Assessment of Palm Products Uses and Sustainable Practices in the Southern Nigeria

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***Abstract*: The study assessed the palm products uses and sustainable practices in selected States of Southern Nigeria. The study adopted the use of cross sectional research design and made use of 560 structured copies of questionnaire to elicit information from the oil palm farmers and producers using purposive and random sampling techniques. Descriptive statistics were used for analyzing the data. Findings showed that oil palm tree has various uses which are apparently and diverse in the study area among which included palm oil, palm kernel oil, brooms, palm wine, building, local baskets, mushroom growth and cooking materials. Results also showed that 53.8% of oil palm famers practiced monocropping while 46.2% engaged in intercropping. However, 3.6% intercropped oil palm with plantain; 38.5% with cassava/cocoyam; 2.3% with banana while 1.7% with vegetables. Findings showed majority (>70%) of sampled oil palm producers frequently carry out oil palm practices which included excessive use of fertilizers, burning of forested lands, extending of oil palm farm, use of empty fruit bunches.. Furthermore, results also indicated that that oil palm producers' (95.2%) rarely treats their liquid waste from initial processing before its final release into the environment; and this practice is not conducive for the environment as this can pollute the environment. More than 75% of respondents agreed that lack of government intervention, high cost of labour, lack of storage capacity, shortage of land, technical and economic inefficiencies, poor road network link road, poor electrical supply inadequate credit facility, heavy use of manual processing techniques and inadequate research to improve oil palm business were the challenges being faced by the oil palm farmers. The study concluded that the practices employed for oil palm production among were not sustainable because of deforestation practices, and forest conversion practices lead to degradation of forests without adequate replacement strategies. The study recommended among others that government should create enlightenment programmes that are directed at educating oil palm farmers as regards conservation strategies that will promote sustainable practices in the face of meeting increasing demands.**

***Keywords*: Palm products; Uses; Sustainable practices; Southern Nigeria; Challenges**

I. INTRODUCTION

Oil palm is a typical crop of the rainy tropical lowlands. The plant belongs to the kingdom Plantae, family Arecaceae, sub family Arecoideae, tribe Cocoeae, genius Elaeis, and it is scientific name is *Elaeis guineensis* (Gledhill, 2008; FAO, 2014). It is in the family along with coconut and date palms. The tree requires a deep soil, a relatively stable high temperature and continuous moisture throughout the year. Soil fertility is less important than physical soil properties. The plants are raised in Nurseries where proper care is given to the seedlings. The seedlings spend 1 year in the nursery before been transplanted to the field. Oil palm is planted in the main field in the triangular system at a spacing of 9 m accommodating 140 palms per ha. Planting is preferably done at the onset of rainfall during May-June. The first harvest can be taken 3.5 to 4 years after planting (Friends of the Earth (FOE), 2015). After field establishment, various management are required before it starts fruiting; and these are: putting wires around seedlings to prevent rodents attack; trimming the plant; cutting the dry leaves close to the trunk; regular weeding; and applying fertilizer at the recommended rate (FAO, 2014).

According to FAO (2014) three varieties of Oil palm are available in Nigeria; namely Dura, Pisifera and Tenera. The preferred variety among palm oil farmers in Nigeria is the hybrid Tenera which is a crossbreed of the Dura (female) and the Pisifera (male). Tenera seedlings are produced by the Nigeria Institute for Oil Palm Research (NIFOR) and commonly referred to as the extension work seeds. In terms of comparison, the fruit of the Tenera variety contains 25% oil, by weight, and the Dura variety 18%, so the same amount of Tenera can yield 30% more oil than the equivalent fruit of the Dura. In Nigeria, oil palm is indigenous to the coastal plain, having migrated inland as a staple crop. For millions of Nigerian, oil palm cultivation is part of the way of life, indeed it is part of their culture. However, during the past decades the country has become a net importer of palm oil. While in the early 1960s, Nigeria's palm oil production accounted for 45% of the world production which has now dropped to 7% of total global output (Walker 2010). In Nigeria 80% of production comes from dispersed small holders who harvest semi-wild plants and use manual process techniques. Several million small holders are spread over an estimated area ranging from 1.65 million hectares to 2.4 million hectares and to a maximum of 3 million hectares. Women play an important role in the production, storage and commercialization of the red palm oil (Walker 2010).

