European Journal of Business and Innovation Research
Vol.12, No.7, pp.,1-16, 2024
Print ISSN: 2053-4019(Print)
Online ISSN: 2053-4027(Online)
Website: https://www.eajournals.org/
Publication of the European Centre for Research Training and Development -UK

Economics of Adoption of Improved Oil Palm Production Technologies in South East, Nigeria

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doi: https://doi.org/10.37745/ejbir.2013/vol12n7116 Published September 21, 2024

Citation: Nwodo S.I. and Dike O.N. (2024) Economics of Adoption of Improved Oil Palm Production Technologies in South East, Nigeria, European Journal of Business and Innovation Research, Vol.12, No.7, pp.,1-16

Abstract: *This study was focused on the economics of adoption of adoption of recommended oil palm production technologies in south east, Nigeria. There is global paucity of research on the economics and adoptability of oil palm production technologies in developing countries with only few extension projects in Nigeria. The supply of oil palm products, which is a major staple food in Nigeria, has not matched up with the demand. It is expected that increase in adoption of oil palm production technologies will scale-up oil palm production and reduce poverty and increase food safety net in Nigeria. The importance of oil palm in National and World Food Economics underscores the need for the intensification of research efforts on the crop. The failure of the current palm oil output to meet domestic demand and leave a surplus for export in spite of the available technologies to boost production could be attributed to slow rate of the expansion and exploitation of the existing plantings. This is as a result of failure to accept and use available oil palm development and management technologies, the adoption of which would have brought about optimal yield increase. This study would provide current information that will help guide farmers in decision-making, agricultural extension practitioners, researchers and the government in formulating functional policies towards finding solution to sustainable agricultural development in Nigeria. Also, institutions and organizations such as the ADPs, NIFOR, Universities etc and students involved in oil palm research and improvement may find the work handy. The study was carried out using a proportional random sampling of oil palm farmers. Data were collected and analyzed descriptively using percentages, frequencies, tables, etc. The major findings of this study are that adoption of oil palm production technologies in the study areas is low but profitable; funds/capital are important in adoption of recommended oil palm production technologies, and that household size and cost of innovation are important variables that affect adoption. In view of this, encouragement of farmers with large household size to participate actively in adoption of oil palm production technologies, the provision of credit/input to farmers, are among the recommendations made.*

Key words*:* Nature *of agriculture,* oil palm, economics of adoption, adoption of innovation concept of technology and structure of production

INTRODUCTION

In the Nigerian society, like any other economy, (both developed and developing), the roles of agriculture are almost the same: raw materials for the industrial sector, source of food for the societal members, employment opportunities for the unemployed able-bodied labour force, improvement of income distribution, source of income for the nation and the farmers themselves, instrument of poverty reduction and ease of balance of payment problems on the economy (Khoo, 2019). The oil palm (Elaeis guimeensis) is a crop of the low land tropics. In Nigeria, the distribution of the crop ranges between latitude 4^0 and 11^0N from fresh water swamp forest of the coast to the Northern zone of the Guinea Savannah (Omoti, 2019). It is a tall monocot belonging to the family, palmae and growing unbranched up to a height of 24 metres (80ft) or more in open farm lands (Hartley, 2019). The palm, on one hand, is within our disposal and on the other hand, it is not. The palm is within our reach because we have it abundantly everywhere in the wild as grove palm, in village compounds and farms as a compound or farm crop and in estates as a plantation crop. The palm is out of reach to us or so it seems, because we have not been able to avail ourselves of the right technology with which we can actualize its full potential benefits (Omoti, 2019). These palms are harvested for the production of mainly palm oil, palm kernels, and palm oil with considerable human drudgery. Okwelogu (2019) stated that agriculture had been the base of Nigeria's sustenance in the mid sixties and early seventies prior to the advent of the crude oil which had not only dominated as the mono-product yielding over 90% of the country's revenue but has nearly swept the relevance of agriculture under the carpet with the result that the importation of food items top the list in the country's importation schedules.

