COMPARATIVE ANALYSIS OF CLIMATE CHANGE INFORMATION SOURCES AND UTILIZATION AMONG OIL PALM FARMERS IN EDO AND DELTA STATES, NIGERIA.

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BEING A THESIS WRITTEN IN THE DEPARTMENT OF AGRICULTURAL ECONOMICS AND EXTENSION SERVICES AND SUBMITTED TO THE SCHOOL OF POST GRADUATE STUDIES

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CERTIFICATION

We, certify that this research work was carried out by Victor Etunim OGBE **PG/AEE230090** in the Department of Agricultural Economics and Extension Services, Faculty of Agriculture and Agricultural Technology, Benson Idahosa University, Benin City.

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DEDICATION

This thesis is dedicated to God Almighty and to the entire household of the Ogbe, Mafiele and Onyeabor families.

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ABSTRACT

This study investigates the level of access, awareness, and use of climate change information among oil palm farmers in Edo and Delta States, Nigeria. With rising climate variability and the urgent need for localized adaptation strategies, the research explores how socio-economic factors influence farmers' information-seeking behavior and their adoption of climate-resilient practices. Using a multistage sampling technique, data were collected from 336 oil palm farmers across 24 communities 165 validated responses from each state. A structured questionnaire served as the primary data collection tool. Analysis involved descriptive statistics, multiple regression, binary logistic regression, and independent t-tests. Demographically, respondents were mostly middle-aged (Edo: 42.8 years; Delta: 45.5 years) with substantial farming experience (Edo: 12.8 years; Delta: 14.4 years) and relatively large household sizes (Edo: 6.9; Delta: 6.7). Farmers in Delta State had higher annual incomes from oil palm production (₦477,481) compared to those in Edo (₦427,941), and greater access to extension services (Delta: 37.6%; Edo: 17.6%). In terms of communication channels, mobile phones and radio were the most used formal tools, while informal sources such as friends (Edo: 73.3%; Delta: 60.6%) and neighbors (Edo: 100%; Delta: 104.8%) were the most influential. Despite low usage, institutional sources like the Nigerian Meteorological Agency and universities were recognized as valuable but underutilized. Extension officers emerged as the most preferred formal source of climate information, with high awareness ratings (Edo: 3.80; Delta: 3.90). Farmers expressed the greatest interest in actionable information such as pest and disease control, yield forecasting, and rainfall prediction while interest in broader ecological risks (e.g., desertification, wildfires) remained low, revealing a knowledge gap in long-term environmental awareness. Regression analyses showed that education level ($\beta = 0.614$, $p = 0.009$), farm size ($\beta = 0.527$, $p = 0.011$), income ($\beta = 0.492$, $p = 0.015$), and membership in farmer associations ($\beta = 0.689$, $p = 0.002$) significantly influenced access and use of climate information. Logistic regression also highlighted years of farming experience ($\beta = 0.438$, $p = 0.021$) and extension contact ($\beta = 0.743$, $p = 0.001$) as critical factors. An independent t-test revealed a statistically significant difference in the adoption of climate-smart practices between the two states ($t = 2.91$, $p = 0.004$), with Delta State farmers demonstrating higher adoption levels. In conclusion, oil palm farmers in Edo and Delta States possess significant farming experience and moderate educational backgrounds but show limited engagement with formal climate information systems. Although mobile phones and radio are popular, informal networks dominate information dissemination. Institutional sources especially extension agents have strong potential for delivering targeted climate information but remain underexploited due to infrastructural and communication barriers. Strengthening these formal channels and enhancing farmer group participation could significantly improve climate resilience among oil palm farmers in the region.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background of the study

Numerous studies have explored the issue of climate variability and the vulnerability of farming households, particularly highlighting that Nigeria's agricultural sector is highly susceptible to climatic fluctuations. This heightened vulnerability stems from the dominance of landless, impoverished, undernourished, and largely uneducated farmers with minimal technological capabilities, who are consequently ill-prepared to effectively adapt to climate changes (Awono and Messang, 2020; Danso-Abbeam *et al.,* 2021).