The oil palm is one of the important economic crops in the tropics (Adeniyi et al., 2014). It is the most important source of oil and produces more oil per hectare than any of the oil

producing crops. The primary products of the oil palm are palm oil (from the mesocarp) and palm kernel oil obtained from the kernels (seeds). Palm oil contains carotene, a precursor of vitamin A, a high prized energy vitamin rich food used for cooking in oil producing countries of Africa. Palm oil and palm kernel oil provide raw materials in the manufacture of soaps and detergents, margarine, candle, confectionery, epoxy resins, bakery trade, lubricants, pomades and cosmetics. Other uses include palm kernel cake obtained from the crushing of palm kernel to extract oil. It serves as additives in livestock feed manufacture. Palm wine which is obtained from the male inflorescence is very popular and of great socio-economic importance in some parts of Nigeria. The trade in palm wine competes favourably with that of palm oil. There is no part of oil palm that is not of economic value. The leaflets are used for making thatch for roofing houses while the leaf rachises are used for fencing, reinforcing buildings and basket making. The midribs of the leaflets are used for brooms. The palm cabbage, a soft tissue and the apical bud serves as a delicacy for eating. The bunch refuse, which is left after the fruits have been removed from the palm bunch, is a rich source of potassium. Locally, it is used for making soap. The fibre residue left after the oil has been extracted from the fruit provides fuel while the shell from cracked palm nuts provides not only fuel, but also serves as an aggregate for flooring houses. The palm trunk is sawn into timber and used in construction of fences, roofing houses and reinforcing buildings.

However, the issue of sustainability and conservation of oil palm resources is of topmost priority because this species are threatened by reckless exploitation, inadequate use of land and deforestation which is resultant effect of an upsurge in population. Conversely, sustainable palm oil does make businesses profitable while not harming people or the environment. Thus, in order to achieve this, palm oil majors must adopt policies that promise no form of exploitation at the expense of other environmental resources and practices that embrace sustainable production and uses. Previous studies have said much about the probable products from oil palm but the studies were captured generally and lacked being specific to a particular location in which the present study took as its most priority. Thus, several challenges can hamper the use and economic potentials of the oil palm seeds; therefore sustainable use and practices to effectively manage its over-exploitation and underutilization in the face of growing population in Nigeria cannot be over stated. It is based on this background that the study did comparative studies on the uses and sustainability of oil palm resources in selected States (Akwa Ibom, Imo and Rivers States) in southern Nigeria.

II. MATERIALS AND METHODS

The study was carried out in communities in Akwa Ibom, Imo and Rivers State, Southern Nigeria. They are located geographically within latitude 4^{o} 02’ 00’’N and 6^{o} 00’ 00’’N and longitude 6^{o} 00’ 00’’E and 8^{o} 30’00’’E (Figure 1). The study areas eResxperience a tropical climate consisting of rainy season (usually from April to November) and dry season (December to March). High temperatures and humidity as well as marked wet and dry seasons characterize the climate of the area (Kuruk, 2004).