Table 1: Gross Domestic Product (GDP) at current factor cost (N million)

Activity sector	**1973/74**	**1974/75**	**1975/76**	**1976/77**	**1977/78**
Agriculture	3327.79 (29.8)	4845.18 (26.1)	5729.99 (26.9)	6426.45 (23.8)	7473.76 (23.4)
Mining and quarrying	2020.59 (18.1)	6087.27 (32.8)	4668.37 (21.9)	6797.31 (25.2)	7904.96 (24.7)
Others	5831.57 (52.1)	7621.28 (41.1)	10928.49 (51.2)	13732.52 (51.0)	16613.27 (51.9)
Total	11,179.95 (100)	18,553.73 (100)	21,326.85 (100)	26,956.23 (100)	31,991.99 (100)

Note: Figures in parentheses represent the percentage contribution to the total GDP

Source: Digest of statistics Vol. 27, Dec., 1979..Federal Office of Statistics, Lagos.

The above table shows that the contribution of the mining and quarrying sector to the country's annual Gross Domestic Product (GDP) increased from 18.1 percent in 1973/74 to 24.7 percent in 1977/78, while that of the agriculture sector declined from 29.8 percent to 23.4 percent, in

the same period. This neglect of agriculture is further seen in progress drop in the production of the major food crops. With the post harvest loss of these major food crops, the country loses millions of tones of these crops annually. These losses are of foods, seed or money that can be realized if the product is sold locally or exported. And if not checked, such losses can nullify the gain that may follow from the introduction of improved seed or farming methods. Osemebo (2019) observed that Nigeria's inability to meet up with its food requirements and generate financial resources for its overall development programmes is due to poor development technology through research and inadequacy in basic farm inputs.

Ugwu (2020) stated that low output, hunger and poverty resulting from low resource productivity among farmers are attributable to low adoption of technologies packed for production, processing and marketing of food and cash crop commodities. Omoti (2019) identified the most striking problems of the oil palm production to include those resulting from harvesting, high labour wage rate, marketing problems, lack of access to micro credit and land acquisition.

Kassie et al, (2019) and Khoo (2019) reported that the relevant oil palm technology recommended against the problems in establishing oil palm plantation include the following: ring weeding use of extension work seed (EWS), pruning, intercropping, fertilizer application, wire collar, polybag nursery establishment, disease/pest control methods, cover crops, intercropping, harvesting techniques, maintenance practice. NIFOR (2019) stated that the adoption level of these selected technologies is still low due to inadequate funds, non-availability of some technologies (e.g. fertilizer and seedlings), difficulty in acquiring technologies, land scarcity, age factor, high cost of sustaining the use of the technologies and high labour cost. Since 1979, the dominance of the oil sector had led to a relative neglect of the agricultural sector (including the oil palm industry) in terms of policy resources resulting in declining productivity growth and competitiveness, increased poverty and low technology development. Small-scale farmers are known to produce the bulk of the foods and fibres of the country. The farming population constitutes over 60% of the country's population, but presently, the Nigerian agriculture is characterized by low productivity, low levels of technology adoption and use of inefficient production technologies (Ataga, Eneh and Ilechi, 2020; Francis, 2019). Because the agricultural sector and agriculture in Nigeria as a business have been changing, the farmers, the middlemen, and the government of the country had been adopting one production technology / marketing strategy or the other, to ensure that the role of agriculture is well played in the economy. However, the problems still linger, and it is in an attempt to suggest solutions to better agricultural production technologies/marketing in Nigeria that this exercise is born

It is against this backdrop that the study seeks to identify and describe the levels of adoption of improved oil palm production technologies in the study areas and determine the socio-economic factors which affect oil palm producers that drive them to belong to high or low adoption groups..This study, specifically, is guided by these questions; What is the level of adoption of improved oil palm production technologies in the study areas?, and What are the socio-economic factors that influence oil palm farmers in adopting the technologies?

Significance of the Study.

The importance of oil palm in National and World Food Economics underscores the need for the intensification of research efforts on the crop. The failure of the current palm oil output to meet domestic demand and leave a surplus for export in spite of the available technologies to boost production could be attributed to slow rate of the expansion and exploitation of the existing plantings. This is as a result of failure to accept and use available oil palm development and management technologies, the adoption of which would have brought about optimal yield increase (Francis, 2010). This study would provide current information that will help guide farmers in decision-making, agricultural extension practitioners, researchers and the government in formulating functional policies towards finding solution to sustainable agricultural development in Nigeria. Also, institutions and organizations such as the ADPs, NIFOR, Universities etc and students involved in oil palm research and improvement may find the work handy.

Conceptual Clarification.

Agriculture: Its Nature in Nigeria.