Further investigation by Adepoju and Oyedepo (2024) focused on farmers' perceptions and the indigenous adaptation strategies they employ. Their findings revealed that farmers are aware of climate change and have implemented various coping mechanisms to mitigate its detrimental effects.

Adaptation plays a crucial role in reducing the negative consequences of climate change while maximizing its potential benefits. Prior research has identified a range of frequently used adaptation practices, including irrigation, improved crop varieties, diversification of crops and farming activities, alterations in planting schedules, and engagement in supplementary income-generating ventures (Olutoye, 2019).

Understanding the key determinants that drive farmers' decisions to adopt specific adaptation strategies is vital for the development of sound policies aimed at enhancing climate resilience within the agricultural sector (Haider, 2023).

Effective utilization of agro-climatic information has been shown to boost crop yields by up to 30%. Such climate-related data, when consistently and reliably collected, can be instrumental in forecasting and tailoring agricultural practices to local needs (Olutoye, 2019).

Dissemination of agricultural information in local dialects can significantly improve agricultural productivity, raise household incomes, and support rural communities engaged in farming activities (Ladan and Addo, 2024).

Oil palm (*Elaeis guineensis*), a native tropical species originating from West Africa's rainforest zone, continues to be cultivated extensively both within the region and across other tropical areas. Historically, palm oil served both nutritional and medicinal purposes.

Nigeria ranks among the top global producers of palm oil and palm kernels. The trade in palm products was a major attraction for early European merchants to the West African coast. Oil palm remains a vital food and cash crop in Nigeria, with palm oil rich in carotenoids, the precursors to vitamin A playing a significant role in food security.

Despite its economic importance, the processing of fresh fruit bunches (FFBs) into palm oil is labour-intensive, involving several stages such as threshing, fruit selection, parboiling, digestion, oil extraction, and separation (Adeniyi *et al.*, 2019).

1.2 Statement of the Problem

Agriculture in Nigeria is increasingly threatened by the adverse effects of climate change, which manifest in the form of erratic rainfall, rising temperatures, prolonged dry spells, flooding, and increased pest and disease outbreaks (IPCC, 2022; Ayanlade

et al., 2017). These climate-induced disruptions are especially detrimental to the production of perennial cash crops like oil palm (*Elaeis guineensis*), which play a significant role in rural livelihoods and the national economy. In Nigeria, the Niger Delta region including Edo and Delta States is a major oil palm producing zone. However, climate variability is altering the ecological balance required for sustainable oil palm cultivation (Adeniyi *et al*., 2023).

The vulnerability of oil palm farmers in this region is compounded by limited access to timely and actionable climate information, which is essential for adopting climate-smart agricultural practices (Ojo and Baiyegunhi, 2020). While climate information can be disseminated through multiple sources including extension agents, radio, mobile phones, farmer cooperatives, and traditional networks the effectiveness of these sources varies with farmers' socio-economic characteristics, literacy levels, and institutional support (Eze *et al*., 2020). Unfortunately, most smallholder farmers in Edo and Delta States lack adequate exposure to accurate and localized climate forecasts, thereby limiting their capacity to respond proactively to environmental changes.

Existing research in Nigeria has predominantly focused on climate change adaptation in relation to food crops such as rice, maize, and cassava, with limited attention given to tree crops like oil palm (Madu and Nwosu, 2021). Moreover, most studies either generalize climate information sources across regions or neglect the comparative differences in agro-ecological, institutional, and infrastructural contexts between states. This creates a knowledge gap in understanding how oil palm farmers in different geographical settings access, interpret, and utilize climate-related information to guide adaptive decisions.

In addition, despite policy frameworks such as the *National Adaptation Strategy and Plan of Action on Climate Change for Nigeria (NASPA-CCN, 2012)* emphasizing the importance of information access in agricultural resilience, implementation at the grassroots level remains weak. Without empirical insights into how oil palm farmers obtain and apply climate information, efforts to improve resilience and promote sustainable oil palm production will remain ineffective.

Thus, a critical problem exists in the limited understanding of the nexus between climate change, information dissemination, and adaptation behavior among oil palm farmers in Edo and Delta States. Addressing this gap is essential for formulating evidence-based interventions that enhance farmers' adaptive capacity and reduce vulnerability to climate risks.