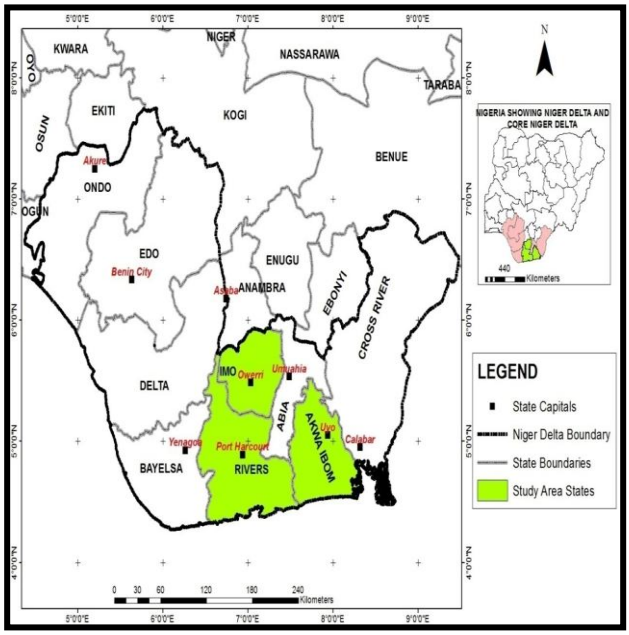

Figure 1: Study Area States

The geology is basically sedimentary and is dominated by the geology of arcuate Niger delta; composed of an overall classic sequence which reaches a maximum thickness of 9-12 kilometers (lbe, 1988). The vegetation of the area is characterized by mangrove forests, brackish swamp forests and rain forests. The study adopted the cross sectional research design (*Schmidt and Kohlmann, 2008*). The study involved using primary data acquired from the field surveys using structured questionnaire which was administered on the sampled oil palm producers and business men and women in the study areas. The population of study involved all oil palm processors in three LGAs under each three States (that is; Akwa Ibom (Esit Eket, Nsit Ubium and Ibesikpo), Imo (Ezinihitte Mbaise, Obowo and Aboh Mbaise) and Rivers States (Ikwerre, Etche and Emohua)). The study area was divided into wards and a total of 114 wards were obtained for the study whereby, 34 wards were recorded for the 3 LGAs in Akwa Ibom, another 34 wards were obtained from 3 LGAs in Imo State; while the remaining 46 wards were obtained from the 3 LGAs in Rivers State. The total number of wards of 114 was considered high for the study. Thus, a sample size of 50% was determined from the total number of each ward in each LGA. In other words, half of the size of each total number of wards (50%) was used as criteria for selecting oil palm farmers and processors as participants for the study. In each selected ward, ten (10) oil palm farmers and processors were selected to give a total of 560 respondents for the study. Thus, based on the number of wards, the sample size for the study was 560 respondents. The sampling procedure employed multi-stage sampling, purposive sampling and random

sampling techniques. Oil palm agricultural zones namely; Akwa Ibom, Imo and Rivers States were purposively selected among Niger Delta member states because of the intensity of oil palm processing activities in these areas and also that oil palm processing is largely a rural based enterprise (Onoh and Peter-Onoh, 2012; Eze et al., 2014; Uche et al., 2017). Thus, rural communities as grouped by wards in each LGA under each state were used as the study areas where questionnaire administrations were carried out for the study in line with the study objectives. Descriptive statistics in form of frequency and percentages were used for the data analyses.

III. RESULTS AND DISCUSSIONS

Socio-economic Characteristics of Respondents

The data presented in Table 1 shows the socio-economic status of respondents in the study area. In Akwa Ibom State, it was revealed that 26.0% oil palm farmer were males while 74.0% were females; in Imo State, 27.3% respondents were males while 72.7% were females; however, least number of males (24.4%) were sampled from Rivers State with highest number of females of 75.6%. The distribution revealed that more female oil palm farmers/traders/retailers were sampled for the study. The information for the age distribution of revealed that 12.4% of sampled respondents were between the age bracket of 26 and 35 years; 44.5% of sampled respondents were between the age bracket of 36 and 45 years; 33.8% falls within the age bracket of between 46 and 55 years; while the remaining 9.4% are 56 years and above. Thus, more within the age bracket of 26 and 55 years were sampled for the study with majority (49.1%) being contributed from sampled oil palm farmers from Imo State.

The information for the level of education revealed that 5.5% had primary level education; 59.2% had secondary level education; 23.9% of respondents have tertiary level of education; while the remaining 11.5% have other forms of education that teaches them to read and write. The occupational status of respondents for the study indicated that 30.9% are farmers; 60.3% of the respondents are oil palm traders; while the remaining 8.8% of respondents are oil palm businessmen/women or retailers. The average monthly income showed that majority (76.9%) earned at least #61,000 and above.