Agricultural activities in Nigeria include crop farming, livestock production, hunting, fishing and forestry (Eseigbe, Eneh and Joe, 2019). The organization of these activities is broadly divided into two: Subsistence farming, where the farmer and or his family produces for personal consumption and any marketing and marketable surpluses (resulting from a stroke of luck) are sold in the local markets; and commercial farming where private individuals, organizations and institutions, the government and its agencies, participate fully in producing the commodities in large quantities mainly for commercial purposes. Unlike the subsistence type where human labour assisted with implements (hoes and matchets etc are much employed, with shifting cultivation as the most practiced method), commercial farming is mainly technological in nature as machines (cultivators, tractors, planters, harvesters, etc) do most of the jobs from land clearing, planting, weeding to harvesting with crop rotation as the method of the day. These are easily found in such areas as Imo (Adapalm), Abia (Abiapalm),and Rivers (Risonpalm), among others. The features of agricultural production in Nigeria are geographical concentration of production, annual variability in production, varying costs of production, farm supply industry dependency (Abbot and Markahan, 2019), while the products are characterized by raw materials form, bulkiness, high perishability due to lack of storage facilities, quality control difficulties, seasonality, geographical determination of production, long gestation periods, time lapse and storage and high marketing costs (Eneh, 2019). Agricultural production and produce in Nigeria are geographically based. The major agricultural zones in the country, according to Okwelogu (2019) and Omereji (2019) are divided into five as follows;

--The mangrove swamps found along the coastal lines in the Niger Delta area (Rivers, Bayelsa, Edo, Akwa Ibom, Cross River, Ondo and Delta States) with fish as the major agricultural produce.

--The tropical rainforest zone of the Eastern Central and Western states of Ogun, Oyo, Ondo, Imo, Delta, Anambra, Abia, Enugu,Cross River, and Akwa Ibom states with the crops (Cocoa, Kolanut, Palm produce, timber) and food crops (Cassava and Yams) popularly produced.

--The derived Savanna Zone of the middle belt region of old Kwara, Benue, Niger and Gongola states, specializing in cereals, roots and tubers, as well as cotton and groundnuts.
--The Guinea Savanna zone, comprising the southern parts of the Sokoto, Kaduna, Kano, Bauchi and Bornu states with groundnut, sorghum, millet, rice, tobacco and livestock as the main produce.
--The Dry Savanna Zone covering the Northern parts of the Sokoto, Kaduna, Kano, Bauchi and Bornu states, with specialization in groundnut, sorghum, millet, cowpeas and livestock production.

Oil Palm Systems/Structure of Production

Nigeria has basically three production structure or systems responsible for palm oil and palm kernel production in the country (Kassie et al, 2019). The first structure of production is characterized by small-scale palm oil producers who employ improved methods in the processing of fresh fruit bunches (FFB) from wild and cultivated grove palms. Khoo (2019) stated that this method guarantees only modest output since well over 40% of the oil is lost during extraction. The second structure of production is characterized by small-holders who own small plots of oil palm plantation of a few hectares in size which are improved high yielding tenera palms capable of producing up to 15 tonnes of FFB per hectare per year in good soil under good plantation management. The processing of fresh fruit bunches (FFB) under this system is mostly by the use of scrow and the hydraulic hand press in combination with much human effort (Ugwu, 2020). The third system of production comprises large, government owned as well as private oil palm estates. These estates make use of large integrated oil mills with process capacities varying from 15 to 40 tonnes FFB through put per hour. Given exceptive expansion and rehabilitation programmes complemented by the elimination of certain socio-institutional constraints particularly in the area of land tenure, these estates and the small-holder plantations can be relied upon as a dependable source of palm oil production in Nigeria (Eneh, 2019).

