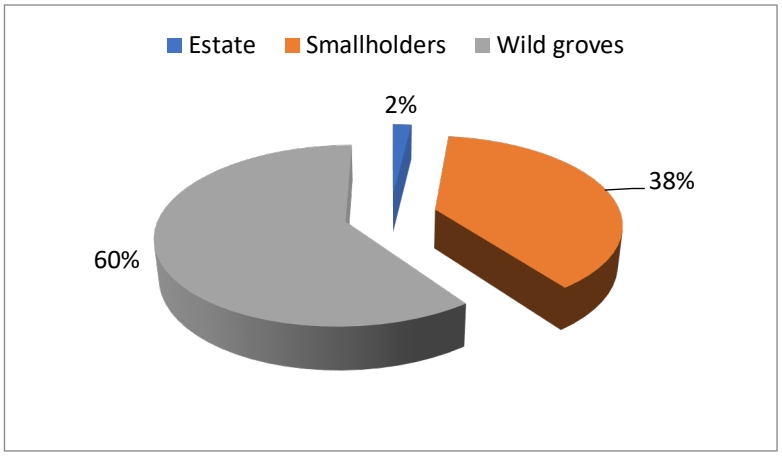
These clusters also produce abundant palm kernels often using locally fabricated nut crackers. Plam kernel and shell separation is done in clay baths and manually often by women. The major clusters of palm kernel enterprise are located at Agbor on the Agbor Asaba Road and Umunede.



1.1.1.3 Major Oil Palm Growers/Mills in Imo State

As at 2009 as baseline, Imo State had 3,410 ha under industrial plantation and about 67,700 ha under improved small holders system. The state has a number of small scale palm oil mills and processors who source FFBs as far field as Rivers State and neighbouring Abia state.

Figure 16: Oil palm production systems in Imo State



Source: Omoti, 2009

Production System	Ha
Estate	3,410
Smallholders	67,690
Wild groves	106,690
TOTAL	177,970

From sprouted seeds supplied to the state, it is estimated that about 3,360 ha of new plantings would have been made between 2009 and 2018 (Fig. 18). The state also has numerous farms established from doubtful sources of seeds or farmers own seeds.

The state has numerous palm oil processors located mainly along Owerri Port Harcourt Road and in areas in Ohaji Egbema, Mbaitolu/Ikeduru, Nwangele, Orlu, Mbano and Ngor Okpala, Mbaise and Ahiazu areas. These mills are mainly locally fabricated. The components of these mills are as described for Delta State.

The main constraints among the small processors is inadequate FFBs during the lean season of June to December and inefficient processing with high loss of oil due to the equipment used. Generally the extraction rates achieved by processors are between 10 and 12% compared to 20 – 24% in industrial mills. Access to land for expansion of farms is a major constraint in the state.

1.1.1.4 Major Oil Palm Growers/Mills in Rivers State

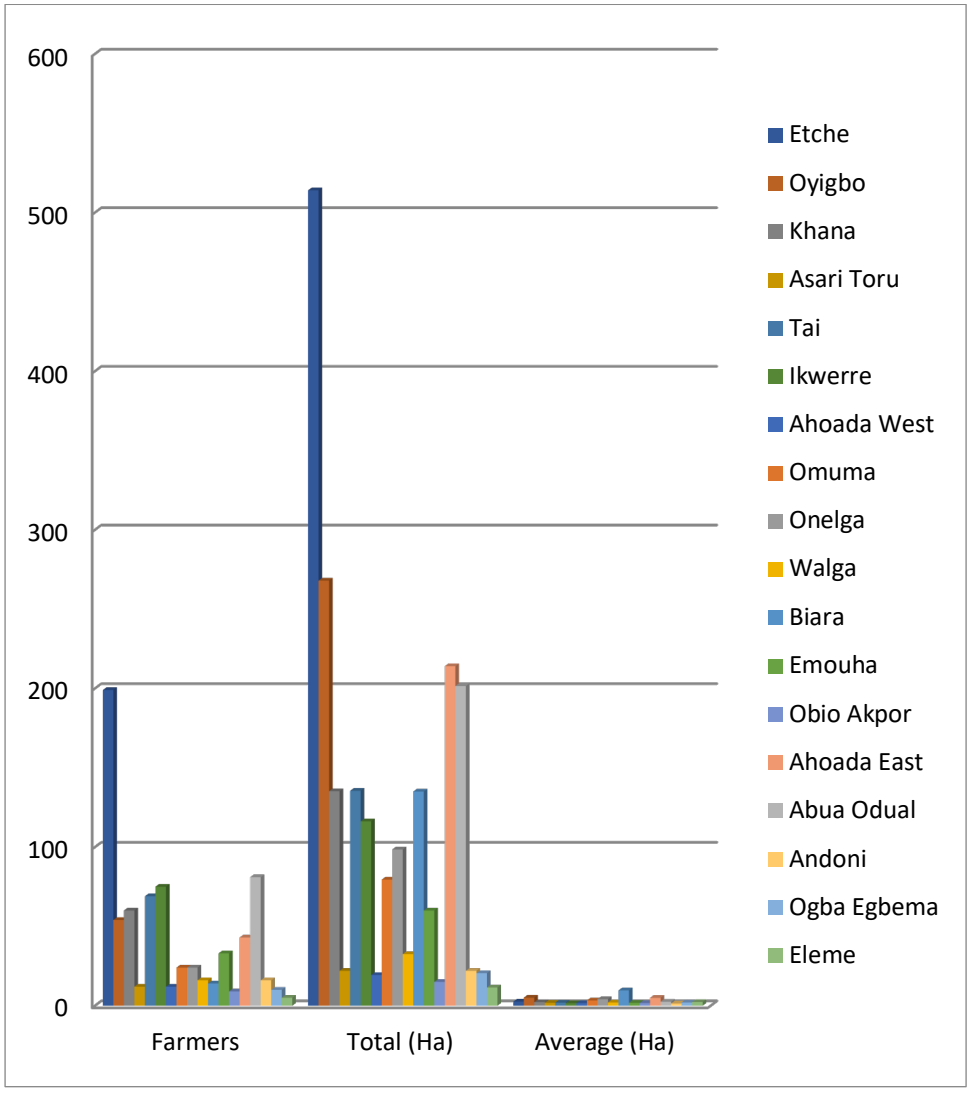
The global positioning system (GPS) captured geographical coordinates of key locations such as small processing mills in Elele and industrial integrated processing mill at SIAT Nigeria Ltd, Ubima estate. The GPS also was used to validate data on location of smallholders farms visited and SIAT Elele estate. The activity summary carried out by the enumerators include amongst others:

1.1.1.4.1 Smallholders Oil Palm Farms and Processors

Clusters formation in the state were occasioned by factors such as oil palm plantations prevalence in specific locations or local government areas over a long period, due to suitable climatic conditions; and Agricultural Development Programme (ADP) delineation of State Ministry of Agriculture to unite into formal or semi-formal groups.

There are 732 oil palm farmers and/or processors having high yield oil palm variety in Rivers state spread across clusters in 16 LGAs of the state. Fig. 19 below shows the distribution along the LGAs:

Figure 17: Rivers - Clusters Distribution



Source: Survey Field Data and ADP, 2018

1.1.1.4.2 Marketing Information through Survey of Oil Palm Processors of Elele Cluster

Elele cluster communities cut across two Local Government Areas of Rivers state that is, Ikwerre and Emohua; which formed the commercial centre for palm oil production in the state. Ikwerre LGA accounts for 26% of total groves in the state which about 23,466ha (out of 91,655ha) according to NTCDU & Rivers State Ministry of Agriculture Survey (1999). Emohua LGA likewise has 4,367ha of wild groves. These wild groves account for 60% of FFBs source to millers in this cluster presently. Ikwerre LGA is also the host to SIAT Nigeria Ltd (former Risonpalm limited) one of the largest single Oil Palm holding in Africa having 16,000ha in Ubima & Elele out of the total estate of 16,300ha. Elele cluster alone accounts for about half of total production from Ikwerre & Emohua LGAs that is, 40% of the state palm oil production.

The clusters were grouped according to communities making up the cluster but processors from only 3 communities were available for sampling where one hundred and three (103) were randomly selected:

Table 20: List of Clusters

SN	Purposive sampled communities of Elele cluster	Processors randomly sampled	LGA	Remarks
1.	Elele	75	Ikwerre	103 respondents in all
2.	Omudioga	18	Ikwerre	
3.	Elele-Alimini	10	Emohua	

The units of measurement and their equivalent which help immensely in collating various data gathered into quantitative form were fashioned out during the field exercise and the summary is in Table 21 below.

Table 21: Approximate Unit of Measurement

SN	Categories of measurement	Equivalent in Elele
A	**PALM OIL**	
1	1 litre palm oil	1 kg
2	1000kg/litre palm oil	1 tonne Palm Oil
3a	A lorry load of 600 fresh fruit big bunches (ffbs)	10 tonnes ffbs
3b	A lorry load of 1000 fresh fruit small bunches (ffbs)	10 tonnes ffbs
4	A tractor (trailer) load of fresh fruit big bunches (ffbs)	5 tonnes ffbs
5a	Processing of 10 tonnes ffbs Dura (during season)	50 to 60 jerry cans Palm Oil
5b	Processing of 10 tonnes ffbs Dura (during offseason)	40 to 42 jerry cans Palm Oil
6a	Processing of 10 tonnes ffbs Tenera (during season)	70 to 72 jerry cans Palm Oil
6b	Processing of 10 tonnes ffbs Tenera (during offseason)	55 to 60 jerry cans Palm Oil
7	1 jerry can palm oil	20 litres
8	Processing of 9 head-pans loosed fruits	1 jerry can palm oil
B	**PALM NUTS & PALM KERNEL**	
9	100 ffbs	A barrel palm nuts
10	18 barrels nuts (that is, 1,800 ffbs or 30 tonnes ffbs or 3 lorry loads ffbs)	1 lorry load palm nuts
11	Processing of a lorry load palm nuts to fine palm kernel	20-24 bags kernels (80kg each)

A Processor at Daniel's mill, Elele

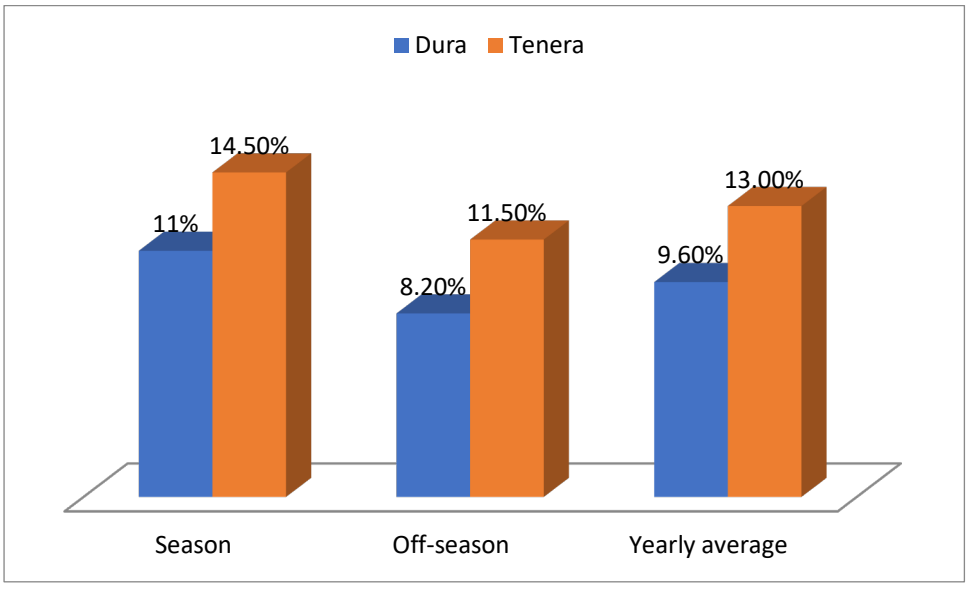
Different barrels for cooking for loosed fruits

A common press inElele cluster

Processors at Ewo mill, Umudioga

The predominant processing technology in the clusters is small scale milling equipment made up of detachment of digester and press powered by diesel engine . Different barrels (drums) sizes are used to boil loose fruits of FFBs before digestion operation. After pressing crude palm oil, fibres are separated from the nuts manually with use of serrated knife by female folks. Field findings show that the extraction rate of the present small scale milling machine is influenced by season and oil palm varieties as shown in Fig. 20.

Figure 18: Extraction Rate of Small Scale Machine



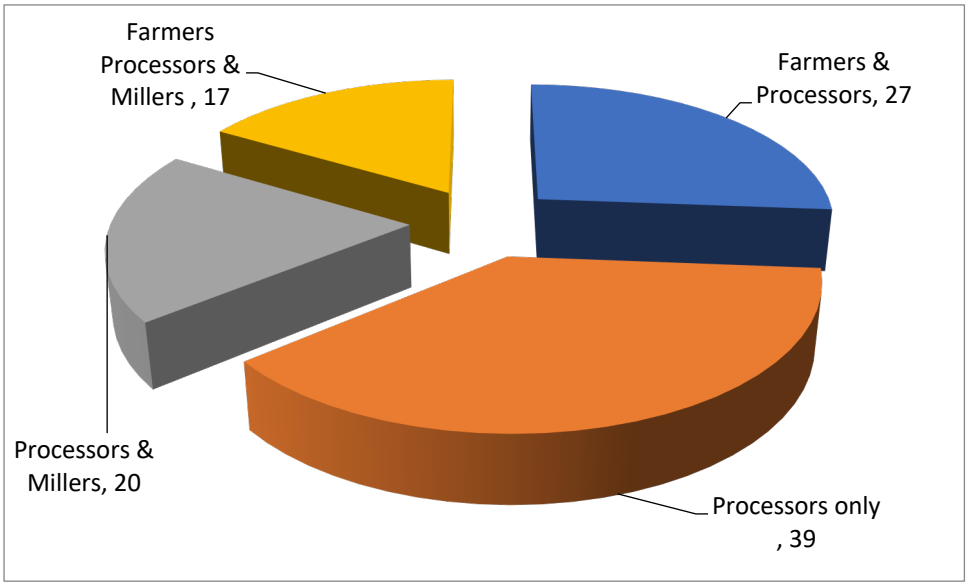
Source: Field Survey Report

The implication is that 10 MT FFB Tenera produces an average of 71 jerry cans palm oil of 20litres each (translating to abpout 13% extraction. At the industrial millis extraction rates of 20 – 24% may be achieved. This therefore implies a loss of potential 7 – 11% extraction while Dura of the same quantity produces 55 jerry cans palm oil of 20 litres (estimaed at 10% extraction rate) each

during the season (Jan-May). It was reported by the processors that the same quantity of FFB during the off-season (June-Dec) usually give 56 jerry cans and 41 jerry cans for Tenera and Dura respectively. One of the respondents told the lead enumerator that that the difference in palm oil yield season to off-season could be attribute to increase in water content to oil content. But this needs further investigation.

From the field survey, there are four categories of processors and these categories with their tallies are:

Figure 19: Processors Categories



This shows that 37 of the respondents are mill owners either with processing only or along with FFB production and processing.

The processing cost of 1 tonne FFBs to palm oil ranges between N2,040 and N3,450 with average cost of N2,745 which is the lower compared to close-by clusters of Umuagwo. Field survey findings revealed that the non-native migrant workers have taken over the activities of bunch quartering, Knocking-out of fruitlets, Filtering or fruit screen and Loading into drum at reduced charges. Even at Umudioga migrant non-natives are now involved in milling (digestion and pressing) at a cheaper wage than the Ikwerre natives who demand higher wages.