Table 1: Socio-economic Characteristics of Respondents

Socio-economic Status		State			Total
		AkwaIbom	Imo	Rivers	
Gender	Male	39	44	52	135
		26.0%	27.3%	24.4%	25.8%
	Female	111	117	161	389
		74.0%	72.7%	75.6%	74.2%
Age	26-35 years	15	20	30	65
		10.0%	12.4%	14.1%	12.4%
	36-45 years	69	79	85	233
		46.0%	49.1%	39.9%	44.5%
	46-55 years	51	49	77	177
		34.0%	30.4%	36.2%	33.8%
	56 years and above	15	13	21	49
		10.0%	8.1%	9.9%	9.4%
Level of Education	Primary	15	3	11	29
		10.0%	1.9%	5.2%	5.5%
	Secondary	87	100	123	310
		58.0%	62.1%	57.7%	59.2%
	Tertiary	32	41	52	125
		21.3%	25.5%	24.4%	23.9%
	Others	16	17	27	60
		10.7%	10.6%	12.7%	11.5%
Occupation	Farmer	49	47	66	162
		32.7%	29.2%	31.0%	30.9%
	Oil Palm Trader	91	98	127	316
		60.7%	60.9%	59.6%	60.3%
	Business/Retailer	10	16	20	46
		6.7%	9.9%	9.4%	8.8%
Average monthly income	#31,000 - #60,000	0	2	0	2
		0.0%	1.2%	0.0%	0.4%
	#61,000 - #90,000	2	19	2	23
		1.3%	11.8%	0.9%	4.4%
	#91,000 - #120,000	27	41	28	96
		18.0%	25.5%	13.1%	18.3%
	#121,000 - #150,000	74	67	109	250
		49.3%	41.6%	51.2%	47.7%
	#151,000 and above	47	32	74	153
		31.3%	19.9%	34.7%	29.2%

Oil palm Resources and its Uses

The predominant oil palm found in the study area is called the African oil palm tree (*Elaeis guineensis*) and their various uses are apparently diverse and high. There are various forms of uses of the oil palm and these are categorized into food uses and non-food uses as displayed on Table 2. The utilization of oil palm by the indigenous people ranges from palm oil, palm kernel oil, making brooms, etc. This African oil palm, *Elaeis guineensis*, is part of the Arecaceae family along with coconut and date palms. The study observed that there are three (3) forms of the oil palm abundance in the study area and these included the Dura palms which have kernels with a thick shell; the Pisifera palms which have kernels with no shell; and the Tenera palms that have kernels with a thin shell. Most cultivars that are prominently used among farmers and oil palm producers are the Tenera form which produces fruit with higher oil extraction and content and this aid the oil production business. Similarly, there are other forms of uses obtained from the oil palm, but the predominant ones in the study area are those displayed on Table 2. Plates 1a-1g depict some of the uses of oil palm trees in the study area.

Table 2: Uses of Oil Palm Products

S/N	Resources	Food Uses	Non-food uses	Part used
1	Palm oil	Cooking	Skin treatments, soaps, adhesives	Matured seed (mesocarp) (extraction of pulp from the fruit
2	Palm Kernel oil	Cooking, Margarine,	Soaps, polish, livestock feeds	Kernel of seed, residues
3	Brooms		Brooms	Oil palm leaves stalk (scraping of the leaf part of the palm frond)
4	Drinks	Palm wine		Obtained directly from the Oil palm tree produces palm wine from its sap during a process called tapping)
5	Building materials		Roofing materials	Stem of kernel, palm fronds and leaves
6	Hand crafts		Basket seats	Leaves and trunk
7	Clothing		Masquerade attires	Oil palm tree trunks
8	Field mulching		Manure, fertilizers	After stripping of the fruitlets, the remnants of the fruit bunches are used
9	Locally made baskets		Locally sieve Baskets	Oil palm tree ribs, palm fronds
10	Mushroom growth	Mushroom leafs		Part of the bunch that grows out (bunch waste – Pericarp waste)
11	Timber		Building/construction purposes	Oil palm Stem
12	Fires	For cooking	Fires as boilers for Mills	Fibre from the fruit and the nut shells are recycled and used as mills (heating process during extraction)