Concept of Technology

Chen and Popovich (2020) defined technology as a design for instrumental action, which reduces the uncertainty in the cause-effect relationship involved in achieving a desired outcome. Technology is also identified as the transition of scientific laws into machines, tools, mechanical devices, instruments, breeds of livestock, innovations, techniques meant to accomplish tangible ends, attain specific needs or manipulate the environment for practical purposes (NIFOR, 2019). Technology may also be defined as the systematic application of collective human rationality to the solution of problems of asserting control over nature and human processes of all kind. It is not mere intellectual speculation or theoretical modeling but rather knowledge application to practical problems (Das and Hassan, 2022). Cortez and Johnston (2019) differentiated between traditional or indigenous technology and modern (or improved) technology. He stated that traditional technology which is a localized technique unique to particular societies or ethnic groups under various production systems contrast with the modern technology as generated through global networks of research centers and agro-business enterprises. Agricultural technology can be defined as any behavior or practice that corresponds to the interaction of individuals within a particular production system (Ugwu,

2020; Omoti, 2018). In this sense, both sets of behaviours and or practices, those applied by farmers as well as those followed by agricultural professionals constitute agricultural technologies. It is however, enough to say that agricultural technology is the application of scientific knowledge including skills, machines, varieties of seeds, breeds of livestock, etc the use which leads to the solution of practical problems of the agricultural setting or farming system.

Diffusion of Innovation (New Product):

Diffusion is the process by which something spreads. Diffusion of innovation studies which started from anthropology and sociology have now spread to a number of other subject areas, namely education, medical sociology, rural sociology, geography, agriculture and marketing (Dalla Pozza, Goetz and Sahut, 2018). When related to agriculture specifically, diffusion refers to the process and rate of acceptance or rejection of innovation by farmers. In diffusion, however, the emphasis is on the percentage of potential adopters within the social system or market segment who purchase rather than on absolute sales figure (Ugwu, 2020). It has been suggested that the adoption process of an individual goes through four stages which are (Boulding, Staelin, Ehret and Johnston, 2020):

Knowledge; The individual is aware of the innovation of new product and has acquired information about it.

Persuasion; The individual has formed an attitude which may be positive or negative about the new product.

Decision; The individual may decide to adopt or reject the new product or simply to allow more time before deciding.

Confirmation; The individual tries to confirm his earlir decision or may discard the earlier decision should additional information strongly suggest that he does so.

Farmers (consumers) adopt innovations at different relative rates. Some quickly, others slowly. This has led to attempts to analyze and classify the adoption/buying behavior of farmers in terms of the normal distribution / description of the various adopter categories of (Eze, Chinedu-Eze and Bello, 2021; Rahimi and Kozak, 2019):

Innovators:

They are venturesome group who occupy 2.5% and are the first to adopt an innovation. Compared to later adopters, the innovators are likely to be younger, have a higher social status and be more comfortable financially. They also tend to have broader, more cosmopolitan social relationships. They are likely to rely more on impersonal sources of information.

Early Adopters:

This group occupy 13.5% and tend to be more integrated part of a local social system. They are localities in contradiction to the innovators who are cosmopolites. There are usually more opinion leaders in the early adopter group than in any other adopter group. They are given great respect in the social system.

Early Majority.
This group has 34% and constitute the more deliberate group. They tend to accept an innovation just before the proverbial average adopter in a social system. This group is a bit above average in social and economic measures. They rely fairly heavily on advertisements, sales people and contact with early adopters.

Late Majority;
This is usually a group of skeptics who occupy 34% and who adopt an innovation in response to an economic necessity or to peer group pressure. They rely mostly on their peers as sources of information. Consequently, advertising and personal selling would not be as effective as word-of-mouth in trying to reach this group.

Laggards:
This is a conservative and tradition-bound group who are the last to adopt an innovation. Laggards occupy 16% and they are suspicious of innovation and innovators. They are usually older and at the low end of the social and economic scales.
Many characteristics of innovation as perceived by individuals seem to influence the adoption rate. Five of these characteristics have been popular in the literature and they include (Eze, Chinedu-Eze and Awa, 2021):

Relative Advantage;
This refers to the degree to which an innovation is perceived as being better than that which it supersedes or replaces. In cases where an innovation is new and does not directly replace or supersede another, relative advantage may be assumed to relate to the utility of using the innovation compared to its non-use. The higher the relative advantage, the faster the adoption rate, all things being equal.

Compatibility:
This refers to the degree to which an innovation is seen as being consistent with the values, past experience and needs of potential adopters. The more compatible, the faster the adoption rate.
Complexity:
This relates to the extent of difficulty in undertaking and using a particular innovation. It is assumed that potential adopters place an innovation on a notional complexity scale. The hypothesis is to the effect that the greater the perceived complexity of an innovation, the slower will be the rate of adoption.

Trainability:
This refers to the degree to which an innovation can be used on a trial basis or sampled before full adoption can be confirmed. Those innovations which can be tried tend to be adopted more quickly.