SIAT Nigeria Ltd (Risonpalm's new owners) has stopped the sale of FFBs from their estates to millers since they have insstalled their milling facility of 60MT/hour. This has consequently diminished the milling capacities of independent millers far below their installed capacities while some of these private small artisanal mills have closed down operations due to lack of access to FFBs which hitherto came from the fields of SIAT. Have become even more scarece for the small millers as SIAT Nigeria Ltd is competing with millers in the purchase of Dura FFBs from farmers at higher price 50-100% (N360 per bunch far above N200 – 250 per bunch) above price offered by millers.

It was learnt in the course of this study that SIAT group has installed an automated 60 tonnes per hour processing mill and available FFBs from their estates is below installed capacity hence their drive for FFBs from the groves as long as it can be supplied within two days of harvesting. It is to be noted that the original concept of the defunct Risonpalm which has now been succeeded by SIAT was to secure complementary FFBs supplies from the abundant groves of Rivers State. Some of the private millers informed the enumerators that because of the stiff competition for FFBs in Rivers atate, they now go as far as Bayelsa state to buy grove FBBs to stay in business. Small

millers often do not own their own farms and rely on purchase of FFBs from farms and wild grove harvesters.

Only 70 out of 103 processors had access to credit facilities; since respondents with personal savings claimed that they did not enjoy credit facilities. It was also discovered that informal sources of funding such as loans from friends/relatives and loans from Thrift societies (Esusu) accounted for 34.0% of the credit facilities availability to the processors. Likewise, the trade credit from palm oil merchants especially the Northerners also accounted for 34% with unpalatable consequences. These palm oil merchants determine the purchasing price of palm oil to their own advantage making the processors struggling to break even.

Technical palm oil (TPO) is the quaity of palm oil mostly producced by the small scale operators. This oil is called TPO because of its high FFA content (usually higher than 6%), and is not easily refinable and amenable for industrial use. TPO marketing is concerned with all stages of operation that aid movement of the produce to the final consumer. These include: assemblage, storage, transportation, grading and financing. The major markets patronized by TPO merchants are Elele, Borokiri, Mile 1 & Mile 3 in Rivers state. There are wholesale and retail types in both rural and urban centers in the state. Generally, TPO is transported by merchants from the supply markets in Rivers state to the demand regions of Northern Nigeria especially Abuja, Zaria and Kano; as well as Lagos. All quantities of crude palm oil (SPO) and its fractional products from SIAT Nigeria Ltd Ubima estate are for industrial use.

1.1.1.4.3 Siat Nigeria Ltd Ubima Estate

SIAT Nigeria Limited, Ubima Estate is at Km 6 Elele / Owerri Road, Ikwerre Local Government Area, Rivers State, Nigeria. SIAT Nigeria Ltd (SNL) is a wholly owned subsidiary of SIAT nv.

In 2011, SNL acquired from the Rivers State Government the assets of Risonpalm, which comprise 16,000 hectares of old oil palm plantations, plus the entire social and industrial infrastructure such as the industrial oil palm complex. Both the Ubima (9513 ha) and Elele (5718 ha) estates are currently replanted.

As of 2017, SIAT Nigeria Ltd. (SNL) had:

- Oil palm plantations of 15,231 hectares of which 10,863 are mature
- A palm oil mill with a capacity of 60 tons fresh fruit bunches/hour
- A palm kernel crushing plant with a capacity of 120 tons/day
- Storage capacity of products of 5200 tons Crude Palm Oil (CPO) and 600 tons Crude Palm Kernel Oil (CPKO).

The Chairman of Board, Mr Vandebeck noted that since the takeover of the facility in 2011, the company has made substantial investments which has led to the emergence of a state of the art oil mill, with fruit bunches being harvested in commercial quantity both in Ubima and Elele estates.

SIAT aims to grow to an agro-industrial complex of >40,000 hectares of oil palm and rubber plantations with the required processing facilities and infrastructure.

Key components of the agro-industrial complex:

- The Ubima Estate - 15,000 hectares
- The Elele Estate - 9,000 hectares
- Land Acquisitions - Ambition to reach 40,000 hectares by means of land acquisitions
- Palm Kernel Crushing Plant - (1,000 TPD)

- Biomethanization Plant
- Refinery and Fractionation Plant
- Rubber Processing Factory

SIAT had invested an excess of N 100 Billion (50M USD) as of 31st July 2017 in rehabilitation, renewal, expanding, planting and replanting of the obsolete assets of Risonpalm since acquisition in 2012.

Environmental Commitment

SIAT Nigeria Ltd (SNL) is fully committed to providing quality services in a manner that ensures a safe and healthy workplace and minimizes its potential impact on the environment. It will operate in compliance with all relevant environmental legislation and will strive to use pollution prevention and environmental best practices in all its operations.

Round Table on Sustainable Palm Oil (RSPO)

RSPO, Round Table on Sustainable Palm Oil, is a non-profit organization that unites all stakeholders of the palm oil industry towards the development and implementation of a global standard for sustainable palm oil. SNL is in the process of being RSPO certified.

SIAT Nigeria Ltd seeks to obtain the Roundtable for Sustainable Palm Oil (RSPO) Certification and adheres to strict tenets of the Health Safety and Environment.

To fast track the process of its RSPO certification, a committee (RSPO committee) was set up. The committee is charged with the task of ensuring that SIAT Nigeria Ltd conforms to the RSPO Principles and Criteria which are relevant to its operation.

SIAT Nigeria Ltd hoped that the first RSPO audit would have conducted by the first quarter of 2018.

1.1.1.4.4 Problems and Constraints

The problems and constraints connected with some issues in oil palm enterprise business in Rivers state are summarized in the schedule below:

SN	ISSUES	CONSTRAINTS	REMARKS
1	Land acquisition	Land is either owned by family or communal therefore, acquisition difficult task for perennial crops like oil palm. Even when it is available it is fragmented at exorbitant price in Ikwerre, Etche Emohua & Obio Akpor LGAs.	Hindrance to large scale plantation among smallholders and bottleneck for large estate expansion drive.
2	Land development	Due to semi-forest nature of agricultural land in Rivers state, land development is difficult due to no readily available machinery and labour.	
3	Plantation establishment and maintenance	The true to type Tenera seedlings are not readily available within smallholder farmers reach making them fall victim of adulteration.	

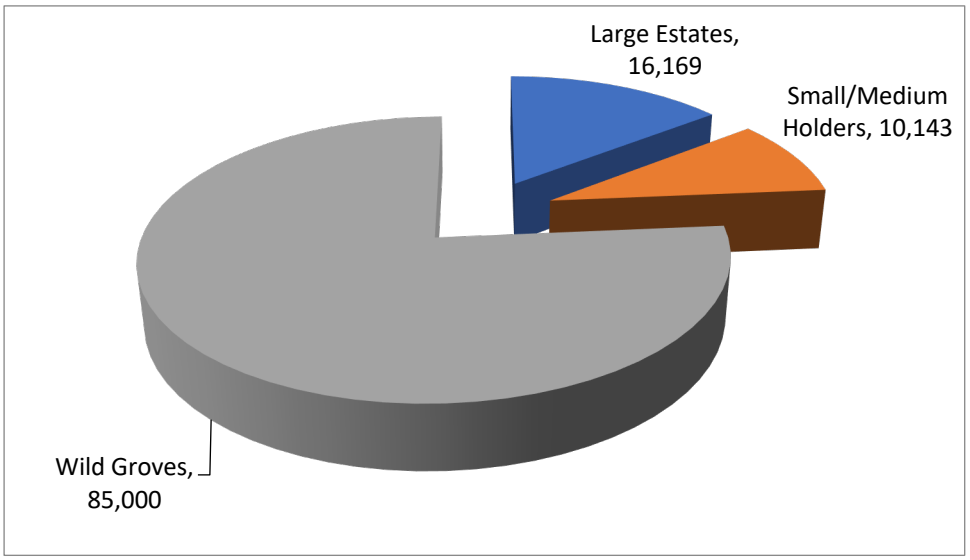
		Technical knowhow in the area of proper marking and pegging is lacking making some having plant population above 150. Most youth in Rivers state are not interested in laborious work, therefore, the few labour are either Northerners or from A/Ibom.	Common to smallholders
4	Mill acquisition, installation and operation including acquisition of spare parts	Local fabricators within the reach of miller or processors have little knowledge of SSPE and finishing of their manual digester and presser is poor. Consequently there is frequent break down and spare parts either gotten in Aba or Onitsha.	
5	Availability and cost of inputs	Fertilizer: Not available when needed especially NPK +MgO 12:12:17+2 Pesticides: Available with high cost Seed: Sprouted nuts not produced in Rivers state. Even SIAT import sprouted nuts from Palm Elit in Republic of Benin. Seedlings: Adulteration is high.	
6	Sources of funding and cost of fund	Sources: Personal funding, Money lender, Trade credit Cost of fund: Apart from personal which highly limited cost of funding either from money lender or trade credit provider is high Most commercial banks are not willing to fund oil palm establishment except trading in palm oil to very few.	
7	Management problem	Most smallholder oil palm farmers in the state have no knowledge of Best Management Practice (BMP). Only few farmers in some clusters of Etche LGA where SHERDA/PIND have footprint are practicing BMP. In July, 2018 Rivers ADP representatives and Agro-dealer were trained in BMP by SHERDA/PIND and MoU is at advance stage with agro-dealer to spread the BMP techniques to many clusters in the state.	
8	Policies of government	Gas flaring is causing serious heat and acid rain. High interest rate is a bane to oil palm plantation expansion	

9	R&D	The NGOs involving in this are PIND, MADE & SHERDA	

1.1.1.5 Major Oil Palm Growers/Mills in Ondo State

Using a baseline year, as at 2009, Ondo State had nearly 16,200 ha under large estate system made up mainly the Okitipupa Oil Palm Co system with a total holding of 11,317 ha and Araromi Ayesan Oil Palm Co which had about 1260 ha and the Ore-Irele Oil Palm company which had about 2380 ha planted. The state had about 10,100 ha under the small medium holdings and about 85,000 ha wild groves (Omoti, 2009).

Figure 20: Oil Palm Holdings in Ondo State as at 2009



Source: Omoti (2009)

The Okitipupa area of the state has traditionally had the largest clusters of oil palm as shown in Table 22. Below

Table 22: Small Holders in Ondo state as at 2012

Local Government Area	No of Farmers	Area Planted (Ha)
Ile-Oluji/Okeigbo	6	14
Akure North	14	114
Akure South	8	30
Owo	14	521
Ondo	10	38
Ondo North East	6	25
Ondo West	2	11
Idanre	2	9
Ifedore	13	108
Akoko South West	7	17
Akoko North West	5	9
Akoko North East	3	9
Akoko North	2	2
Akoko South East	1	4
Ose	3	135
Odigbo	1	13

Okitipupa	83	614
Total	**180**	**1672**

Omoti and Ikuenobe (2012) Unpublished Field Report

Based on seeds supplied to Ondo State from NIFOR between 2008 and 2017, an additional area of 4,286 ha of improved plantings would have been planted between 2009 and 2018. Some oil palm farmers in the major clusters around the Okitipupa and Ore-Irele areas of the state are organized in cooperatives of some loose associations as shown in Table 4. Below. These cooperatives or associations include both male and female gender. Their holdings usually range between 1 and 25 ha. As shown in Tables below.

Table 23: ODE – AYE OKITIPUPA LG - Details of Smallholder Oil Palm Farmers in Ondo State

S/N	Names	Sex	Association	Ha	Day Cap.	Mill	Location Of Farm	Telephone
1	Ewuola Gabriel Olalegan	M	Layelu Oil Palm Farmers	2	2 Kegs	Self	Oranyin Ore-Aye old road	7060525150
2	Ewuola Martins Olaniyan	M	Layelu Oil Palm Farmers	2	2 Kegs	Self	Oranyin, Ore Aye Old Road	8039788530
3	Mr Maku Francis		Layelu Oil Palm Farmers	2	2 Kegs	Self	B.Gs Road	9052698864
4	Mrs. Aygusan Lecm	F	Layelu Oil Palm Farmers	2	2 ½ kg	Self	Igoloye	8068718258
5	Iwalehin Olamide	F	Layelu Oil Palm Farmers	2	2 kegs	Self	Okenisa	8068522021
6	Ogunmade Christana	F	Layelu Oil Palm Farmers	2	3 Keg	Self	Oranhin	8038219815
7	Olamodu Olaniji	M	Layelu Oil Palm Farmers	2	2 Keg	Self	Onabu	8062994443
8	Aiyejusuwe Edward	M	Layelu Oil Palm Farmers	2	1 ½ kg	Self	Abiye	8039218272
9	Bamgboye Oladun Joye	M	Layelu Oil Palm Farmers	2	2 kg	Self	Logoro	8069243848
10	Akinbo Ihalu	M	Layelu Oil Palm Farmers	2	2 Kg	Self	Ojoihodo	8138138924
11	Ojajun I James	M	Layelu Oil Palm Farmers	2	2 kg	Self	Gbude Igbotako	8062923582
12	Olorunyomi Ikudamro	M	Layelu Oil Palm Farmers	2	2.2 keg	Self	Ikoloma	8069314250
13	Ayelabola Temidayo	M	Layelu Oil Palm Farmers	2	2.1 kegs	Self	Ikoloma	8165342029
14	Arikaw. E. Idowu	M	Layelu Oil Palm Farmers	1.2	1.5 kegs	Self	Igoloye	7031671250
15	Ayekami Logbo Dele	M	Layelu Oil Palm Farmers	1.6	1.5 kegs	Self	Gbude	8061632984
				28.8				

Source: Field surveys, October/November 2018

Table 24: ABUSORO VILLAGE OKITIPUPA LG - Details of Smallholder Oil Palm Farmers in Ondo State

S/N	Names	Sex	Association	Ha	**Day Cap.**	Location	Telephone
1	Ogunsakin Idowu	M	Abusoro Oil Palm Farmers Assoc.	1.6	9 Bunches	Abusoro	8169536020
2	Saanumi Abiodun	M	Abusoro Oil Palm Farmers Assoc.	4	17 Bunches	Abusoro	9069654690
3	Akinrinoye Taiwo	M	Abusoro Oil Palm Farmers Assoc.	2	15 Bunches	Abusoro	8076386191
4	Idogun Osunolale	M	Abusoro Oil Palm Farmers Assoc.	1.6	7-8 Bunches	Abusoro	8153530255
5	Saanumi Akinyomi	M	Abusoro Oil Palm Farmers Assoc.	2.8	5 Bunches	Abusoro	8056717976
6	Charity Sanumi	F	Abusoro Oil Palm Farmers Assoc.	2	6 Bunches	Abusoro	8074041303
7	Loma Elizebeth	F	Abusoro Oil Palm Farmers Assoc.	1.2	4 Bunches	Abusoro	8134161388
8	Saanumi Sunday	M	Abusoro Oil Palm Farmers Assoc.	3.2	9 Bunches	Abusoro	8058143725
9	Ogunsakin Kola	M	Abusoro Oil Palm Farmers Assoc.	2.4	6 Bunches	Abusoro	803938821
10	Saanumi June	M	Abusoro Oil Palm Farmers Assoc.	3.2	9 Bunches	Abusoro	8050392434
11	Akintan Iranlowo	M	Abusoro Oil Palm Farmers Assoc.	2.4		Abusoro	7068863578
12	Ogunsakin Itiola	M	Abusoro Oil Palm Farmers Assoc.	3.2		Abusoro	8156151278
13	Akin Ogunsakin	M	Abusoro Oil Palm Farmers Assoc.	2		Abusoro	8158142476
14	Saanumi Monday	M	Abusoro Oil Palm Farmers Assoc.	3.2		Abusoro	7055017113
15	Saanumi Olasiji	M	Abusoro Oil Palm Farmers Assoc.	1.6		Abusoro	8118563545
16	Ch Am Saanumi	M	Abusoro Oil Palm Farmers Assoc.	4.8		Abusoro	7038168409
17	Ch Akin Folarin .A.	M	Abusoro Oil Palm Farmers Assoc.	2.4		Abusoro	8061587289
18	H.Ch Tunde Saanumi	M	Abusoro Oil Palm Farmers Assoc.	5		Abusoro	8187686654
19	Ap. Olatubora .R.	M	Abusoro Oil Palm Farmers Assoc.	3.2		Abusoro	8137474542
20	Akingboye Vero	F	Abusoro Oil Palm Farmers Assoc.	4		Abusoro	8115452577
21	Ikuesowo Margaret	F	Abusoro Oil Palm Farmers Assoc.	2		Abusoro	8054344715
				58			