Plate 1a: Oil palm Fruits (*Elaeis guineensis*)

Plate 1b: Palm wine tapping

Plate 1c: Thatched Roofing materials from Oil Palm

Plate 1d: The Masquerade called Ekpo in native dialect is decorated by palm trunks

Plate 1e: A locally made Sieve from Palm fronds used for sieving and seperation purposes in homes

Plate 1f: Basket made from Oil palm tree ribs

Plate 1g: Mushrooms growing on cut-down Oil palm tree

Sustainable Oil Palm Production Practices

Land Utilization

The information on Table 3 displays the land utilization for oil palm cultivation. Plate 2a and Plate 2b displays the pictures of a typical monocropping and intercropping farmlands in the study area. The information on Table 3 revealed that 53.8% of sampled oil palm famers are practicing monocropping while the remaining 46.2% are engaged in intercropping. Thus, more monocropping activities were practiced among sampled oil palm farmers. Both farming practices are good, the question that comes to mind is if such practices are performed in a sustainable way. The intercropping farming activities employed by sampled oil palm farmers raise up issues that will require more farmlands in order to meet up the ever pressing demands especially for small scale and medium scale oil palm production there is continuous burden to take care of immediate and market needs for their income (livelihoods). Intercropping may also mean that more farming inputs will be needed like manure and fertilizers as this will put pressure on the land used for oil palm production as nutrient loss will be higher over time and this is not sustainable. On the other hand,

the issue of monocropping especially as it concerns the study area also means that since more lands are devoted for single crop farming which is the oil palm; thus, frequency of oil palm harvesting in relation to palm age will need to be effective so as to promote sustainable oil palm production and practices.

Table 3: Land Utilization for Oil palm Cultivation

State	LGA		Land Utilization		Total
			Monocropping	Intercropping	
	Akwa Ibom	Esit Eket	28	20	48
			5.3%	3.8%	9.2%
		Nsit Ubium	27	20	47
			5.2%	3.8%	9.0%
		Ibesikpo	24	31	55
			4.6%	5.9%	10.5 %
	Imo	Ezinihitte	31	27	58
			5.9%	5.2%	11.1 %
		Obowo	24	25	49
			4.6%	4.8%	9.4%
		Aboh Mbaise	28	26	54
			5.3%	5.0%	10.3 %
	Rivers	Ikwerre	31	35	66
			5.9%	6.7%	12.6 %
		Etche	52	31	83
			9.9%	5.9%	15.8 %
		Emohua	37	27	64
			7.1%	5.2%	12.2 %
Total			282	242	524
			53.8%	46.2%	100. 0%

Plate 2a: Intercropping Oil Palm, plantain, Cocoyam, Cassava (Small scale)

Plate 2b: Monocropping of Oil Palm

Intercropping Types

The information on Table 4 shows the intercropping types practiced by oil palm farmers in the study area. The distribution showed that 53.8% practices monocropping as described earlier. However, 3.6% have intercropped plantain with oil palm; 38.5% are intercropping cassava/cocoyam with oil palm; 2.3% intercropped banana with oil palm while 1.7% have planted vegetable on their oil palm farmlands.