It is for this reason that this study is to address the following research questions.

1. What are the socio-economic characteristics of oil palm farmers in the study area?
2. What is the respondents' level of awareness, access, frequency of use and preference for information sources about climate change?
3. What are the climate change information needs of respondents?
4. What climate change information are respondents aware of, and have adopted?
5. What are factors militating against respondent climate change information sourcing and use?

1.3 Objectives of the Study

The main objective of this study was to assess climate change information sources used for mitigation among oil palm farmers in Edo State, Nigeria.

The specific objective were to:

1. describe the socio-economic characteristics of oil palm farmers in Delta and Edo State;
2. identify respondents' awareness, access to, preference for information sources to climate change;
3. ascertain climate change information needs of respondents;
4. determine their adoption level of proven climate change information and
5. identify factors militating against climate change information sourcing and use

1.4 Hypothesis of the Study

The hypothesis of the study is stated in the null form

1. There is no significant relationship between socio-economic characteristics of oil palm farmers and their access to climate change mitigation.
2. There is no significant difference in climate information needs among oil palm farmers in Edo and Delta.
3. There is no significant difference in information adoption among oil palm farmers in Edo and Delta State.

1.5 Justification of the study

Climate change remains a major threat to agricultural productivity, especially in developing countries where smallholder farmers largely depend on rainfall for crop production (IPCC, 2022). Nigeria, a tropical country with vast agricultural potential, is already experiencing the adverse effects of climate variability, including unpredictable rainfall patterns, increased temperatures, and extreme weather events (Ayanlade *et al.,* 2017). These challenges are particularly acute in oil palm production zones such as Edo

and Delta States, where oil palm farming serves as a major source of livelihood, employment, and raw materials for agro-industrial processes (Oni *et al.,* 2021).

Oil palm (*Elaeis guineensis*) is highly sensitive to climatic conditions, with optimal productivity requiring stable rainfall and temperature regimes (Corley and Tinker, 2015). Disruptions caused by climate change including prolonged dry spells, flooding, and temperature stress have led to reduced yield and increased pest and disease incidence (Adeniyi *et al.,* 2023). Consequently, there is an urgent need for oil palm farmers to adopt adaptive practices informed by timely, accurate, and accessible climate information.

Access to reliable climate information is a key determinant of farmers' capacity to adapt effectively (Mertz *et al.,* 2009). However, the sources of such information, their perceived credibility, and the extent to which they influence decision-making vary significantly across regions and socio-economic groups. Studies have shown that smallholder farmers in Nigeria often rely on informal sources such as local leaders or fellow farmers, while access to formal channels like agricultural extension services and ICT platforms remains limited (Eze *et al.,* 2020; Nnadi *et al.,* 2013). The level of access and responsiveness to climate information is also influenced by educational background, gender, income, and farming experience (Ojo and Baiyegunhi, 2020).

Edo and Delta States offer a valuable comparative context for investigating these dynamics. While both states are part of the Niger Delta agro-ecological zone, they exhibit differences in infrastructural development, extension coverage, and socio-economic characteristics of farmers (Ogundele *et al.,* 2021). Yet, there is a dearth of empirical studies focusing specifically on how oil palm farmers in these regions source and use climate information for adaptive responses. This research will fill that gap by

exploring the sources, reliability, and impact of climate information on the adaptive behavior of oil palm farmers.

Moreover, the study aligns with Nigeria's National Adaptation Strategy and Plan of Action on Climate Change for Agriculture (NASPA-CCN, 2012), which emphasizes the importance of climate knowledge dissemination and capacity-building in promoting sustainable agricultural development. Findings from this study will support evidence-based interventions by policymakers, NGOs, and agricultural extension systems aimed at enhancing adaptive capacity among vulnerable farming populations.

Finally, this research contributes to the broader scholarly discourse on climate change communication and agricultural resilience in the global South. By focusing on a perennial cash crop like oil palm which is often neglected in climate adaptation literature the study provides novel insights into the long-term implications of climate variability on tree crop systems and rural livelihoods.