Observability:

This refers to the degree to which the benefits and other attributes of an innovation are apparent to non-adopters. It is noted, however, that the high cost of some innovations could limit the speed at which they are adopted.

Economics of Adoption

This simply means economic returns to adoption. Farm income is a significant factor influencing farmers adoption of innovation judging from the fact that the acquisition of the innovation usually has financial implications. In making decision about the adoption of a given technology, a farmer evaluates the new technology in terms of its incremental benefits (Eneh, 2019). Though several oil palm production and processing technologies have been recommended and pushed to farmers in the Southeast, South-west and North central zones, some of the recommended oil palm technologies selected for this study include the following:

i) Pruning

This is an agronomic husbandry practice which involves the regular removal of dead and diseased leaves, fronds and epiphytes from the palm. It increases the yield of the palm by over 40% as it improves the tree hygiene and reduces competition from sunlight (Eseigbe et al, 2019). The efficiency of the operation varies greatly according to the age of the trees and the number of leaves to be cut. In the high rainfall areas, pruning is best carried out at the end of the raining season. Heavy-duty pruning shears are preferred during the operation but a matchet can be used up to 5 or 6 years and thereafter, shears, sickles, axes or chisels are used.

ii) Ring Weeding

This is another important agronomic husbandry practice done manually by the use of both cutlass and herbicides. It prevents creepers from smothering the palms and makes collection of loose oil palm fruits from harvested bunches easy. It involves clearing round the base of the palm of a radius 1-2m and is carried out 3times a year in young plantations and twice in old plantations. Ring weeding by the use of herbicides involved spraying velpar k 4 at 2kg/ha which has advantage of both pre-emergence and post-emergence activity on weeds (Eneh, 2019).

iii) Fertilizer Application

The use of appropriate fertilizer compound or single element of nitrogen phosphorous, potassium and magnesium (NPK)mg package increases the yield of the palms by over 50%. Fertilizer may be applied either manually, in a ring round the weeded circle or mechanically, in band along the inter-row. The commercially formulated fertilizer RUSTICA contains Nitrogen, Phosphorus, Potassium and Magnesium in the ratio 12:12:17 + 2 respectively. Annual application should be made in April and May, not when the rains have fully set in (Eneh, 2019). Dates of application depend on rainfall distribution and the best results obtain during periods when rainfall is not too heavy or frequent.

ii) Use of Wire Collar

This is used in the oil palm nursery and in newly planted oil palm fields to protect each planted palm from rodents and other animals that eat the succulent bulbs at the base of the palm. A collar of ½ inch netting, 45cm (or 18inchees) (Eneh, 2019). After 12 – 18 months, large ones with a height of 60cm, a circumference of 120cm and a diameter of 38cm will be needed. This form of technology and or protection is complemented by actively hunting (shooting), and trapping the larger rodents.

v) Improved Seedlings

The Nigerian Institute for Oil Palm Research (NIFOR) produces high yielding, disease resistant tenera hybrid variety for distribution to oil palm growers. The tenera seeds are produced through controlled pollination between dura female parent and pisifera male parent of known ability. There has been a rising time in oil palm cultivation in Nigeria as reflected in seed demand by farmers and supply by NIFOR (Eneh, 2019). The tenera hybrid EWS released by NIFOR from here elaborate breeding programme has the following characteristics: Early maturing (3 years after planting), high yielding (15 – 18 tonnes FFB per hectar per year, Disease (fusarium wilt) tolerant/resistant and slow stem height increment.

vi**). Intercropping;**

Intercropping is an agricultural practice that involves growing two or more crops simultaneously on the same piece of land. This method is designed to maximize the use of resources such as light, water, and nutrients, increase biodiversity and enhance the sustainability of farming systems. Intercropping is a valuable practice for sustainable agriculture, promoting biodiversity and resilience in farming systems (Hartley, 2019). Some key aspects of intercropping are;

- Mixed intercropping. Growing two or more crops together without a distinct row arrangement.
- Row intercropping. Growing two or more crops simultaneously with at least one crop planted in rows.
- Strip intercropping. Planting different crops in alternate strips along the length of the field.
- Relay intercropping. Planting a second crop into a standing crop at a stage before harvesting the first crop. The benefits of intercropping include the following (Eneh, 2019); -It can lead to higher total yields compared to monoculture, - It improves soil fertility as leguminous crops can fix nitrogen in the soil, benefiting other crops. - Diverse plant species can disrupt pest cycles and reduce disease spread. - It makes efficient resource use by utilizing sunlight, water and nutrients due to different rooting patterns and growth habits and it reduces the risk of total crop failure to adverse weather or pest outbreak.