Table 4: Intercropping Types

			Intercropping Types					Total
			Oil Palm only	Plantain	Cassava/ Cocoyam	Banana	Vegetable	
	Akwa Ibom	Esit Eket	28	3	10	3	4	48
			5.3%	0.6%	1.9%	0.6%	0.8%	9.2%
		Nsit Ubium	27	4	15	1	0	47
			5.2%	0.8%	2.9%	0.2%	0.0%	9.0%
		Ibesikpo	24	0	28	1	2	55
			4.6%	0.0%	5.3%	0.2%	0.4%	10.5%

	Imo	Ezinihitte	31	1	24	1	1	58
			5.9%	0.2%	4.6%	0.2%	0.2%	11.1%
		Obowo	24	3	22	0	0	49
			4.6%	0.6%	4.2%	0.0%	0.0%	9.4%
		Aboh Mbaise	28	1	23	1	1	54
			5.3%	0.2%	4.4%	0.2%	0.2%	10.3%
	Rivers	Ikwerre	31	2	31	2	0	66
			5.9%	0.4%	5.9%	0.4%	0.0%	12.6%
		Etche	52	1	27	2	1	83
			9.9%	0.2%	5.2%	0.4%	0.2%	15.8%
		Emohua	37	4	22	1	0	64
			7.1%	0.8%	4.2%	0.2%	0.0%	12.2%
Total			282	19	202	12	9	524
			53.8%	3.6%	38.5%	2.3%	1.7%	100.0 %

Oil Palm Production Practices

The information for the oil palm production practices employed among sampled oil palm producers is displayed on Table 5. The distribution revealed that all stated statements were accepted by oil palm farmers as ways following their production processes/practices. This is because the mean values were all higher than the criterion mean of 3.00. The percentage responses received across sampled study areas also showed majority (higher percentages) of sampled oil palm producers frequently carry out these oil palm practices in the study area. However, the statement that was rejected (2.37) indicated that that oil palm producers' (95.2%) rarely treats their liquid waste from initial processing before its final release into the environment (Plates 3a and 3b). This practice is not conducive for the environment as this can pollute the environment. Therefore, oil palm production practices in the study area are not sustainable because several practices as indicated by sampled oil palm producers have social and environmental impacts and these are: deforestation practices (use of fire for forest clearing – air pollution); forest degradation (biodiversity loss, primary forest conversion); use of waste fibres converted as burning requirements for mills (especially as its being commonly practiced among small-medium scale oil palm production) leads to high concentration of particulate matter in air ($PM_{10,\ 2.5}$,) and others like VOCs and SO_2 which may be higher than limits.

Table 5: Oil Palm Production Practices

Oil Palm Production Practices	Always	Frequently	Occasionally	Rarely	Never	Mean	Decision
Forested areas have been used for the cultivation and production of oil palm business	159 30.3%	259 49.4%	76 14.5%	30 5.7%	0 0.0%	4.04	Accepted
Burning of forested lands to create space for oil palm plantation	169 32.3%	240 45.8%	87 16.6%	28 5.3%	0 0.0%	4.05	Accepted
Fertilizers application to help boost the development of my plantation	159 30.3%	248 47.3%	79 15.1%	38 7.3%	0 0.0%	4.01	Accepted
Oil Palm plantation extension to cope with high demands of products	159 30.3%	259 49.4%	76 14.5%	30 5.7%	0 0.0%	4.04	Accepted
Palm oil mill effluents are converted to fertilizers use	164 31.3%	238 45.4%	82 15.6%	40 7.6%	0 0.0%	4.00	Accepted
Your oil palm activities is characterized by excessive use of fertilizers	169 32.3%	254 48.5%	71 13.5%	30 5.7%	0 0.0%	4.07	Accepted
Palm oil mill effluents serves as energy inputs and fossil fuels for mills	167 31.9%	249 47.5%	80 15.3%	28 5.3%	0 0.0%	4.06	Accepted
Liquid waste from initial processing are treated before	0 0.0%	9 1.7%	192 36.6%	307 58.6%	16 3.1%	2.37	Rejected

their release to the environment							
Use of empty fruit bunches, waste fibres and shells are commonly burnt to provide the power requirement for mills	193 36.8%	237 45.2%	75 14.3%	19 3.6%	0 0.0%	4.15	Accepted

Plate 3a. Poor channelization & untreated Palm oil mill effluents from Factory

Plate 3b. Untreated Palm Oil Mill Effluents (POME) before its discharge to the environment

Challenges Limiting the Sustainable Production and Conservation of Oil Palm Resources