CHAPTER TWO

2.0 LITERATURE REVIEW

Oil palm (*Elaeis guineensis*) is among Nigeria's most economically significant oil-producing crops. As reported by the World Rainforest Movement, the species originates from the Nigerian coastal region, although its cultivation has extended inland and become integral to rural livelihoods and agricultural traditions. The crop is highly valued for its multifunctionality, as all parts including fronds, leaves, trunks, and roots serve diverse purposes. These range from the extraction of palm oil and palm kernel oil to the production of palm wine, brooms, and palm kernel cake.

In the early 1900s, Nigeria dominated the global palm oil market, supplying the entirety of world exports. By the 1960s, the country accounted for 43% of worldwide palm oil production. However, several factors, including dependence on archaic farming techniques, excessive harvesting for palm wine, and the disruptions caused by the Nigerian Civil War (1967–1970), hindered the country's capacity to meet growing global demand (Abogunrin-Olafisoye, (2024).

Nigeria's oil palm production zone spans 24 states, encompassing all nine Niger Delta states (Akwa Ibom, Abia, Rivers, Edo, Imo, Ondo, Bayelsa, Cross River, and Delta). Smallholder farmers, operating within this belt, are responsible for roughly 80% of national output. These producers typically manage semi-wild palm groves and rely on traditional processing methods. Estimates of the cultivated area range between 1.65 million and 3 million hectares, while formal plantations account for between 169,000 and 360,000 hectares comprising both estate-managed and smallholder-operated fields (Edaba, *et al*., (2024).

Many of these plantations stemmed from earlier government-led initiatives to establish large-scale operations, many of which ultimately failed. Notable examples include the Cross River

project of the 1960s and the European Union-backed Oil Palm Belt Rural Development Programme in the 1990s. A particularly ambitious scheme led to the planting of 6,750 hectares of oil palm within a vital rainforest zone under Risonpalm Ltd, a state-partnered enterprise. The project was abandoned in 1999, reinitiated in 2003, and later slated for privatization in 2010 due to mismanagement and corruption, as acknowledged by the Rivers State Governor, who criticized the squandering of public funds in Risonpalm (Ekong, (2023).

The World Bank has also played a pivotal role in promoting palm oil development in Nigeria. Between 1975 and 2009, Nigeria received support for six palm oil-related projects making it the second-highest recipient globally. While these efforts led to the development of over 42,000 hectares of plantations, road infrastructure, and increased milling capacities, only one of the projects remains active; the others failed due to poor implementation. Consequently, many of the abandoned public plantations were leased to private entities. In response, several entrepreneurs established limited liability companies to attract investment and improve operational efficiency. Though some plantations now contain younger palms, many have aged beyond 30 years, reducing productivity (Igbosoroeze, (2022).

At the turn of the 21st century, the Nigerian government embarked on a renewed campaign to reestablish agriculture particularly palm oil as a cornerstone of economic development. Under President Olusegun Obasanjo, a strategic framework for vegetable oil production was launched in 2000, culminating in the formation of the Vegetable Oil Development Programme (VODEP). A central objective of this initiative was to plant one million hectares of oil palm over a five-year period (Okoro, *et al.,* (2017).

Further efforts to enhance the oil palm sector were seen in 2010 through a partnership involving Nigeria, Cameroon, the United Nations Industrial Development Organization (UNIDO), and the private sector. This initiative, under the Common Fund for Commodities, aimed to boost

income-generating opportunities in the palm oil industry across West and Central Africa. The Nigerian Institute for Oil Palm Research (NIFOR) supported this direction, emphasizing the importance of private sector engagement in revitalizing the industry. However, challenges such as land tenure constraints were identified as significant obstacles, prompting calls for local and state governments to allocate land to encourage mass cultivation.

In a bid to reduce dependence on imported palm oil, Nigeria banned the importation of crude and refined vegetable oils in 2001. This policy spurred increased domestic investment in new and existing plantations. Additionally, the government began promoting smallholder and out-grower schemes to further support local production. Despite earlier setbacks and underperformance, there is renewed interest in harnessing the oil palm value chain as a tool for rural development and poverty alleviation, particularly within the Niger Delta. The focus going forward is on identifying viable opportunities within the value chain and devising strategies to overcome the challenges impeding sustainable growth (Paterson, and Chidi, (2023).