Eneh (2019) opined that intercropping has challenges which includes complexity in management, harvesting difficulties, and competition between crops, and the examples of intercropping are (Omoti, 2019): Maize and Beans; This is common in many parts of Africa and Latin America, where maize provides support for climbing bean varieties; Wheat and Chickpea: In some regions, these crops are grown together to optimize nitrogen use and reduce pest incidence. Other improved agronomic practices include (Osemebo, 2019);

(vii). Use of cover crops (viii). Harvesting techniques (ix).Oil palm nursery establishment etc.

Empirical Reviews

Findings from empirical reviews on the economics of adopting oil palm technologies:

i). Economic Benefits: Studies have shown that adopting advanced technologies in oil palm cultivation can significantly reduce production costs and increase net income. For example,

research in Colombia found that the cost of producing a ton of fresh fruit bunches (FFB) was 2.5% to 8% lower in lots with high technology adoption compared to those with lower adoption.

ii). Socio-Economic factors: In Nigeria, factors such as education, extension contact, availability of credit and awareness were found to positively influence the adoption of improved oil palm processing technologies. These factors help in overcoming barriers to technology adoption and enhance productivity.

iii). Competitiveness: The adoption of technology has been linked to increased competitiveness in the global market. For instance, Colombian growers who adopted advanced technologies were found to be competitive in the European market, which is a major destination for their crude palm oil exports.

iv). Gender Analysis: Gender plays a role in technology adoption. In South-West Nigeria, studies have shown that technology adoption among oil palm processors can vary significantly between men and women, impacting their productivity and economic outcomes.

METHODOLOGY

The research design adopted for this study is the descriptive survey research design. The study was carried out using primary and secondary data. Data from primary sources came from interviews and questionnaires distributed among the oil palm farmers in Nsukka, Isi-Uzo, Ikwuano and Obingwa local Government Areas of Enugu and Abia States respectively.. Data from secondary sources came from libraries, the internet, textbooks, management journals etc. The researcher employed close-ended questions to pose questions and the questionnaires were administered to them through the help of four experienced enumerators. The population of the study covers all the oil palm producers (farmers) in the selected local Government Areas in Enugu and Abia States respectively. Nsukka and Isi-Uzo Local Government Areas in Enugu State and Ikwuano and Obingwa local Government Areas in Abia State were selected respectively because agriculture is the major economic activity in these study areas and the main occupation is farming. Some farmers are engaged in the production of cash crops like oil palm. A sample size of 20 respondents were randomly selected from oil palm farmers by the researcher in each of the four local government areas of Enugu and Abia states making a total of 80 respondents. A total of 80 questionnaires were distributed out of which 60 were returned which formed the basis for data analysis. The researcher assisted some of the respondents in understanding the questions in the questionnaire due to their level of education. The primary data collected for the study was analyzed using descriptive statistics. The researcher used frequency tables and percentages to analyze the response of respondents from the research questions.

Data Analysis.

The primary data collected in this study were collated and analyzed using descriptive statistics and the responses from research questions were elicited as follows:

Research question I

What is the level of adoption of recommended oil palm production technologies in the areas?

Table 1; Level of technology adoption by respondents

Variables	Adopted	Frequency %	Did not adopt	Frequency %	Total
Hybrid seedlings	12	20	3	5	15 (25)
Intercropping	5	8	-	-	5 (8)
Use of wire collar	3	5	2	3	5 (8)
Ring weeding	15	25	3	5	18 (30)
Prunning	4	7	4	7	8 (14)
Fertilizer application	7	12	2	3	9 (15)
					60 (100)