Source: Field Surveys October /November 2018

Table 25: IRELE - Details of Smallholder of Oil Palm Farmers Surveyed in Ondo State

S/N	Names	Sex	Association	Ha	Owner	Location	Telephone
1	Rufus Olayeye	M	Oil Palm Association	25	Nil	Urohwo	7066226016
2	Neayo Adeh Unm	M	Farmer Oil Palm	4	Self	Uroho	8146222668
3	Bulu Egbekele	M	Oil Palm Association	10	Self	Lokaka	7030382395
4	Omoniyi Oloruntola	M	Oil Palm Association	20	Self	Uroho Legbogbo	8006061072
5	Sunday ldoka	M	Oil Palm Association	7	Nil	Legbogbo Gbayi Lofun	8153556363
6	Moderayo Adegbemiro	F	Oil Palm Association	5	Nil	Along Isowa	8133662004
7	Omonyi Omosulie	M	Oil Palm Association	11	Self	Legbogbo Abukorocho	7053431776
8	Akinbrebije Sile Ola. F.	M	Oil Palm Association	6	Nil	Omifun Fun	7065285259
9	Ayo Orlie Falona	M	Oil Palm Association	3	Nil	Along Gbaye	8103337340
10	Adetuwo Olowo Gbemi	M	Oil Palm Association	5	Self	Logbe Camp	8134321866
11	Omoniyi Adewole	M	Oil Palm Association	10	Self	Urogho Legbogbo	8152991300
12	Akinola Adeyeye	M	Oil Palm Association	8	Self	Lokaka Camp	7037480586
13	Ohowo Gbemi Ajibeadie	M	Oil Palm Association	10	Self	Logbe Camp	7066562441
14	Olowogbem Adetuwo	M	Oil Palm Association	10	Self	Logbe Camp	8134321866
15	Peter Ebiekuraju	M	Oil Palm Association	5	Self	Lumeko	9069140066
				139			

Source: Field surveys, October/November 2018

Palm oil processing among these small producers is by simple equipment as described for Delta state. These processing equipment are to a large extent inefficient with low extraction rates, high oil losses and poor quality which does not lend to easy refining. However this oil is acceptable for domestic use. Most of the farmers interviewed indicate inadequate supply of FFB for milling especially during the lean season of June to December. Many of the farms also complain of having been victims of fake seeds and seedlings marketers. Therefore the many farms classified as having improved plantings have mixtures of adulterated materials and good tenera variety. The major constraints of the small holder producers are presented below.

Major constraints of oil palm production by farmers in Ondo State

Operator	Constraints	Suggested Solutions
Small Holders	- Inadequate capital - Irregular availability of bunches - Scarcity and high cost of input such as fertilizers, seedlings - Difficulty in acquiring land - Inadequate processing equipment - Inability to distinguish between fake and genuine seeds and seedlings from - Transportation of bunches -Theft of bunches	- Development of efficient processing equipment; - Provision of credit facilities to farmers; and - Regulate seeds and seedlings production and sales - Government should supply seeds and seedlings - Adequate extension services and training
Nursery Operators	- Inadequate capital, - Proliferation of adulterated sprouted oil palm seeds,	- Provision of affordable credit facilities; - Provision of subsidies to reach the grassroots;

	- High cost of sprouted seeds and difficulty in procurement from NIFOR. - Lack of modern automated irrigation facilities - Water - High cost of labour	- NIFOR should establish seeds sales outlet closer to farmer locations.
Processors	- Inadequate capital - Irregular supply and availability of fresh fruit bunches - Frequent breakdown of mill - High cost of processing equipment and spare parts - Poor record keep - Scarcity and high cost of labour - Scarcity and high cost of diesel - Poor state of rural infrastructure (roads, water and electricity power) - Poor incentives and encouragement from Government - Lack of training	- High cost of diesel - Provision of affordable credit facilities - Development of efficient and affordable processing equipment - Government should help with land acquisition - Provision of roads and electricity - - Improved extension service and training

Palm oil processing among these small producers is done using simple equipment as described for Rivers and Delta states.

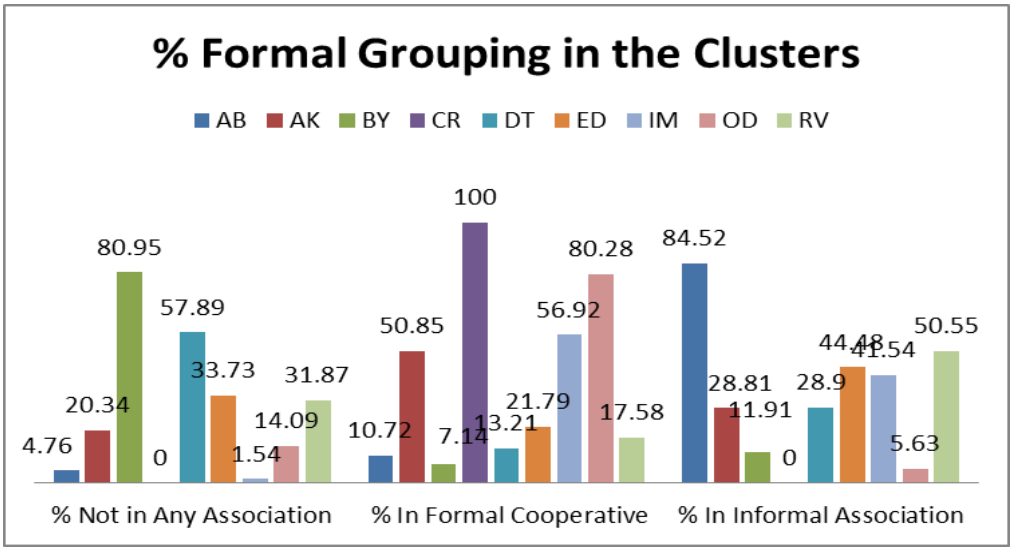
1.2 Clusters' Understanding to Promote Improved Technologies

In this section, the report highlights the current status of the farmers' adoption of improved technologies and practices, coupled with the factors, which influence the said adoption.

1.2.1 Farmers' Group Action

The following Fig. shows the distributions of cluster membership of formal cooperatives.

Figure 21: Formal Grouping in the Clusters



From the Fig., Cross River, Ondo and Imo farmers had a high affinity for formal cooperative societies (100%, 80.28% and 56.92% of mapped clusters respectively) because some benefits such as receipt of inputs spplied by government programmes at subsidized prices had

periodically accrued to them because they were in groups; on the other hand, respondents in Bayelsa (with 80.95% not in any association) have yet to be convinced that there are benefits in agricultural cooperatives.

Farmers' groups, be they formal or informal, are effective vehicles for the rapid and effective dissemination of technological innovations in agriculture; the likelihood of farmers in a group benefitting from carefully planned interventions depends very much on the extent of its formalization. For potential investors, variations in the level of group action may not have a significant impact on decision making because small-scale entrepreneurs quickly synergize once they realize that their operations would be smoother and yield more benefits if they work as groups.

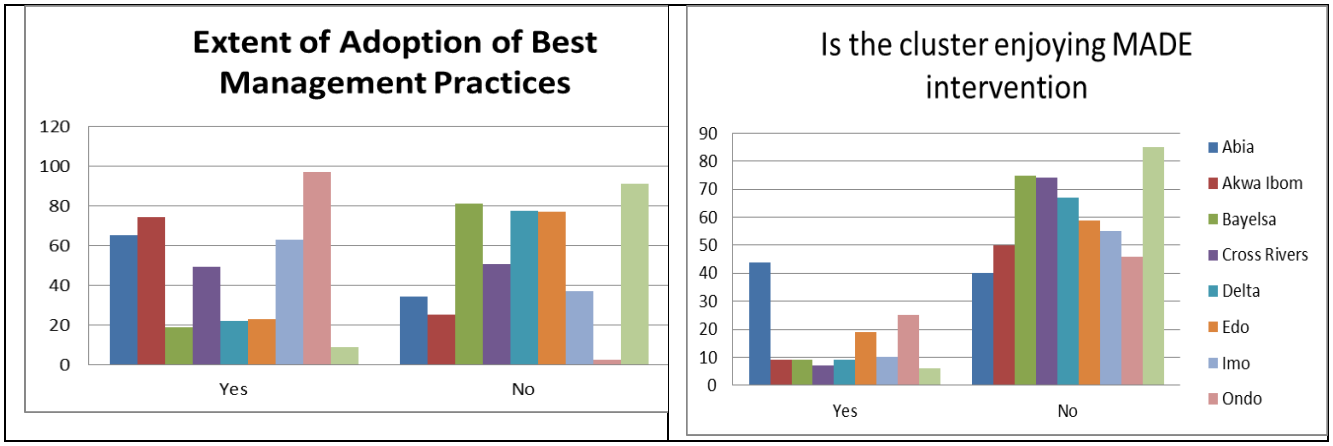
1.2.2 Adoption of Best Practices in Field Management

Management practices adopted are removal of dead branches, weed control and rehabilitation of plantations. The adoption of best management practices in the fields of oil palm among the sampled clusters varied between states, with Ondo, Akwa-Ibom, Abia and Imo being high at 97.18%, 74.58%, 65.48% and 63.08% respectively while Rivers was the least as less than 10% of clusters had imbibed the culture. Reasons for disparities in the level of technology adoption include:

a) High adopters, especially under mixed cropping carry-out weed control while low adopters did not acknowledge the need for weed control at all
b) Farmers in Bayelsa, Delta and Edo saw the weed control process as laborious and expensive
c) Farmers in Bayelsa, Edo and Rivers, because existing palms were still producing FFBs, felt it was not necessary to rehabilitate old plantations.

The statistics are in the Fig. below:

Figure 22: Extent of Adoption of Best Management Practices



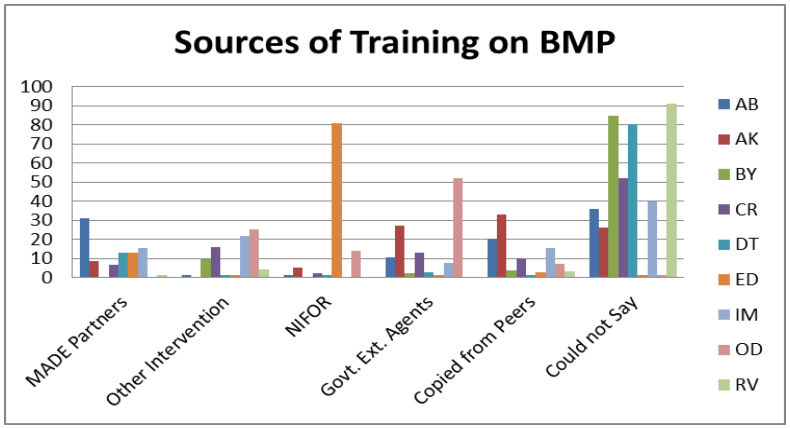
a) High adopters practiced weed control while low adopters, as reflected in Bayelsa, Delta and Edo farmers did not, because they considered weed control as a laborious and expensive activity, in view of the high cost of labour and herbicides.
b) For farmers in Bayelsa, Edo and Rivers, because existing trees were still producing FFBs, they felt it was not necessary to undertake rehabilitation of old plantations.

Effective training facilitates the continued adoption of technological innovations in agriculture and therefore under the mapping exercise, interviewees affirmed that farmers in their localities

were always willing to be trained, provided the knowledge transferred would be relevant to their farming activities. When asked if cluster members had had any training on oil palm best management practices (BMP), the cluster leaders' responses were similar to those for the question on if the farmers adopt BMP (contained in Fig. 6 above).

The training was given by various entities as contained in the following Fig.:

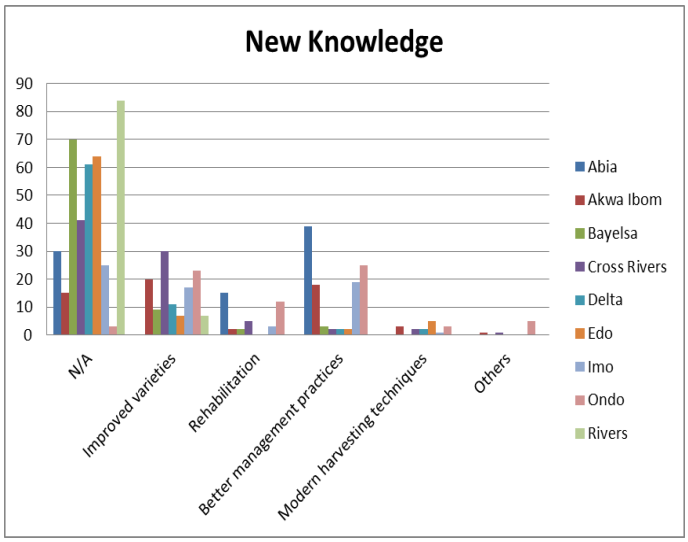
Figure 23: Sources of Training on BMP

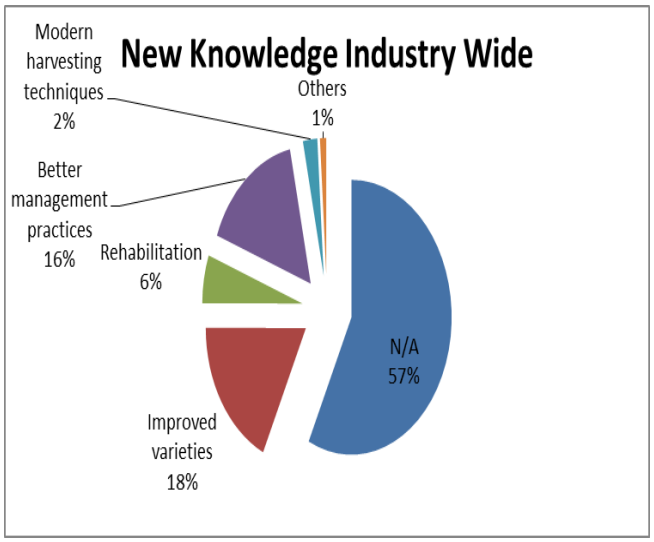


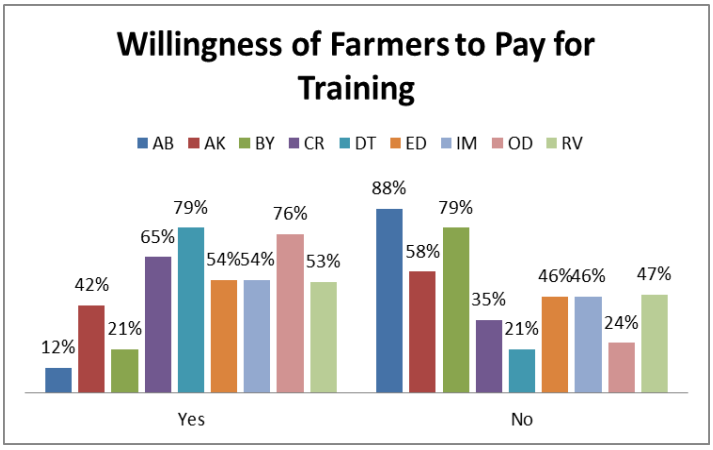
A major inference from the above Fig. is that potential investors desirous of facilitating farmers' adoption of innovations should cooperate with MADE (due to the effectiveness of the programme) and similar interventions or their structures, NIFOR and government extension staff. These two latter channels of knowledge dissemination were specifically highlighted due to their ability to network and train farmers, no matter how minimally.