2.1 Palm Oil Market in Nigeria

Although the oil palm tree yields a wide range of products such as palm oil, palm wine, and various wood-derived materials this study specifically concentrates on oil-based outputs and their immediate derivatives. The three primary oil products are Technical Palm Oil (TPO), Special Palm Oil (SPO), and Palm Kernel Oil (PKO). Additionally, palm kernel cake and sludge, by-products of the oil extraction process, hold commercial value, particularly within the livestock feed sector.

Palm oil intended for international markets is classified and graded based on 17 quality parameters. Key among these are the free fatty acid (FFA) content, dirt levels, iodine value, and presence of contaminants. For an oil to qualify as SPO, the FFA content must be below

5%, making it suitable for direct consumption, inclusion in cosmetics, or further refinement for use in soaps and bleaching agents. Oils that exceed this threshold those with FFA levels above 5% are designated as TPO and are mainly used for edible purposes after further processing.

In Nigeria, the utilization and transformation of both primary and secondary oil palm products for diverse food and non-food applications remain underdeveloped. In contrast, industrialized nations have significantly diversified the uses of palm oil, integrating it into the production of various processed foods as well as a broad spectrum of industrial goods, as illustrated in the following box.

Table 2.1: Food and Non-food uses of Palm Oil Products

Food uses	**Non – food uses**
Cooking Oil Deep Frying Oils Margarines and spreads Bakery fats Cocoa butter alternative fats Confectionary fats Ice cream fats Infants nutrition fats Other food applications	Cosmetics and personal care Soaps Candles Pharmaceuticals Lubrications and Grease Surfactants Industrial Chemicals Agrochemicals Coatings Paints and lacquers Electronics Leather Biodiesel

Source: Unleashing Agricultural Development in Nigeria through Value Chain Financing, Working Paper November 2010

The palm oil market in Nigeria is expected to remain primarily domestically oriented in the near future, as the country continues to be a substantial net importer of palm oil for both food-related and industrial applications. The domestic consumption of Technical Palm Oil (TPO), particularly by households and commercial food services such as hotels and restaurants, is the main driver of demand. In fact, the volume of palm oil consumed in the traditional food sector

is approximately three times greater than the industrial demand, making the household market the principal contributor to the national supply shortfall (UNIDO). (2024).

Palm oil with a free fatty acid (FFA) content ranging from 5% to 30% is widely accepted in Nigerian kitchens due to the diversity of local culinary requirements. This traditional market segment is predominantly supplied by smallholder producers, who are responsible for over 70% of domestic output, amounting to approximately 650,000 metric tons annually.

In contrast, Special Palm Oil (SPO) commands a premium price and caters to the industrial sector, where it serves as a raw material for products such as soap, frying oil for instant noodles, bakery fats, and other processed items. Despite its superior quality and higher market value, SPO competes with TPO, which remains in consistently high demand due to its lower processing requirements and easier market access.

Palm Kernel Oil (PKO), another derivative of oil palm, has witnessed a significant rise in demand owing to its widespread application in the production of confectionery fillings, soaps, cosmetics, and personal care items. It is also employed as an emulsifier in the food processing and pharmaceutical sectors, as well as in the manufacture of industrial products such as tobacco, alkyd resins, paints, varnishes, explosives, polyurethane, and cellophane. Additionally, Palm Kernel Cake (PKC) a by-product of PKO extraction is extensively used in livestock feed formulations.

Both SPO and PKO can be upgraded into Refined Bleached Deodorized Palm Oil (RBDPO) and Refined Palm Kernel Oil (RPKO), respectively. These refined oils are then fractionated into olein and stearin, which are key components in food manufacturing processes.

Beyond the primary oil outputs palm oil, palm kernel, and palm kernel oil the oil palm tree and the residual biomass from processing also offer multiple uses. For instance, sludge is used in

traditional soap making and as fertilizer, while PKC continues to serve as a valuable ingredient in both the livestock feed and fertilizer industries. Notably, processing by-products such as empty fruit bunches, fibres, shells, sludge, and effluents collectively constitute about 74% to 76% of the total mass generated during palm oil production.