Source; Field Data, 2024

The above table 1 shows that 12 respondents (20%) adopted hybrid seedlings while 3 respondents (5%) did not; The researcher concludes that farmers are favourably disposed to the use of hybrid seedlings which are improved seedlings that ensure early maturing, high yielding and disease (fusarium wilt) resistant. Table 1 indicates also that 8% of the respondents only adopted intercropping. This implies that this group of farmers want to maximize the use of resources such as light, water, and nutrients, increase biodiversity and enhance the sustainability of farming systems. In table 1, it was discovered that 5% of the respondents adopted the use of wire collar while 3% of the respondents did not adopt it. This form of technology requires hunting and or shooting skill and trapping of the larger rodents which most of the farmers do not posses. The relatively low adoption of wire collar was attributed to scarcity and high cost of the technology. It was indicated further in table 1 that 25% of the respondents adopted ring weeding while 5% of the respondents did not adopt it. Ring weeding was the most widely adopted innovation which may be attributed to the fact that the practice fits into the farmers' existing practice which most likely offer them much attention to adopt..Table 1 indicated further that 7% of the respondents adopted pruning method while the same 7% of the respondents did not adopt this method. This implies that there is high cost of the technology, and lastly, 12% of the respondents adopted the use of fertilizer application while 3% of the respondents did not adopt it. This is another widely adopted innovation by the farmers which increases the yield of the palms by over 50%.

Research question 2:
What are the socio-economic factors that influence oil palm farmers in adopting the technologies?

Table 2: Socio-economic factors influencing oil palm farmers in adopting relevant technologies.

S/N	Socio-cultural factors	SA	A	N	D	SD	Total
1	Farmers economic status	20(33%)	30(50%)	10(17%)	-	-	60(100%)
2	Farmers level of education	18(30%)	35(59%)	2 (3%)	-	5(8%)	60(100)
3	Gender and marital status	25(42%)	30(50%)	5(8%)	-	-	60(100)
4	Weather condition	-	15(25%)	40(67%)	5(8%)	-	60(100)
5	Household size	20(33%)	40(67%)	-	-	-	60(100)
6	Technology non-availability	25(42%)	20(34%)	8(13%)	2(3%)	5(8%)	60(100)
7	Level of extension work	40(67%)	15(25%)	-	5(8%)	-	60(100)
8	Profitability of technology	33(55%)	20(34%)	-	7(11%)	-	60(100)

Source; Field Data, 2024.

Table 2 contains responses on the socio-economic factors influencing farmers' adoption of Oil Palm technologies in the study areas.. It was revealed in table 2 that33% of the respondents strongly agreed that farmers' economic status affect their adoption of relevant oil palm technologies in the study areas, 50% respondents agreed to the same item and 17% of the respondents were neutral/undecided at the instance of the research. The implication is that farmers have social and cultural influences that affect them and which shape their behaviours, values, beliefs and practices about oil palm technology adoption within a community. Table 2 indicated that 30% of the respondents strongly agreed that farmer's level of education influences his adoption of palm oil technology, 59% of the respondents agreed to the same item, 2% of the respondents were neutral at the instance of the research while 8% of the respondents strongly disagreed to the same item. This implies that the farmer's access to education and the value placed on it impacts his literacy rates, knowledge dissemination and economic opportunities of oil palm technology adoption. Table 2 also showed that 42% of the respondents strongly agreed that gender and marital status influence the adoption of oil palm technology by farmers, 50% of the respondents agreed to the same item while 8% of the respondents were neutral at the instance of the research. This implies that the analysis of gender and marital status is necessary because women and children are source of family labour and provide other important socio-economic functions in the economy of the family. In table 2 above, it was revealed that 25% of the respondents agreed that the weather condition has influence on the adoption of oil palm technology by farmers, 67% of the respondents were neutral at the instance of the research while 8% of the respondents disagreed to the same item. This implies that weather conditions (state of the atmosphere at a specific time and place) also affect the farmer's adoption of oil palm technology, but some farmers could not describe

weather conditions in terms of severe weather, dew point, sunlight, visibility, wind, humidity and temperature due to their level of literacy. Table 2 further indicated that 33% of the respondents strongly agreed that household size has influence on the adoption of oil palm technology by farmers while 67% of the respondents agreed to the same item. The implication of the household size is that since oil palm is labour intensive, large household size can provide labour at the reduced cost and majority of the farmers had formal education showing that they are literate and a literate person is amenable to teaching. Table 2 above pointed out that 42% of the respondents strongly agreed that the non-availability of technology influenced the farmers' adoption of oil palm technology in the areas, 34% of the respondents agreed to the same item, 13% of the respondents were neutral at the instance of the research, 3% of the respondents disagreed to the same item while 8% of the respondents strongly disagreed to the same item. The implication is that some technologies are unavailable and when available are expensive to adopt and farmers do not have enough capital to adopt certain technologies. Table 2 explicitly showed that 67% of the respondents strongly agreed that the level of extension work done influenced the adoption of oil palm technology by farmers, 25% of the respondents agreed to the same item while 8% of the respondents disagreed to the same item. The implication is that the rural extension workers need to provide and disseminate reliable, adequate and time-bound information relating to the economics of oil palm technology adoption to the farmers. Finally, table 2 indicated that 55% of the respondents strongly agreed that the profitability of the technology influenced the adoption of oil palm technology, 34% of the respondents agreed to the same item while 11% of the respondents disagreed to the same item. The implication is that farmer's decision to adopt a particular technology is usually based on its return on investment