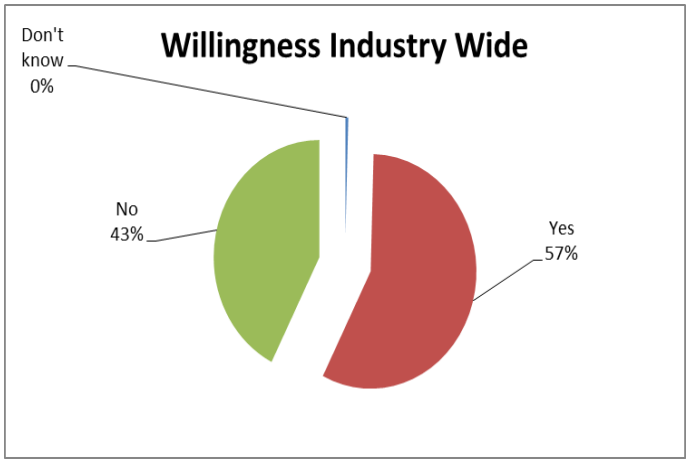
For sustainability of the knowledge transfer process, it is necessary to wean investors in oil palm production from th ementality free training and extension and subsidy. This way they see oil palm cultivation and processing as a business which must be underaken adopting best management practics to achieve profitability and competitiveness. The extent to which farmers are willing to pay for training, especially if the activity would eventually increase their income, is highlighted in the Fig. below:

Figure 24: Willingness of Farmers to Pay for Training







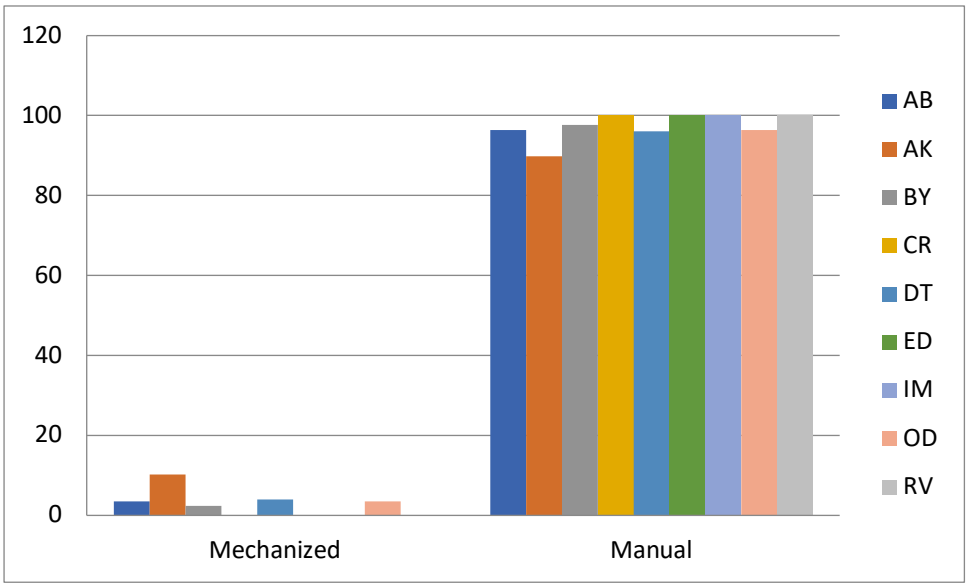


Evidently, producers in Cross River, Delta, Edo, Imo, Ondo and Rivers states were willing to bear the cost of training, because they had seen that the activity leads to the informed application of practices and eventually, increased output and income. Conversely, in Abia and Bayelsa states with low rates of willingness to pay (12% and 21% respectively), the main reason adduced was unaffordability. Therefore, in making investment decisions in these states, entrepreneurs should consider initially bearing the sunk costs of for instance, rendering training services free-of-charge and implementing demonstrations within the clusters, so that the farmers would see first-hand, how improved technologies differ from traditional practices and also result in significant increases in yields and revenues.

1.2.3 Land Preparation

Fig. 4.24 below shows that Akwa-Ibom had the highest rate of 10.17% for mechanized land preparation in oil palm clusters.

Figure 25: Method of Land Preparation



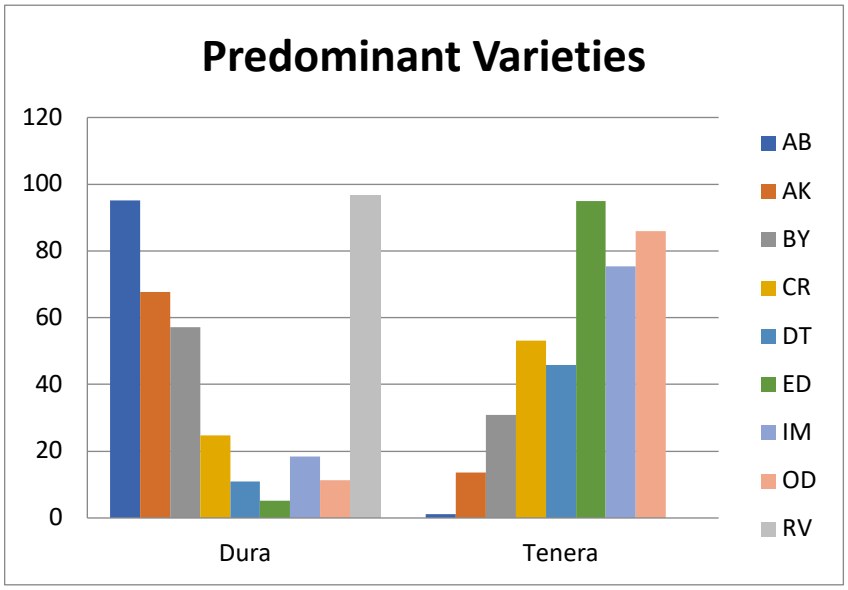
For reasons ranging from insufficient funding to acquire mechanized land preparation machinery, inability to access government-owned equipment hiring services where they exist, scattered farm holdings of oil palm producers, non-necessity of detailed land preparation on long-existing plantations and paucity of services, many farmers tend to rely on manual labour for land

preparation. Therefore the unmet need for agricultural mechanization machinery in the Niger Delta represents a bundle of investment openings in the region.

1.2.4 Varieties of Oil Palm Planted

For any crop, the kind of variety has a direct influence on the subsequent performance of the crop and the resulting yield. As earlier mentioned, the wild groves are mostly of the Dura variety while Tenera is improved variety as a crossbreed between Dura and Pisifera. The following Fig. shows the predominant varieties in the areas mapped:

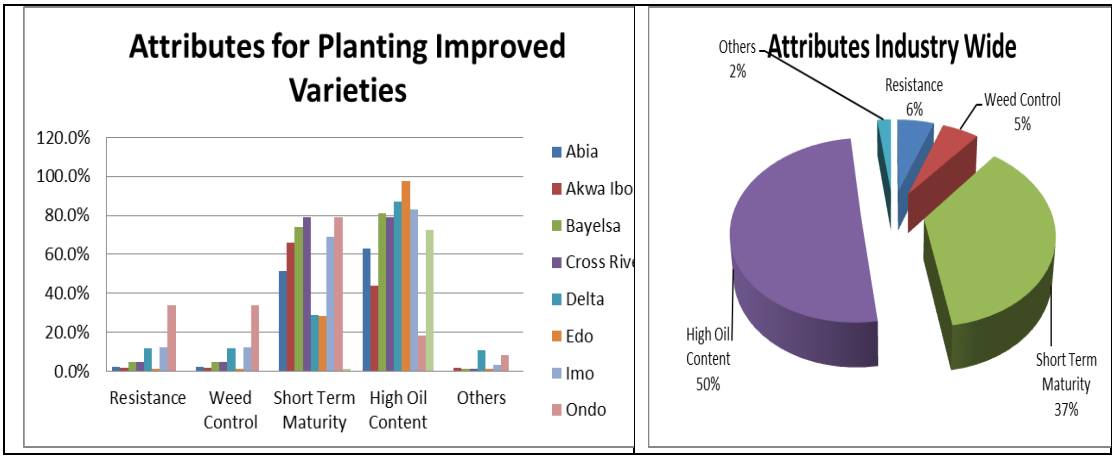
Figure 26: Predominant Varieties



As earlier mentioned in Sub-Section 4.4.1 from the above figures, while clusters in Abia, Akwa Ibom, Bayelsa and Rivers have a high density of Dura (mainly from inherited groves and traditional practices), the farmers in Delta were evenly divided between not knowing what varieties were on their fields and those who planted Tenera. . Edo, with 94.87% of clusters planting Tenera, demonstrated the impact of proximity to NIFOR and its activities; the similarly high levels of adoption in Ondo and Imo (85.92% and 75.38% respectively) reflect acceptability of the improved variety.

The above statistics are to some extent consistent with the findings of PIND9, that Akwa-Ibom and Abia each have a high density of wild groves, while Edo, Cross River and Ondo have a predominance of improved variety type of plantations. However, in this mapping exercise, a significant high area was found to be under improved variety in Delta and Imo states.

Figure 27: Attributes for Using Improved Varieties

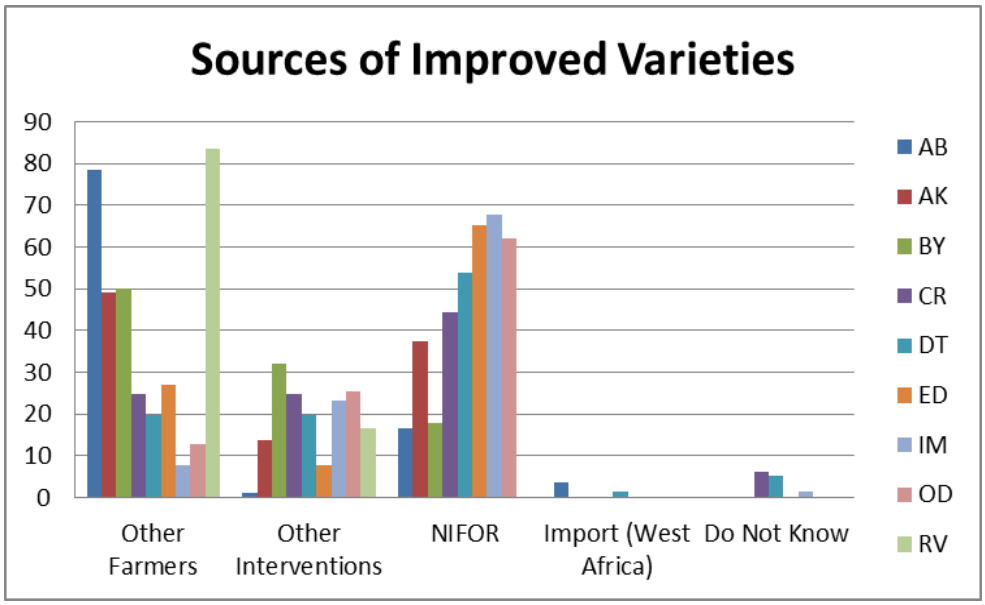


[9]PIND (2011): Palm Oil Value Chain Analysis in the Niger Delta; Foundation for Partnership Initiatives in the Niger Delta, page 15

In decreasing order of preference, the three factors that informed farmers' choice of varieties to plant are oil content (50% of clusters) short maturity period (37% of clusters), and resistance to pests and diseases (6% of clusters). In many instances, respondents selected multiple factors, usually short maturity and oil content as indicated above. Accordingly, an investor may use these facts to determine the likely sources from which high quality raw materials could be available in viable quantities.

Closely related to the above statistics are the sources of improved varieties, as reflected in the Fig. below.

Figure 28: Sources of Improved Varieties



The high dependence of farmers on their contemporaries as sources of seedlings is a sign of weakness on the formal extension system in Abia Akwa Ibom, Bayelsa and Rivers States. This is fraught with possible adulteration of quality of planting materias which exchange hands in such transactions. In such circumstances, a few farmers got the plants free-of-charge while many others got them at cost, as there was no record of any nursery operator in the clusters. A valuable inference from the farmer-farmer dependence for improved seedlings is that the relationship could be seen as an opportunity for copying, a process that further drives the achievement of results under MADE, as more farmers adopt any innovation.

On the whole, the predominant source from which the farmers got their improved seedlings was NIFOR (67.69% in Imo and 65.38% in Edo State). In some insignificant cases as in Edo state, farmers obtain genuine planting materials direct from Okomu Oil Palm Plc or Presco Plc. This does not include the high proliferation of quack marketers who produce seeds and seedlings from unknown sources but pass them to unsuspecting farmers as being from NIFOR. In addition, in the few instances of importation from Benin Republic the farmers bought the plants from private vendors.

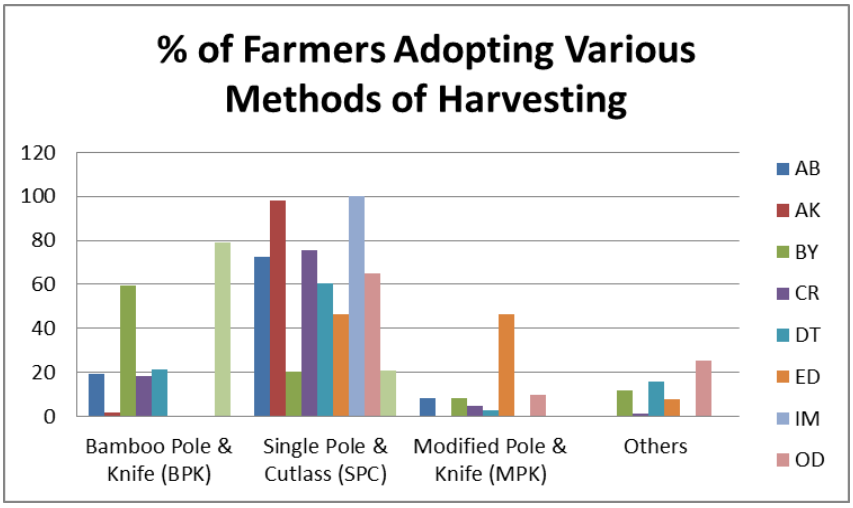
1.2.5 Adoption of Best Practices in Harvesting

The FFBs of oil palm are harvested according to harvesting cycles, and as in most agricultural value chains, the bunches should be delivered to the mills on the same day for commencement of processing. The quality of crude palm depends on the careful post-harvest handling including

processing FFbs early afer arvest rather than waiting about 7 – 14 days after harvesting to allow the fruits loosen before processing[10].