In addition the other parts of the palm tree (trunk, leaves, fibre) have broad uses, while the bunch refuse, and by-products from the oil processing (fibre, shell, sludge) can be used as fuel for the mills, making briquettes to substitute for fuel wood,

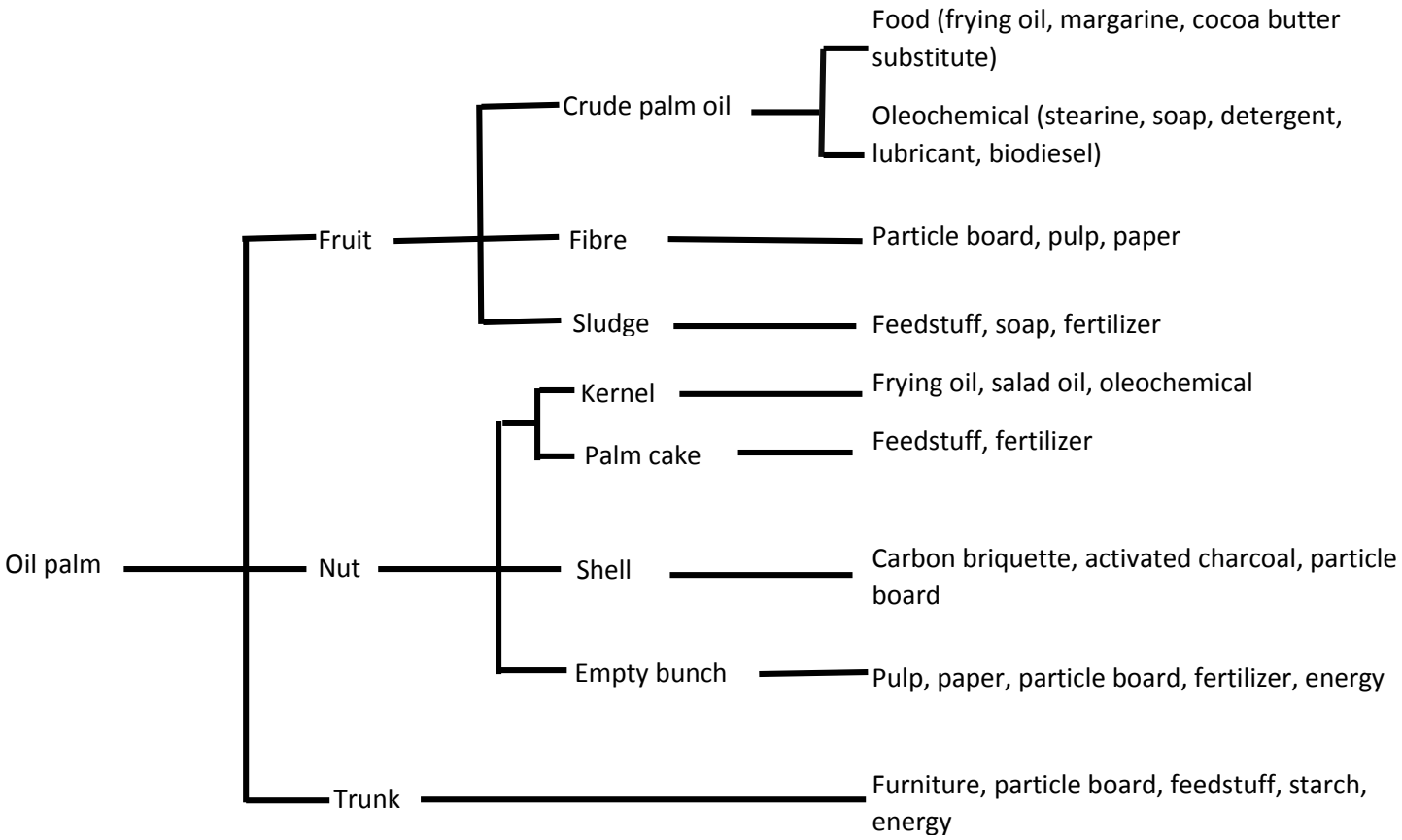


Figure 2.1: Uses of the oil palm tree

Source: Abia State Palm Oil Value Chain Development Project Abia State, Nigeria, 2010