RESULTS / FINDINGS

From this discourse, the following are the salient points to be noted:

i) Majority of the respondents were married males who had large household size with a low level of education.
ii) Ring weeding was the most widely adopted (25%) technology, followed by hybrid seedling (20%) and fertilizer application (17%).
iii) The major socio-economic factors which influence oil palm farmers were identified. These include; farmers economic status and level of education, gender and marital status, weather parameters, household size etc.
iv) Rural extension workers need to provide and disseminate reliable, adequate and time-bound information relating to the economics of oil palm technology adoption to the farmers.
v) Farmers should be provided with loans/grants by Government to enable them access certain oil palm technologies.
vi) Farmers' decision to adopt a particular technology is usually based on its return on investment or elative advantage.

DISCUSSION OF FINDINGS

Oil palm production is highly laborious requiring a lot of strength, thus, there is male dominance over female which lends credence to the common statement that the oil palm is a male crop, the analysis of gender and marital status is necessary because women and children are source of family labour and provide other important socio-economic functions in the economy of the family, the implication of the household size is that since oil palm is labour intensive, large household size can provide labour at least cost and majority of the farmers had formal education showing that they are literate and a literate person is amenable to teaching. Some technologies are expensive to adopt and farmers do not have enough capital to adopt certain technologies. Farmers decision to adopt a particular technology is usually based on its return on investment To adopt new technologies, farmers routinely make complex decisions and they would choose new technologies that are more gainful than their existing practices. Farmers, sometime, may refuse to adopt new technologies because they would like to understand these technologies and compare and contrast with the existing practices. New technologies to be adopted should be appropriate since farmers' ability to maximize profit is dependent on the social system and available infrastructure.
These insights highlight the importance of supporting technology adoption through education, financial access, and targeted intervention to enhance the economic benefits for oil palm growers and processors.

Implication to Research and Practice

Findings of the study are expected to have implications for management practices of oil palm growers, the government and the society at large. The significant effect of economics of adoption of improved oil palm technologies on the management practices of oil palm growers in south east, Nigeria will require oil palm growers to focus on most lucrative and productive oil palm technologies. This study has formed a body of knowledge (reference material) which has closed the gap identified in literature and which can also be cited by both present and potential researchers. Results of the study provided direction for oil palm growers with respect to which improved oil palm technologies to adopt in order to improve on their marketing performance as well as where and how to direct available resources. Improved marketing performance of oil palm growers in south east, Nigeria will also improve the contributions of oil palm industry to the gross domestic product of the economy. This will also imply increased tax payment by the farmers to government, which will in turn make revenue available for societal development.

CONCLUSION

Based on the salient findings and conclusion of the study, we, therefore, concluded that
Farmers with large household size stand the chance of providing labour at the least cost. They should be encouraged to actively involve in new technologies adoption. Farmers' tendency to adopt technologies is reduced by the high cost of innovation. They should be provided with credit facilities and have access to highly divisible and relatively inexpensive production

technology inputs such as seeds and fertilizers. Technological inputs for adoption should be made available and at subsidized rate to the predominantly poverty stricken resource farmers. Relevant information from government research and extension services on how to improve on the low level of farmers' adoption of technologies should be timely disseminated.

Future Research.

This study examined the economics of adoption of oil palm technologies in south-east, Nigeria. This research can be improved upon by studying other cash crops like cocoa and rubber plants in Western region using other improved agronomic practices such as use of cover crops, harvesting techniques and nursery establishment etc. Also, similar studies could be conducted in different local government areas and states in south east, Nigeria to increase the samples of the study and refine the results using different statistical technique

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