The Single Pole & Cutlass (SPC) was the most frequently reported harvesting device, accounting for 100% of clusters surveyed in Imo State and 98.31%, 75.31% and 72.62% in Akwa Ibom, Cross River and Abia, respectively. There appeared to be continuous efforts to increase the level of adoption of the Modified Pole & Knife (MPK) device, which is also known as the Malaysian Knife; this had taken root significantly in Edo State, where 46.15% of clusters used it. The statistics are presented in the Fig. below:

Figure 29: Percentage of Farmers Adopting Various Methods of Harvesting



Generally, the farmers acknowledged the inefficiency and drudgery associated with the traditional methods of harvesting FFBs. They also affirmed that many of their members had heard about and/or seen improved devices for harvesting, which they were willing to adopt.

1.2.6 Periods of Major Activities in Oil Palm Clusters

Oil palm production is a perennial and seasonal activity, whereby certain activities are carried out in specific months of the year as depicted on the following activity charts:

Table 26: Period for Peak Season Planting

AB	J	F	M	A	M	J	J	A	S	O	N	D
AK	J	F	M	A	M	J	J	A	S	O	N	D
BY	J	F	M	A	M	J	J	A	S	O	N	D
CR	J	F	M	A	M	J	J	A	S	O	N	D
DT	J	F	M	A	M	J	J	A	S	O	N	D
ED	J	F	M	A	M	J	J	A	S	O	N	D
IM	J	F	M	A	M	J	J	A	S	O	N	D
OD	J	F	M	A	M	J	J	A	S	O	N	D
RV	J	F	M	A	M	J	J	A	S	O	N	D

[10]PIND (2012): A Scoping Study on the Palm Oil Value Chain in Rivers and Imo States, Nigeria, page 32

Table 27: Period for Peak Season Harvest

AB	J	F	M	A	M	J	J	A	S	O	N	D
AK	J	F	M	A	M	J	J	A	S	O	N	D
BY	J	F	M	A	M	J	J	A	S	O	N	D
CR	J	F	M	A	M	J	J	A	S	O	N	D
DT	J	F	M	A	M	J	J	A	S	O	N	D
ED	J	F	M	A	M	J	J	A	S	O	N	D
IM	J	F	M	A	M	J	J	A	S	O	N	D
OD	J	F	M	A	M	J	J	A	S	O	N	D
RV	J	F	M	A	M	J	J	A	S	O	N	D

Table 28: Period for Off-Peak Season Planting[11]

AB	J	F	M	A	M	J	J	A	S	O	N	D
AK	J	F	M	A	M	J	J	A	S	O	N	D
BY	J	F	M	A	M	J	J	A	S	O	N	D
CR	J	F	M	A	M	J	J	A	S	O	N	D
DT	J	F	M	A	M	J	J	A	S	O	N	D
ED	J	F	M	A	M	J	J	A	S	O	N	D
IM	J	F	M	A	M	J	J	A	S	O	N	D
OD	J	F	M	A	M	J	J	A	S	O	N	D
RV	J	F	M	A	M	J	J	A	S	O	N	D

Table 29: Period for Off-Peak Season Harvest

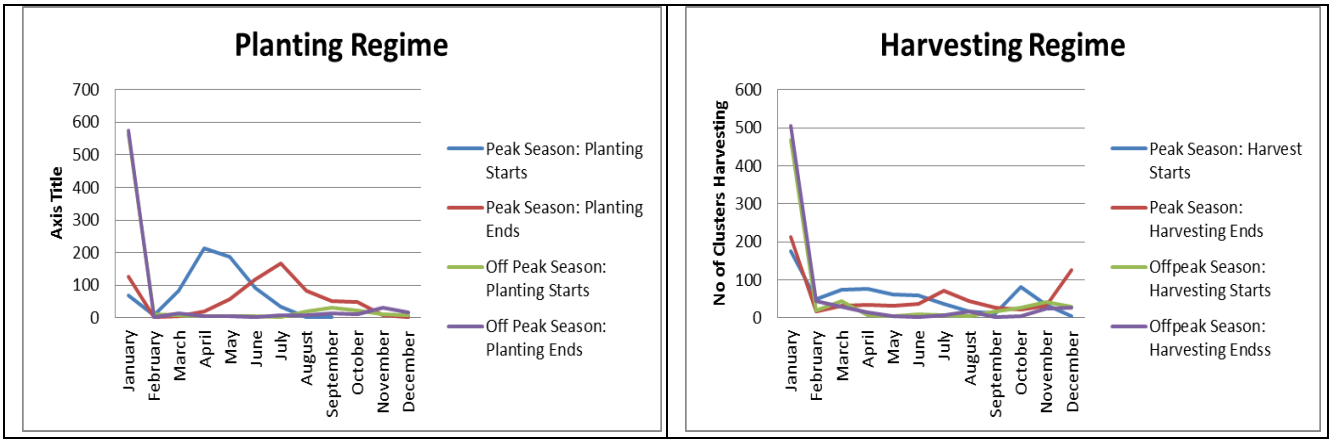
AB	J	F	M	A	M	J	J	A	S	O	N	D
AK	J	F	M	A	M	J	J	A	S	O	N	D
BY	J	F	M	A	M	J	J	A	S	O	N	D
CR	J	F	M	A	M	J	J	A	S	O	N	D
DT	J	F	M	A	M	J	J	A	S	O	N	D
ED	J	F	M	A	M	J	J	A	S	O	N	D
IM	J	F	M	A	M	J	J	A	S	O	N	D
OD	J	F	M	A	M	J	J	A	S	O	N	D
RV	J	F	M	A	M	J	J	A	S	O	N	D

The above self-explanatory activity charts indicate the time period (months of the year) when planting and harvesting take place during the year. Due to the fact that planting is not done every year (except when new fields are being planted or new varieties are being introduced, most of

[11] Planting only takes place during the rainy season from March to September. Land preparation takes place from November to March to take advantage of the dry season to underbrush, fell trees and burn.

the focus is on the months of harvest, which form the basis of planning by processing plants and other interested investors.

Figure 30: Planting and Harvesting

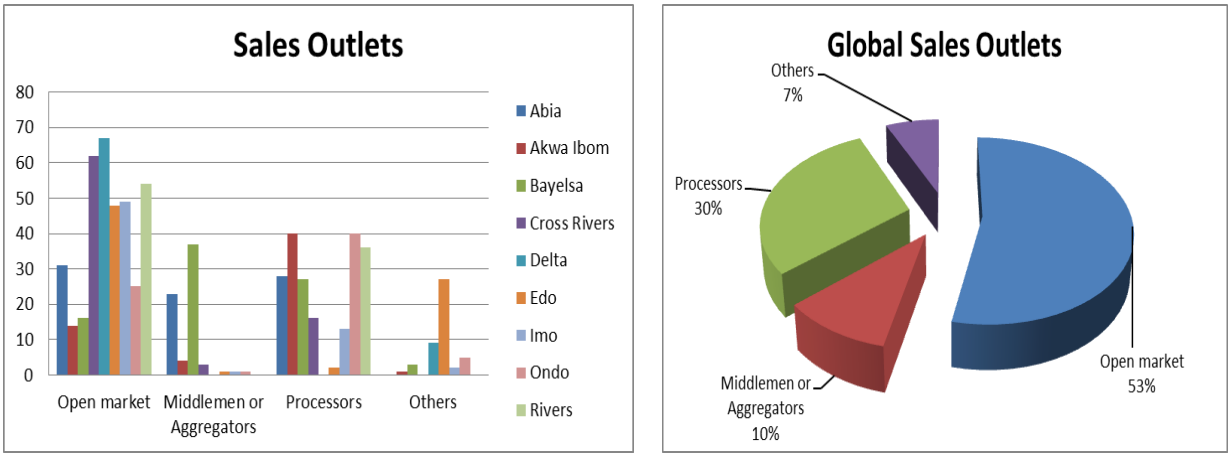


While the activity charts are a dependable guide, the ultimate investment decision would require additional data on the agro-climatic variables peculiar to the specific location in which a plantation is to be sited. Furthermore, notwithstanding the harvesting period indicated on the chart for any state, the harvest of FFBs could always be kick-started once the reddening signs of FFB maturity are evident.

1.3 Estimated Profitability of Oil Palm Production

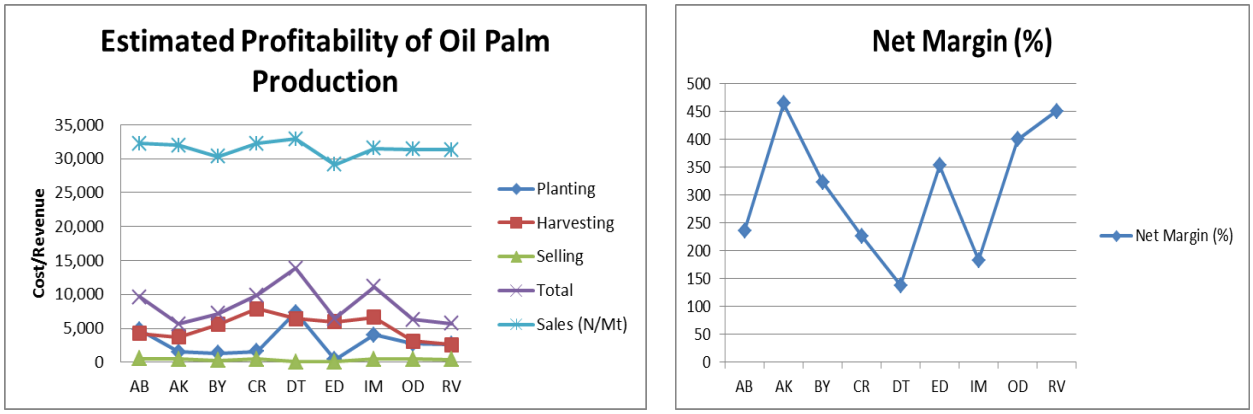
Sales outlets for the farmers have been grouped as seen in Fig 14 below. Open market transaction predominate in most of the states except Bayelsa sharing between middlemen/aggregators and the plants; and Edo joining Akwa Ibom and Ondo as best in suppliers to the plants. Globally, the open market captures about 53% of the sales, 30% to processing plants, middlemen capture 10% and the balance of 7% is taken by others players.

Figure 31: Sales Outlets



For sustainability of the entire value chain of a commodity, the primary producers of the major raw material must be operating profitably. Data from this mapping exercise were used to ascertain the extent to which the primary production of oil palm is profitable. The state-by-state results are shown below:

Figure 32: Profitability of Oil Palm Production



The total cost of production per metric ton was computed as the sum of all costs incurred in planting, harvesting and selling each ton of FFBs while the sales was the price at which the farmer sold each ton, irrespective of the prevailing market price at the time of sale. Net margin was calculated as the difference between price and total cost, taken as a proportion of total cost.

Net margin ranged from 138% in Delta to 400% in Ondo, 451% in Rivers and 464% in Akwa-Ibom; in lay-man's expression, the margin of 355% in Edo State for instance, implies that for every N100 expended in producing 1mt of FFBs the farmer translates into a net income of N355.

The comparatively lower net margins in Abia, Delta and Imo resulted from the high cost incurred in planting activities that took place during the year; these costs were considered as part of the farmers' total costs.

In decision making, investors must recognize that although the primary production of oil palm is significantly profitable throughout the Niger Delta, the extent of profitability could be further boosted depending on:

a) If an existing plantation is acquired or if a fresh plantation is established

b) What the average age of trees is and what varieties are predominant if plantations were to be acquired

c) The kinds of mechanized technologies to be used, the length of useful life and the impact of these on depreciation charges and maintenance costs

d) How the invested amount is treated in accordance with Generally Accepted Accounting Principles (GAAP), given that a plantation could take between 5 – 10 years before the fruits start to yield oil and

e) Ability to market the FFBs seamlessly and at the most profitable prices

1.4 Oil Palm Processing Facilities & Products

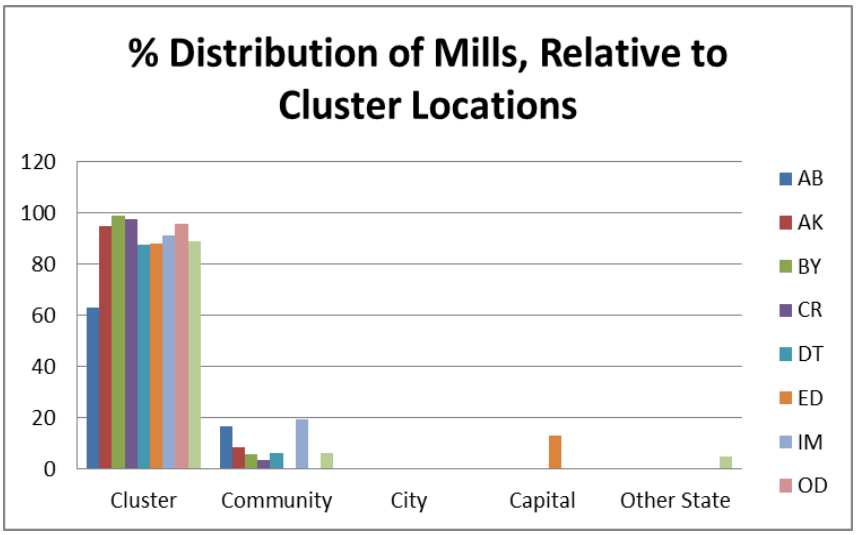
1.4.1 Processing Facilities Available and Their Locations

As revealed in Sub-Section 4.7.3 hereunder, most processing facilities in the Niger Delta region are the home-based manual mills and the mini mechanized mills.

Most mills were located within or very close to oil palm clusters (from 63.1% in Abia State to as high as 98.81% in Bayelsa). Characteristically, most of the processing mills were very close to the

clusters because they are small, manual and labour-intensive businesses that are near the cluster and the homestead. The following Fig. shows the spread of mills in the various locations:

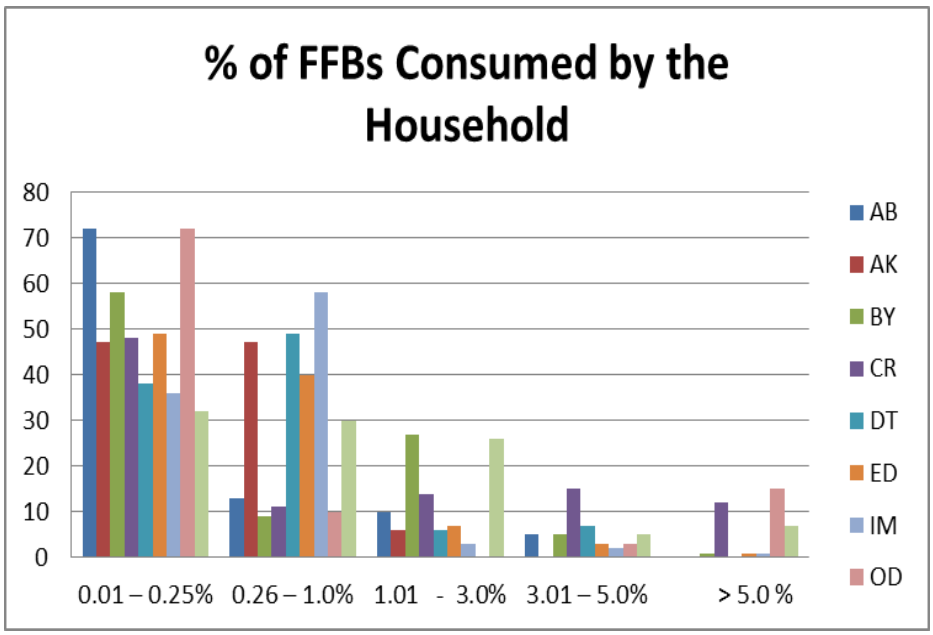
Figure 33: Percentage Distribution of Mills, Relative to Cluster Locations



From the above Fig., not only were mills located predominantly in the clusters, the facilities became fewer with distance away from the cluster. In other words, each processing mill though small, was close to, or within the cluster of primary production, as reflected in the statistic of zero mills in the city, while only Edo and Ondo had mills in the state capitals. Lastly, only in Rivers State did the mapping exercise capture very few instances in which processing mills closest to a cluster were located in neighbouring Bayelsa state.