Oil palm fruits



Oil palm plantation



Oil palm plantation



Fresh fruit bunches



Oil palms



Oil palms

2.2 The Effects of Climate Change in Nigeria

The agricultural sector contributes some percentage of the Nigerian Gross National Product and majority of the rural populace are employed in this sector. The dominant role of agriculture makes it obvious that even minor climate deteriorations can cause devastating socioeconomic consequences. Policies to curb the climate change by reducing the consumption of fossil fuels like oil, gas or carbon, have significant economic impacts on the producers or rather the suppliers of these fuels. Nigeria is the eighth largest oil supplier in the world and the ninth largest deposits of gas. The Nigerian national economy would be massively affected by a sustainable reduction of fossil energy consumption. Nigeria is practically a monoculture: about 80% of the government income, 90-95% of the export earnings and more than 90% of the foreign exchange revenues evolve from the oil sector. However, during the last years the government of Nigeria tried to diversify. Special attention is nowadays paid to gas which emerges in the joint-production of oil. So far, the gas has mainly been flared (75%), simply due to the lack of technical facilities to make use of it. A study commissioned by the World Bank in 2007 Nigeria accounts for roughly one-sixth of the world-wide gas flaring which in turn, spews some 400 million tons of carbon dioxide into the atmosphere (World bank, 2020). However, the World Bank survey has listed Nigeria and 15 other oil producers, as countries that have progressively reduced gas flaring. Following the Kyoto-Protocol is a double-edged sword for Nigeria: The probably positive long-term effects on the climate change are opposed to the negative short-term effects for the economic development. Observing the Kyoto-Protocol would reduce the income of the OPEC – States, amongst them Nigeria, about 25% until 2010. This would be a catastrophe for the Nigerian development plan. The countries politics and public discussions are barely addressing the mentioned problems. The last two years were so much dominated by the internal questions of power that political issues as regards content or even specific problems like the climate change would not have attracted real attention outside

the circle of environment experts or NGOs. In terms of short-term development policy more urgent worries exist and strategic foresight is not a fixed part of politics in the country. Furthermore, the climate change and its problems and solution strategies do not generate great publicity effects as they are too complex for rather superficial political talks. Nigeria's development plan does not recognize the economic threat caused by the climate change nor the menace of declining oil prices which could result from a reduced consumption of fossil fuels. In the arid zones, droughts are getting worse and climate uncertainty is growing, Climate change is an unprecedented and threat to food security. Arid and semi-arid areas in northern Nigeria are becoming drier, while the southern part of the country is getting wetter, Global warming means that many dry areas are going to get drier and wet areas are going to get wetter. They are going to be caught between the devil of drought and the deep blue seas of floods. However, "great tragedy" and Nigeria had played virtually no role in global warming; a problem was caused by economic activity of the rich, industrial countries. Unless climate change was tackled all the "best efforts" to help this great country could come to nothing (Abbass *et al.*, 2022). One of the biggest threats is growing climate unpredictability, which makes subsistence farming difficult. But a better planning to reduce the risk from disasters, together with developing agricultural practices that can withstand changing climates, have been shown to work and could help mitigate the impact if use more widely. The impact of the change will be difficult to handle and it will be potentially very long lasting. "It is very serious," Two things, the scientific evidence on global warming is strengthening daily, and there are risks over and above those that are usually considered. The disproportionate impact on Nigeria will be for a combination of reasons. Global warming will be greater over land than over sea because land retains heat more than water. There is also increasing evidence that it will be particularly hit by the effect of vertical rises and falls in air currents. Climate change often appears very esoteric but in Nigeria, it's real. We already have an increasing incidence of

disease, declining agricultural productivity, and a rising number of heat waves. There is glaring evidence that climate change is not only happening but it's changing our lives. Declining rainfall in already desert-prone areas in northern Nigeria is causing increasing desertification, the former food basket in central Nigeria is now empty, and people in the coastal areas who used to depend on fishing have seen their livelihoods destroyed by the rising waters. Adapting to climate variability and mitigating its impacts is something that we do in our everyday lives, but we have to understand what climate change is, that we contribute to it, and how we can adapt and reduce our vulnerabilities.