The challenges limiting the effective production, conservation and sustainable oil palm production in the study area are displayed on Table 6. All identified challenges were indicated by majority of sampled oil palm producers in the study area. These challenges and limitations are: lack of government intervention (4.49); high cost of labour (4.05); lack of storage capacity (4.44); shortage of land (4.20); technical and economic inefficiencies (4.41); poor road network (3.90) (however, 32.0% of oil palm producers disagreed – indicating good road network around their oil palm production site (an example of this is the good road network around some oil palm production factories in Ibesikpo LGA); poor electrical supply (4.43); inadequate credit facility (4.56); heavy use of manual processing techniques (4.24); demands outweigh supply (4.49); underfunding of research to improve the oil palm business (4.09) and lack of awareness on methods of sustainable oil palm production (3.38) (slightly above average mean score). The study discovered that some farmers and oil palm business owners believe their oil palm production methods are sustainable may be due to the profit they have being realizing from the business over time even with the other identified challenges. Thus, the government needs to be more active in this sector of oil palm production business because it has several environmental implications when methods and practices utilized are not sustainable.

Table 6: Challenges Limiting Effective Production, Conservation & Sustainable Oil Palm Production

Challenges	Strongly Agree	Agree	Disagree	Strongly Disagree	Undecided	Mean	Decision
Lack of government intervention	256 48.9%	268 51.1%	0 0.0%	0 0.0%	0 0.0%	4.49	Accepted
High cost of labour	161 30.7%	257 49.0%	76 14.5%	30 5.7%	0 0.0%	4.05	Accepted
Lack of storage capacity	228 43.5%	296 56.5%	0 0.0%	0 0.0%	0 0.0%	4.44	Accepted
Shortage of land	209 39.9%	231 44.1%	62 11.8%	22 4.2%	0 0.0%	4.20	Accepted
Technical and economic inefficiencies	235 44.8%	267 51.0%	22 4.2%	0 0.0%	0 0.0%	4.41	Accepted
Poor road network/link road	166 31.7%	190 36.3%	115 21.9%	53 10.1%	0 0.0%	3.90	Accepted
Poor electrical supply	223 42.6%	301 57.4%	0 0.0%	0 0.0%	0 0.0%	4.43	Accepted
Inadequate credit facility	256 48.9%	268 51.2%	0 0.0%	0 0.0%	0 0.0%	4.56	Accepted
Heavy use of manual processing techniques	207 39.5%	254 48.5%	44 8.4%	19 3.6%	0 0.0%	4.24	Accepted

Demands outweigh supply	255	48.7%	269	51.3%	0	0.0%	0	0.0%	0	0.0%	4.49	Accepted
Underfunding of research to improve the oil palm business	225	42.9%	225	42.9%	7	1.3%	28	5.3%	39	7.4%	4.09	Accepted
Lack of awareness on methods of sustainable oil palm production	82	15.6%	264	50.4%	24	4.6%	81	15.5%	73	13.9%	3.38	Average

IV. CONCLUSION AND RECOMMENDATIONS

The study concluded that the practices employed for oil palm production among were not sustainable because of deforestation practices, forest conversion practices leading to degradation of forests without adequate replacement strategies. Furthermore, the use of waste fibres converted as burning requirements for mills (especially as its being commonly practiced among small-medium scale oil palm production) leads to high concentration of particulate matter in air ($PM_{10,}$ and $PM_{2.5}$) and others like VOCs and SO_2 which may be higher than air quality limits. The study therefore recommended that the excessive use of fertilizers to improve oil palm growth and development can be curtailed when government creates enlightenment programmes that are directed at educating oil palm farmers as regards conservation strategies that will promote sustainable practices in the face of meeting increasing demands. Also, adequate power supply will ensure that the use of air polluting substances as inputs for fire during the heating processes of crude oil extraction and production as this will help oil palm farmers in reducing cost of operations and productions so that they can divert their funds into strategies and practices that is sustainable for both the environment and their socio-economic livelihoods.

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