Prior to sale, a portion of the harvested FFBs goes into family food needs and consumption, however the quantity of FFBs consumed by the farm family is not significant. As can be seen in the Fig. below, most households consume less than 3% of harvested FFBs, This means that the bulk of harvested output (up to 97%) is invariably sold.

Figure 34: Percentage of FFBs Consumed by the Household



Across the clusters in the states, household consumption of FFB was less than 5% of FFBs harvested and marketed or disposed off as shown in the chart above.

Most farmers usually sell their FFBs either directly to a specific processor or to aggregators in the market, who in turn sell to selected processors. There was

little evidence of awareness about the existence of any bulk buyers of FFBs because farmers who made any reference to this route, indicated willingness to sell to any major buyer who could come and pick-up the FFBs from farmers at designated collection centres.

The processors, apparently due to poor linkage and paucity of market information, sell the bulk of their palm oil to dealers who aggregate the product in different markets for onward conveyance to other markets in the Middle Belt and North of Nigeria. In addition, just like the farmers, the processors may be aware that large-scale buyers of palm oil exist, but they do not have any interface with the buyers.

Accordingly, any investor who establishes proper and efficient structures for the purchase of FFBs from farmers and palm oil from small-scale processors, especially if collections are well arranged and properly timed, would have developed a huge activity along the value chain.

TPO is used mainly by households and it is also sold in many markets from which palm oil is conveyed to other parts of Nigeria. However, during the survey, most respondents tended to interpret the word 'special' to mean 'top grade' and because every cluster leader was determined to emphasize that they produce high quality oil, the responses were skewed more towards special palm oil and palm oil. One respondent even seemed to connect the word 'technical' in TPO with lubrication of mechanical systems.

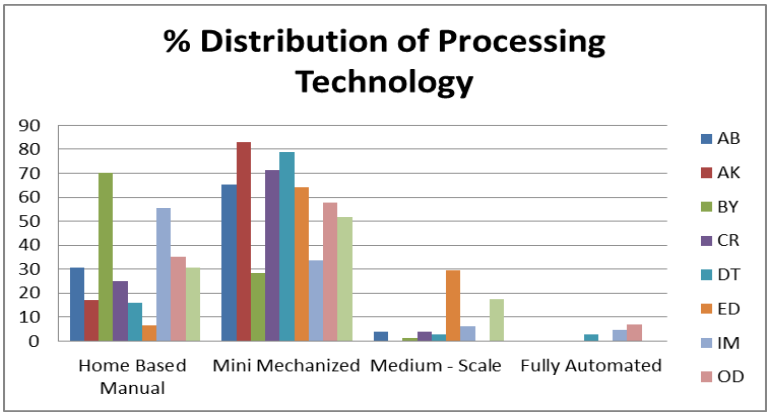
1.4.2 Adoption of Best Practices in Processing

Basically, a palm oil mill produces crude palm oil and kernels, as primary products and biomass as a secondary product.

The home-based manual mill substantially employs manual labour and the output and efficiency are a function of number of workers available and their ability to provide heating and also speedily move intermediary products from point to point.

Mini mechanized mills process between 1 – 2 mt FFBs/day, and consist of operational units for sterilization, stripping, digestion and pressing, clarification, purification, drying and storage. For the kernel line, there are steps such as nut/fibre separation, nut conditioning and cracking, cracked mixture separation, and kernel drying, and storage. The dried kernels are often sold to palm kernel crushers for extraction of crude palm kernel oil. In some integrated plants, kernel crushing facilities exist side by side at the same complex12.

Figure 35: Percentage Distribution of Processing Technology



The processing facilities carry-out similar basic functions but differ in capacity as the home-based mill processes small amounts, which are flexible in accordance with availability of labour. The Semi–mechanized mini to medium scale mills process 1 – 5 tons per day (in this category, the home-based manual mills could operate at full capacity because of small installed capacity, but mini-mechanized and medium-sized mills are unable to operate at high levels once

[12]PIND (2012): A Scoping Study on the Palm Oil Value Chain in Rivers and Imo States, Nigeria

there is scarcity of supply of FFBs during low harvest or low delivery); the fully automated line can do 10 tons upwards per day. Capital is a major determinant of what size to acquire, in addition to existence of a dependable source of FFBs.

The above Fig. shows that apart from Bayelsa and Imo states with 70.24% and 55.38% respectively of manual mills, all other states had a significant ownership of mini mechanized mills. Therefore with some basic knowledge of the mechanized process of oil milling, entrepreneurs in these states had some understanding of mechanization, which would enable them to easily adopt higher levels of mechanization.

Undoubtedly, value chain actors will better comprehend and subsequently, promote the adoption of improved technologies covering best practices if efforts are made to increase their availability and ease acquisition. For instance, the Technology Adoption Grant (TAG) fund launched by MADE in November 2016, would improve access to improved palm oil processing technologies by encouraging equipment manufacturers to fabricate and sell small-sized components of improved palm oil processing technologies, with the aim of addressing the low oil output and earnings experienced by smallholder farmers and millers through the use of engine powered digester and a manual press[13].

1.5 Industrial End Users of Oil Palm Products & Derivatives

Palm oil is used in Nigeria both for food and non-food consumption purposes. Out of the four – five variants of palm oil, four of them, namely Special Palm Oil (SPO), Crude Palm Oil, Palm Kernel Oil (PKO) and Refined Bleached Deodorized Oil (RBD) are of interest to industrial end users.

The end users produce various items such as further refined grades of palm oil, vegetable oils, margarine, pharmaceutical stearin and palm wine, among others. They also have by-products including ashes and brooms.

Less than 2% of processing facilities are industrial and most large scale plantations in Nigeria started out as government owned estates, but were run inefficiently. Some of them like Okomu, Presco became privatized in the 1980s and 1990s and have become efficiently run as private businesses returning good profits annually. Two of them namely, Presco and Okomu, are quoted on the Nigerian Stock Exchange. The defunct Risonpalm was owned and run by the Rivers State Government and has now been acquired by SIAT owners of Presco, while the old Calaro and Kwa falls initially owned by the Cross River state government are now owned and run by Wilmar. These estates are run with best management practices and are highly capitalized. The following estates/firms in the States are:

(i) Presco Oil, Okomu Oil, Benin City, Edo State
(ii) Ada Palm, Camela Palm Oil Company, Owerri, Imo State
(iii) Ore-Irele Oil Palm Company Limited Ondo State
(iv) Araromi-Ayesan Oil Palm Plc Ondo (now privately owned and being rehabilitated)
(v) Wilmar West Africa (Cross River)
(vi) REAL Plantation Limited Odukpani LGA, Cross River State
(vii) Abia palm (currently inactive)Ohambele,

[13]ThisDayTabloid (2016): A Giant Step Towards Helping Niger Delta Farmers; accessed online at http://www.thisdaylive.com/index.php/2016/11/20/a-giant-step-towards-helping-niger-delta-farmers/

Conveying FFBs at Tai LGA in Rivers State

The industrial processing mills buy FFBs from dealers with whom they had established relationships; they are usually reluctant to disclose their installed capacities and capacity utilization.

REAL Plantation Limited (RPL) situated at Odukpani LGA of Cross River State as a case in point; the firm operates an integrated establishment having 1,200 hectares of oil palm (the most recent palms were planted in 2004). The firm does not work with the hundreds of small-holder farmers around due to low quality FFBs; thus the farmers sell their harvest to dealers.

Installed and actual capacities were not disclosed. RPL palm oil has very high demand (sometimes, people make advance deposits prior to collecting palm oil and palm kernel). The company sells the oil in bulk because they are not able to meet the demand for small packaging. The kernels are sold-off to those who make palm kernel oil (PKO).

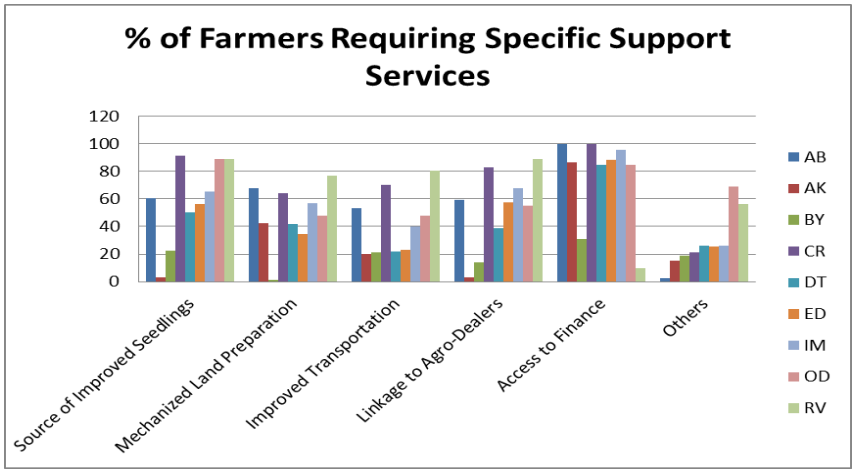
The major challenges faced by RPL include high cost of pesticides, poor access roads (clayey soil, which impedes smooth vehicular movement to and from the farm for collection of harvested FFBs) and poor terrain which also contributes to high cost of tractor and vehicle maintenance.

Processing constraints: low quality of FFBs (usually dura fruits as well as unripe friuts) from farms within the immediate community, implying that the processor is not benefitting from the community and vice versa; paucity of fabricated materials for expansion; poor technical know-how compels the company to adopt trial-and-error measures, which unduly escalate the cost of operations and lack of power supply.

1.6 Critical Market Support Services in the Niger Delta

For a value chain to thrive effectively, certain support services are required; accordingly, the farmers' responses to the question on what support services they need for their business are presented in the Fig. below:

Figure 36: Specific Support Services Demanded by Respondents

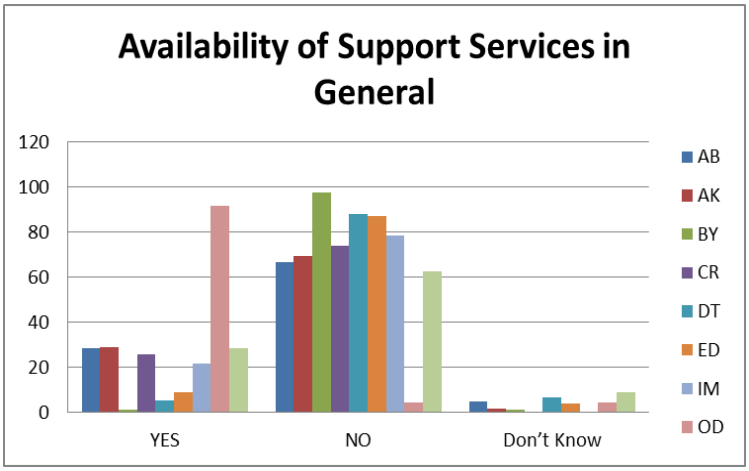


Cross River, Rivers and Ondo states' clusters consistently indicated access to improved varieties as a key need while Akwa Ibom was lowest at 3.22%. Rivers and Abia mentioned mechanized land preparation as an important support service as opposed to Bayelsa at the other extreme (1.19% of clusters). Furthermore, due to the poor nature of feeder roads in the Niger Delta, the need for improved transportation services remained significant, with variation from one state to another; it was low in Delta for instance (22.08%) and highest in Rivers (80.22%).

Expectedly, access to finance is a major challenge facing entrepreneurs; In the clusters surveyed, the oil palm producers mentioned this issue (100% in Abia and Cross River and 95.38% and 88.46% of clusters in Imo and Edo states respectively). In Rivers State 9.5% of farmers in the clusters surveyed considered access to finance as a challenge. This could imply that the players in the industry are well resourced to handle their financial needs to underytake the business.

When asked to rate the general extent of availability of support services (Fig. 14), only in Ondo State did we have a significant number responding positively (91.55%); in other states, the availability was low – Bayelsa 1.19%, Delta 5.26% and Edo 8.97%.

Figure 37: Availability or Otherwise, of Support Services in General



Extension Agent Training of Farmers in Bayelsa State

1.7 Gaps & Opportunities for Investment in Support Services

Any gaps along the supply chain (whether in primary production or at the post-harvest stage) would have a negative impact on the quantity of produce getting to the market.

The mapping exercise revealed at least five support services necessary for the oil palm sector in the Niger Delta and which continued availability and effectiveness would facilitate development of the oil palm supply chain. The services, in decreasing regularity of being mentioned by the farmers, are access to finance, access to improved oil palm varieties, linkage to agro-dealers, mechanized and affordable land preparation services and improved transportation services. Other services, based on our judgment and discussions with key informants, are extension services and linkage to processors.

Towards development of the oil palm supply chain, the Fig. below gives summarizes the perceived gaps, each with its opportunity for investment in a related support service(s) and the expected benefit(s):

Table 30: Gaps, Opportunities for Investment and Expected Benefits

Perceived Gap	Perceived Opportunity	Likely Impact & Benefit(s)
1. Group action still largely rudimentary	Capacity building for farmers and nurturing of existing groups to enhance their formality	▪ Evolution of better-organized groups ▪ For all agencies, the farmers become easier to reach and interact with ▪ Increased adoption of innovations
2. Paucity of mechanical land preparation services	Private mechanization services	▪ Accessibility and timely availability of service to the farmers ▪ Less drudgery in land preparation ▪ Cheaper land preparation ▪ Increased income for the farmers ▪ Income for the service providers ▪ Capacity for maintenance services of equipment

3. Poor extension out-reach	Innovative extension systems linked to input and service provision	▪ Regular contacts with the farmers ▪ Increased adoption of innovations
4. Insignificant linkage to agro-dealers	▪ Creating distribution outlets and expand the customer base ▪ Training farmers on application of fertilizers and agrochemicals	▪ Increased demand for agrochemicals ▪ Farmers become more knowledgeable on the safe and effective use of pesticides ▪ Better crop performance leading to increased yields ▪ Increased income for farmers ▪ Increased income for manufacturers and distributors of agrochemicals ▪ A safer ecosystem.
5. Lack of access to finance	Provide financial services at the different levels of value chain i. Nursery operation ii. Input supplies iii. Transportation iv. Milling equipment v. Aggregation and marketing	▪ Enhanced financial inclusion of the farmers ▪ Increased yields and income for producers ▪ Increased raw materials for processing firms ▪ Increased revenue for institutional lenders
6. Farmers' poor access to large-scale processors	▪ Linkage to be created by agencies, private or public ▪ Investment in Modern Processing Mills	▪ Ready and timely availability of FFBs ▪ Increased availability of raw materials ▪ Increased income for farmers and processors
7. Unavailability of transport to evacuate FFBs from farms to the buyers	Investment in transportation services and simple vehicles for transportation	▪ Timely evacuation of products ▪ Ready and timely availability of FFBs ▪ Increased income for farmers, processors and service providers
8.		▪
9. Scarcity of high quality planting materials	Service provision – Accredited Nursery operators	▪ Progressive replacement of old plantings with new stands ▪ Establishment of new plantations ▪ Shorter gestation period palms, leading to early yields and exploitation ▪ Shorter period for return on investments ▪ Higher yields in the long term ▪ Increased revenues for farmers ▪ Increased revenues for seedling producers

INPUTS FROM KEY INFORMANTS

Responses from Farmers

Farmers consider oil palm as a major crop, despite its long gestation period; for this reason, multiple cropping and other revenue-yielding activities are usually embarked upon.

Participation of females in primary production could be increased through giving them capacity building, access to funding and access to land. Furthermore, in order to increase the participation of females in farmers' training activities, the females need some form of assurance that they would gain access to finance and other support activities; in addition, the training must be effective. In the case of farmers generally, their participation in formal group action can be enhanced if they see positive results and if they can access finance through the cooperatives; many producers believe that enhancing their own participation could be done by the farmers themselves, in addition to extension agents and government-sponsored advocacy through radio jingles.

Where farmers had been trained, the aspects that were most appreciated include the training on BMP, use of harvesting/pruning tools only for short trees, chemical weed control and demonstration on agro-inputs. If training fees are really low, the farmers would be willing to pay for training.

Incidence of mixed stands (local and improved varieties) is occasioned by the high cost of improved varieties; even though some farmers recognize the superiority of improved varieties over local varieties, some 'think' the cost is high; some farmers obtain their seedlings from NIFOR and plant only improved varieties

At the point of selling FFBs, some farmers just decide to sell to processing plants, some process themselves; others are non-selective on who buys, provided the cash comes quickly. Challenges farmers face in selling their FFBs include limited number of mills; unhealthy price competition among farmers; poor transport and inaccurate weighing of bunches.

Farmers, if they were in a position to decide, would establish processing mills of less than 10mt/day, some up to 50mt/day (we were not sure if these farmers really realized how massive such quantity was. Reasons for citing a mill in a given location were proximity to farms and proximity to market.

Farmers' access to support services ranged from 'none at all' to 'empty promises in regards to finance' and poor mechanization and poor transportation. Furthermore, apart from finance, other major challenges limiting farmers' access to support services include lack of information, insincerity of extension agents and general lack of awareness. Relatedly, the effects of these challenges could be cushioned through the use of reputable extension agents and creating more awareness.

Processors' Responses

The sources of FFBs for processors include own farms (30% of processors), farmers' supply (30%) and open market, including any other farmers (40%); processors that purchase FFBs from outside do so on a cash-on-delivery basis (that is, very minimal proportion of their accounts payables would consist of FFBs purchased on credit). Out-grower schemes are not common in the farmer-processor relationship, presumably because most existing processors evolved on account of forward integration, since the facilities were established by entrepreneurs who already had farms. Purchase of FFBs is highest around May to July.

Volume of oil produced per processor ranges from 5,000 litres – 10,000 litres monthly and the peak period of output is April – June and sold from June – December (peaking around October to

December). There is almost always demand for palm oil and therefore over 90% of output is usually sold not long after producing; some processors even record 100% of sales, implying unsold inventories are carried over very short periods.

Most processors are only able to produce Technical Palm Oil (TPO) lareely because of the process of storage of fruits beyond seven days to allow the fruits to loosen befoore processing. This raises the FFA in the fruits before processing. The resulting oil wouldinvariably have FFA higher thanthe 5 to 6% of the Special CPO, demanded for industrail use in refining. TPO is produced by all facilities operating near the homestead. Typically the average installed capacity per day of such miling facilities is 10 MT FFB. These facilities often operate below their capacities, with capacity utilization of 35% - 75%. Reasons adduced for inability to operate at full capacity include strategic focus on raw materials from own farm and from relations, lack of funds to employ more labour, lack of working capital to purchase enough FFBs from the market and slow pace of the whole mill process especially as sterilizers, digesters and press and, as well as low FFB output from own farms and neighbouring farms during the lean FFB seasons from June to December.

Processors' awareness about the existence of other processors appeared superficial, as they generally felt that processing facilities (almost all private-owned), are 2km – 3km apart irrespective of size. Information about the existence of government-owned processing facilities was mostly from third parties. They did not fear likely competition from nearby mills, since the market would absorb all output. Furthermore, if authorized to decide, they would establish mills of 5mt – 10mt per day, to be sited based on considerations such as access to land, access to sources of FFBs and proximity to oil palm farmers.

Farmers' decision to sell FFBs in the market or to a processor is influenced by the need for quick cash; the challenges farmers face in selling their harvested fresh fruit bunches include inadequate transport and poor pricing.

The support services agro-processors need and which they are not getting adequately are transportation and training on best practices in oil palm milling. While some processors feel MADE is best poised to provide the services, many others feel any private sector body could.

Major challenges facing processors is the slowness of processing equipment, in addition to excessive taxation, high cost of repairs and lack of funding. The effects of the challenges could be cushioned by "improvement in the design of oil mill supplied by MADE"

SELECTED COMMENTS FROM INTERVIEWEES

Farmers

1. Those giving support services do not know us; solution is for them to reach-out to the farmers;
2. Our people are unwilling to release any information reasons because so many people have come to interview them without bringing any intervention or services to them in return, so they believe interview sessions are a waste of time;
3. Most entrepreneurs in Cross River have never heard about MADE...they are more familiar with Fadama Program;
4. MADE is the intervention that has impressed me most; not only did they make us receive effective training, they also gave us processing equipment for which each recipient contributed 50% of the cost of equipment, unlike many other interventions that just train farmers and end there;
5. The private sector should invest greatly in oil palm so we do not have to wait for government;
6. The government has promised a whole lot but no support service is coming from them;
7. More trainings should be organized and grassroot farmers should have access to finance;
8. In Edenu Community of Esan Central LGA of Edo State, women are already very much involved in farming, milling and even selling;
9. Farmers are unlikely to want to pay for training if they realize it concerns what they already know; however, if there are innovations and progress with increasing income, they may wish to pay for training;
10. Youths should be encouraged to join oil palm production; and
11. The interventions we get are too many without results; when we see results we would be glad to answer questions at any time.

Processors

1. MADE should inform the fabricators of the processing mill to improve; it takes too much time and water;
2. To help in resolving the challenges facing farmers and processors, MADE could help intercede on behalf of farmers;
3. We need to, as a body of processors, approach the government to lower the tax rates for processors;
4. More assistance in the form of support services and loans/grants should be provided to oil palm processors;
5. One of our major problems is the insincerity of loan disbursement agencies (financial institutions and other bodies promise and fail to deliver); and
6. Processing of oil palm into palm oil is a good business but we need financial assistance to acquire improved technologies so we can add our own quota to the availability of palm oil.

CONCLUDING REMARKS

This cluster mapping exercise commissioned by MADE has enabled the location of oil palm producing clusters in the nine states of the Niger Delta; Abia, Ondo, Rivers, Imo and Cross River have the highest population of oil palm farmers while Abia, Imo, Delta and Cross River have the largest areas under oil palm cultivation.

In line with similar related studies in the past, Akwa-Ibom and Abia have high densities of wild groves, while Edo, Cross River and Ondo have substantial populations of improved varieties. The high quantities of FFBs that can emanate from the region offer a wide range of huge investment openings for entrepreneurs, who must take cognizance of the need to sustain knowledge dissemination activities, which encourage adoption of technologies for increased yields of FFBs.

Oil palm production is quite profitable, as evidenced by net margin of 138% in Delta to 464% in Akwa-Ibom; lower net margins are due to high costs of production, which a determined and discerning investor can control. Overall, profitability could be further boosted depending on some factors such as mode of entry into the business and bases of expense recognition.

Due to the preponderance of home-based manual mills producing Technical Palm Oil in the region, there are investment opportunities for industrial mills, which would mop-up the readily available raw materials under terms and conditions convenient and beneficial to both farmers and millers.

The gaps existing in the availability of key support services have created investment opportunities in capacity building, multiplication of improved seedlings, mechanization, commercial extension services, marketing of agro-inputs, financial intermediation, access to processors and transportation services and vehicles.

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2 APPENDICES

2.1 APPENDIX 1: Features of the Technology Used in Capturing Data from the Field

Features of the Web Application

- User-friendly and easily learned
- Easy to deploy, even in remote locations
- Responsive design so as to look good on both small screens (such as mobile phones and other hand-held devices) as well as big screens of desktop and laptop computers
- Existence of an admin section, which allowed for viewing of all data that had been transmitted from the mobile devices. There was also a provision for editing by the administrator as and when necessary
- Could produce a map using the coordinates of retrieved data plotted
- Sufficiently interactive to display information when a particular coordinate on the map is clicked

Features of the Mobile Application

- User-friendly and easily learned
- Employed common android phones
- Ease of collecting information such as name, LGA and all other items contained in the questionnaire
- Possibility for the local storage of information retrieved so as to view all data collected by each worker (this means that even under conditions of poor connectivity, the data remained in the device for subsequent transmission to the server whenever/wherever connectivity improved).

Complements

On-line Web Hosting Server (A2 Hosting) and the GPS-enabled mobile phone (Android)

2.2 APPENDIX 2: Tables of Top Five Oil Palm Clusters in Each of the Nine Niger Delta State

ABIA						
LGA	Village	Farmers	% Male	% Female	Total HA	Total MT
Ukwa West	Ikpokwu	300	91%	9%	750	6,750
Osisioma Ngwa	Abayi	270	74%	26%	540	3,240
Bende	Lodu	250	76%	24%	500	4,500
Ukwa West	Ukwuapu	240	100%	0%	600	12,000
Ukwa West	Umuadiewe	235	73%	27%	587.5	7,344

AKWA IBOM						
LGA	Village	Farmers	% Male	% Female	Total HA	Total MT
Ini	Ebbo	50	60%	40%	150	600
Etim-Ekpo	Etok Uruk Eshiet	30	40%	60%	90	1,170
Etim-Ekpo	Etok Uruk Eshiet	25	60%	40%	62.5	1,500
Oruk Anam	Obio Ibiet Esa	23	61%	39%	46	377
Etim-Ekpo	Utu Idung	22	14%	86%	66	132

BAYELSA						
LGA	Village	Farmers	% Male	% Female	Total HA	Total MT
Ogbia	Otuaba	90	94%	6%	3,600	32,400
Ogbia	Otuoke	70	93%	7%	490	13,720
Ogbia	Otuabula	16	100%	0	208	2,496
Ogbia	Otuabula	15	100%	0	135	2,430
Ogbia	Emeyal II	14	100%	0	98	1,078

CROSS RIVER						
LGA	Village	Farmers	% Male	% Female	Total HA	Total MT
Ugep North	Mkpani	50	80%	20%	250	3,750
Yarkur	Idomi	36	31%	69%	252	3,528
Abia	Akamkpa	30	67%	33%	498	6,972
Akampa	Aning Eje	27	81%	19%	135	1,991
Abia	Nsidung	25	20%	80%	125	1,750

DELTA						
LGA	Village	Farmers	% Male	% Female	Total HA	Total MT
Isoko South	Alihiamen	40	50%	50%	200	1,800
Aniocha South	Osubi	38	50%	50%	380	4,940
Ethiope East	Ovoire Ovu	35	80%	20%	280	4,760
Ethiope East	Oviore-Ovu	31	81%	19%	403	6,448
Ethiope West	Ogharefe	28	71%	29%	420	5,460

EDO						
LGA	Village	Farmers	% Male	% Female	Total HA	Total MT
Ikpoba-Okha	Egba	30	73%	27%	300	1,249
Ovia South-West	Igo	28	46%	54%	70	329
Ovia South-West	Aden	27	63%	37%	270	1,418
Esan West	Uhiele	25	80%	20%	125	489
Uhunwonde	Ehor	20	55%	45%	100	800

IMO						
LGA	Village	Farmers	% Male	% Female	Total HA	Total MT
Oguta	Eziorsu	110	55%	45%	1100	13,200
Aboh-Mbaise	Umuagwo	85	41%	59%	255	2,040
Aboh-Mbaise	Umulolo, Ogbe	50	50%	50%	150	1,425
Aboh-Mbaise	Alarnyi, Ogwa	47	85%	15%	141	1,340
Aboh-Mbaise	Ezuhu, Nguru Mbaise	45	67%	33%	135	1,080

ONDO						
LGA	Village	Farmers	% Male	% Female	Total HA	Total MT
Owo	Ute Road	90	61%	39%	270	1,350
Owo	Ogunmodede Camp	75	67%	33%	225	1,350
Owo	Ipele	60	67%	33%	120	840
Akure South	Agboola	50	80%	20%	100	600
Akure North	Oba-Ile	48	81%	19%	96	624

RIVERS						
LGA	Village	Farmers	% Male	% Female	Total HA	Total MT
Etche	Elele	70	71%	29%	280	3,136
Etche	Elele-Etche	60	75%	33%	360	3,780
Khana	Taabaa	35	57%	43%	175	263
Khana	Taabaa	30	67%	33%	300	3,540
Etche	Okahi	20	75%	25%	100	1,000

2.3 APPENDIX 3: Raw Data Represented in the Figures

World production of major vegetable oils 2000 – 2016 ('000 tonnes)

Oils	2000	2001	2002	2003	2004	2005	2008	2014	2016
Palm Oil	21,867	23,984	25,409	28,259	30,987	33,846	43,118	59,189	62,792
Palm Kernel Oil	2,698	2,947	3,044	3,347	3,581	3,978	4,989	6,521	6,820
Soya bean oil	25,563	27,828	29,850	31,241	30,729	33,612	37,164	45,072	48,720
Cottonseed oil	3,850	4,052	4,221	3,987	4,367	4,978	5,029	4,910	2,980
Groundnut oil	4,539	5,141	5,178	4,508	4,706	4,506	4,445	3,930	3,680
Sunflower oil	9,745	8,200	7,610	8,917	9,423	9,785	10,687	16,312	14,970
Rapeseed oil	14,502	13,730	13,343	12,698	15,088	16,294	19,847	27,163	26,130
Corn oil	1,966	1,962	2,016	2,017	2,025	2,133	2,408	2,998	3,200
Coconut oil	3,261	3,499	3,098	3,270	3,040	3,237	3,130	3,071	2,980
Olive oil	2,540	2,761	2,773	2,904	3,110	2,965	3,081	2,940	2,860

Castor Oil	497	515	438	425	500	540	603	650	670
Sesame oil	705	747	807	810	831	868	803	872	810
Linseed oil	705	648	581	594	635	626	643	619	

(MPOB Statistics 2008), Oil World 2017.

Major producers of palm oil 1999-2008 ('000 tonnes)

	1999	2008	2017
Indonesia	6250	19330	36800
Malaysia	10,554	17,734	19,920
Thailand	560	1,170	2,580
Nigeria	720	860	1250
Colombia	500	800	1680
Ecuador	263	415	593
Papua New Guinea	264	400	530
Cote d'Ivoire	264	330	415
Others	1,250	2,079	4,102
Total	20,625	43,118	67,870

	1999-2008	2008-2017
Indonesia	209%	90%
Malaysia	68%	12%
Thailand	109%	121%
Nigeria	19%	45%
Colombia	60%	110%
Ecuador	58%	43%
Papua New Guinea	52%	33%
Cote d'Ivoire	25%	26%
Others	66%	97%

Source: Adapted from Index Mundi Statistics (2017) 2018, Ista Mileke Oil World, March 2018

Authors' estimate

World Palm Oil Production ('000,000 MT) and Yield (MT/Ha) 2015 – 2017

Country/Region	Production '000,000 MT			Oil Yield MT/ha		
	2015	2016	2017	2015	2016	2017
Indonesia	33.53	32.40	36.80	3.89	3.54	3.81
Malaysia	19.96	17.32	19.92	4.18	3.51	3.93
Thailand	2.07	1.80	2.58	2.76	2.34	3.15
Americas	3.83	4.04	4.71	2.99	2.93	3.36
Africa	2.38	2.44	2.55	1.66	1.65	1.68
Other Countries	1.17	1.23	1.31	2.28	2.32	2.38
World	62.94	59.23	67.87	3.02	3.25	3.56

Source: Ista Mielke Oil World, March 2018

Seeds sold by NIFOR directly to customers across the Niger Delta states between 2008 and 2017

	Abia	Akwa Ibom	Bayelsa	Cross River	Delta	Edo	Imo	Ondo	Rivers	Total
	No of sprouted seeds supplied									
2008	200	414,500	1,500	925,420	19,450	134,979	208,750	153,600	1,000	1,861,407
2009	8,800	1,000	0	178,300	39,609	68,616	52,250	40,791	500	391,875
2010	23,500	1,000	0	16,966	141,283	68,620	900	388,850	2,166	645,295
2011	7,700	1,000	1,200	60,000	89,600	115,350	10,000	26,700	2,166	315,727
2012	15,000	800	0	4,000	46,900	130,250	7,000	5,500	1,000	212,462
2013	0	2,800	0	19,000	30,600	165,000	300,000	14,800	1,500	535,713
2014	3,000	3,000	0	12,500	29,950	141,800	2,000	22,900	1,000	218,164
2015	14,600	14,600	0	9,000	32,900	134,130	18,160	27,900	0	253,305
2016	3,500	3,500	0	6,000	59,950	93,840	8,000	32,900	3,000	212,706
2017	2,500	2,500	0	46,000	150,540	35,100	2,700	69,300	15,000	325,657
Total	**78,800**	**444,700**	**2,700**	**1,277,186**	**640,782**	**1,087,685**	**609,760**	**783,241**	**27,332**	**4,952,186**

Source: Seed production Division, NIFOR 2018

Sprouted Seeds supplied under the ATA to major Nursery Operators in the Niger Delta between 2012 and 2015

	2012	2013	2014	2015	Total
Abia	125,000	289,288	90,000	100,000	604,288
Akwa Ibom	45,000	294,513	110,000	50,000	499,513
Bayelsa	0	184,560	0	0	184,560
Cross River	120,000	427,123	90,000	177,000	814,123
Delta	30,000	205,341	180,000	0	415,341
Edo	30,000	380,841	88,000	380,000	878,841
Imo	0	139,288	191,500	0	330,788
Ondo	0	176,722	240,000	0	416,722
Rivers	0	109,560	75,000	50,000	234,560
Total	**350,000**	**2,207,236**	**1,064,500**	**757,000**	**4,378,736**

Source: Seed Production Division, NIFOR 2018

Total sprouted seeds supply to states of the Niger Delta from 2008 - 2017

State	**Customers (2008 – 2017)**	**ATA (2012 – 2015)**	**Total (2008 – 2017)**
	No of sprouted seeds supplied by NIFOR		
Abia	78,800	604,288	683,088
Akwa Ibom	444,700	499,513	944,213
Bayelsa	2,700	184,560	187,260
Cross River	1,277,186	814,123	2,091,309
Delta	640,782	415,341	1,056,123
Edo	1,087,685	878,841	1,966,526
Imo	609,760	330,788	940,548
Ondo	783,241	416,722	1,199,963
Rivers	2,700	234,560	237,260
Total	**4,927,554**	**4,378,736**	**9,306,290**

Source: Seed production Division, NIFOR 2018

Estimated Area Planted Assuming 50% success between 2009 and 2018

State	**Sprouted Seeds 2008 - 2017**	**Estimated Area Planted (Ha)**	**Estimated FFB at maturity (MT)**
Abia	683,088	2,440	36,600
Akwa Ibom	944,213	3,372	50,580
Bayelsa	187,260	669	10,035
Cross River	2,091,309	7,469	112,035
Delta	1,056,123	3,772	56,580
Edo	1,966,526	7,023	105,345
Imo	940,548	3,359	50,385
Ondo	1,199,963	4,286	64,290
Rivers	237,260	847	12,705
Total	**9,306,290**	**33,237**	**498,555**

Assumption: Assuming maturity age of 8 years and FFB yield of 15 MT peer ha per year

Predominant Varieties

	AB	**AK**	**BY**	**CR**	**DT**	**ED**	**IM**	**OD**	**RV**
Dura	95.24	67.8	57.15	24.69	10.85	5.13	18.47	11.26	96.7
Tenera	1.19	13.56	30.95	53.09	45.78	94.87	75.38	85.92	0
Pisifera	1.19	13.56	3.57	8.64	0	0	0	0	0
Do Not Know	2.38	5.08	8.33	13.58	43.37	0	6.15	2.82	3.3
Total	100	100	100	100	100	100	100	100	100

Estimated total area, FFB, palm oil and palm kernel production in Abia State

Production System (2009)	Area (ha)	FFB	PALM OIL	PALM KERNEL
		(MT	(MT)	(MT)
ESTATES	4,589	18,356	2,203	734
SMALLHOLDING	27,765	83,295	8,746	3,332
Sub-total of improved plantings	32,354	101,651	10,949	4,066
WILD GROVES	150,000	150,000	13,500	7,500
TOTAL	182,354	251,651	24,449	11,566

Source: Omoti, 2009

FFB, Palm Oil and Palm Kernel Output Akwa Ibom

	Estimates			
PRODUCTION SYSTEM	Area (Ha)	FFB (MT)	PO (MT)	PK (MT)
Large Estate	3,095.40	9,286.20	975.05	371.45
Smallholders	32,277	129,108.00	13,556.34	5,164.32

Wild Groves	240,000	240,000.00	21,600.00	9,600.00
TOTAL		**378,394.20**	**36,131.39**	**15,135.77**

Source: Omoti and Ikuenobe (2009)

Rivers Cluster Distribution

Cumulative

SN	LGA	Farmers	Total	Average
1	Etche	199	514	2.58
2	Oyigbo	54	268	5.06
3	Khana	60	135.2	2.25
4	Asari Toru	12	22	1.83
5	Tai	69	135.5	1.93
6	Ikwerre	75	116.2	1.55
7	Ahoada West	12	19.3	1.61
8	Omuma	24	79.5	3.31
9	Onelga	24	98.5	4.1
8	Walga	16	32.5	2.03
9	Biara	14	135	9.64
10	Emouha	33	60	1.82
11	Obio Akpor	9	15	1.67
12	Ahoada East	43	214	4.98
13	Abua Odual	81	201.5	2.49
14	Andoni	16	22	1.38
15	Ogba Egbema	10	20.5	2.05
16	Eleme	5	11.5	2.3
	Total	732	2,100.20	
	Overall Average Farm Size			2.87

Source: Survey Field Data and ADP, 2018

Oil Palm Growers in Edo State organized in OPGAN

	LGA	Farmers	Ha	FFB MT
1	Akoko Edo	23	169.00	2,028.00
2	Esan Central	5	250.00	3,000.00
3	Esan North East	12	100.00	1,200.00
4	Esan South East	12	3,466.00	41,592.00
5	Esan West	11	130.00	1,560.00
6	Igueben	5	40.00	480.00
7	Etsako Central	9	269.00	3,228.00
8	Etsako East	3	6.00	72.00
9	Etsako West	8	169.00	2,028.00
10	Uhunmwode	46	1,817.00	21,804.00

11	Orhionmwon	68	1,039.00	12,468.00
12	Egor	13	383.00	4,596.00
13	Ikpoba Okha	37	665.00	7,980.00
14	Oredo	22	435.00	5,220.00
15	Ovia North East	46	1,486.00	17,832.00
16	Ovia South West	33	767.00	9,204.00
17	Owan East	22	158.00	1,896.00
18	Owan West	12	48.00	576.00
	Total	**387**	**11,397.00**	**136,764.00**

APPENDICES

APPENDIX 1: Features of the Technology Used in Capturing Data from the Field

Features of the Web Application

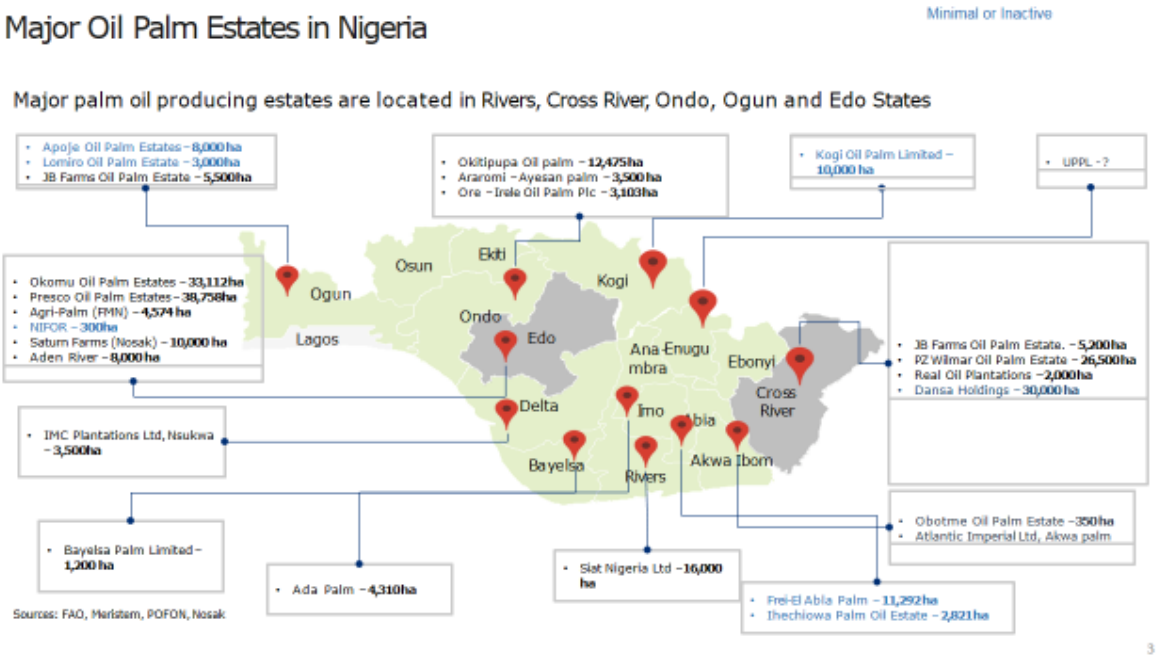
- User-friendly and easily learned
- Easy to deploy, even in remote locations
- Responsive design so as to look good on both small screens (such as mobile phones and other hand-held devices) as well as big screens of desktop and laptop computers
- Existence of an admin section, which allowed for viewing of all data that had been transmitted from the mobile devices. There was also a provision for editing by the administrator as and when necessary
- Could produce a map using the coordinates of retrieved data plotted
- Sufficiently interactive to display information when a particular coordinate on the map is clicked

Features of the Mobile Application

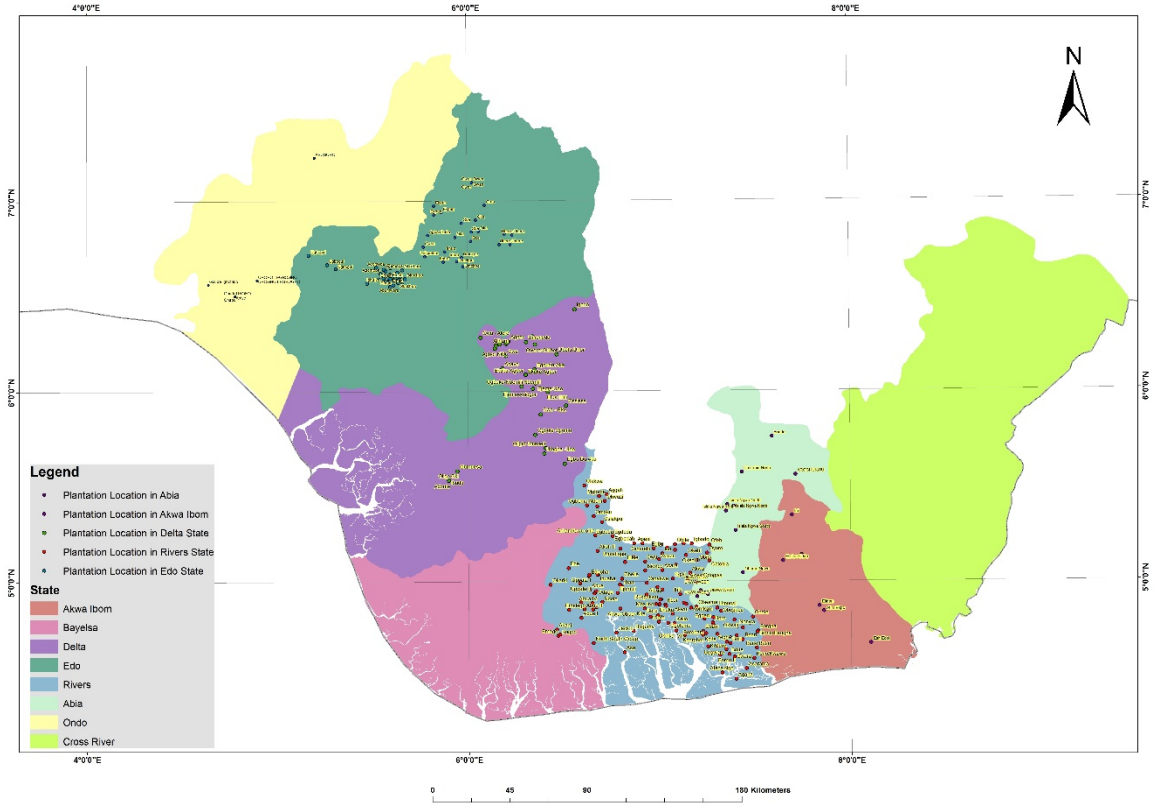
- User-friendly and easily learned
- Employed common android phones
- Ease of collecting information such as name, LGA and all other items contained in the questionnaire
- Possibility for the local storage of information retrieved so as to view all data collected by each worker (this means that even under conditions of poor connectivity, the data remained in the device for subsequent transmission to the server whenever/wherever connectivity improved).

Complements

On-line Web Hosting Server (A2 Hosting) and the GPS-enabled mobile phone (Android)



Locations of clusters studied


4°0'0"E
6°0'0"E
8°0'0"E
N
7°0'0"N
6°0'0"N
5°0'0"N
Legend
Plantation Location in Abia
Plantation Location in Akwa Ibom
Plantation Location in Delta State
Plantation Location in Rivers State
Plantation Location in Edo State
State
Akwa Ibom
Bayelsa
Delta
Edo
Rivers
Abia
Ondo
Cross River
0
45
90
180 Kilometers