Increasing temperature (global warming) and decreasing precipitation in most parts of the world are the greatest impacts of climate change. These bring about either negative or positive ecological impacts in different parts of the world. The increasing temperature has led to increased land-based ice instability and its melting. The thawing of the Arctic, cool and cold temperate ice, the increasing rainfall in some parts of the world and expansion of the oceans as water warms has started impacting on sea level rise, coastal inundation and erosion. The current global estimate of sea level rise is 0.2 m and it is projected to increase to 1 m by the year 2100 (Madaki , Muench, Kaechele Bavorová (2023). The implication is that the present 0.2 m sea level rise has inundated 3,400 km2 of the coastal region of Nigeria, and if the sea level rise attains the projected 1m on or before 2100 then 18,400 km2 of the coastal region may be inundated (Food and Agricultural Organization, FAO, 2023). Coastal settlements like Bonny, Forcados, Lagos, Port Harcourt, Warri and Calabar among others that are less than 10 m above the sea-level would be seriously threatened by a metre rise of sea-level.

The sea incursion due to sea-level rise means salt-water intrusion into the fresh water, invasion and destruction of mangrove ecosystems, coastal wetlands and coastal beaches. The worst impact is population displacement, which may result in communal crisis. The coastal inundation and erosion with their associated population displacement are currently major

environmental problems in Nembe, Eket and other coastal settlements in Bayelsa, Delta, Cross River, Rivers, and Lagos States of Nigeria. It is estimated that a metre rise in sea level will displace about 14 million people from the coastal areas of Nigeria (Nelson, Vanos, Havenith , Jay, Ebi, Hijmans (2024). Ogbuchi,. (2020) also observes that sea-level rise up to a metre will displace 10, 13 and 72 million people in the coastal areas of Egypt, Bangladesh and China respectively.

The increasing temperature and decreasing rainfall have led to frequent drought and desertification. The Sahara-desert is observed to be expanding to all directions trying to engulf the Sahellian region of Africa with annual expansion of 1-10 km (Haider, (2023). Obasanjo, (2018) also observe that Nigeria north of 12oN is under severe threat of desert encroachment and sand dunes are now common features of desertification in states like Yobe, Borno, Sokoto, Jigawa and Katsina. The migrating sand dunes have buried large expanse of arable lands, thus reducing viable agricultural lands and crops' production. This has prompted massive emigration and resettlement of people to areas less threatened by desertification. Such emigration gives rise to social effects like loss of dignity and social values. It often results in increasing spate of communal clashes among herdsmen and farmers and such clashes resulted in the death of 186 people in six northern states of Nigeria between 1998 and 2006 (Addo and Asare, (2021).). Amoah, and Gyau, (2021) also shows that most of the destitute that emigrated as a result of drought and desertification usually move to nearby urban areas to beg for alms thereby compounding the already tense urbanization problems.

Climate change will alter all aspects of the hydrological cycle ranging from evaporation through precipitation, run off and discharge (Addo and Addo (2021). The global warming and decreasing rainfall together with the erratic pattern of rainfall produce a minimal recharge of groundwater resources, wells, lakes and rivers in most parts of the world especially in Africa thereby creating water crisis. In Nigeria, many rivers have been reported to have dried up or

are becoming more seasonally navigable while Lake Chad shrunk in area from 22,902 km2 in 1963 to a mere 1304 km2 in 2000. This shows that what is left of Lake Chad in the year 2000 is just 5.7% of 1963 (Olufemi, and Olutoye, (2019). Ladan, M. T. (2019) also confirms the fact that Lake Chad has shrunk by 95% since the 1960s and Aral Sea in Central Asia was the fourth largest lake in the planet in 1960, but by 2007 it had shrunk to 10% of its original size. Lake Chad and so many rivers in Nigeria, especially in Northern Nigeria, are in the danger of disappearing.

The water scarcity will create the tendency for concentration of users around the remaining limited sources of water. Under such circumstances, there is increased possibility of additional contamination of the limited sources of water and transmission of water borne diseases like cholera, typhoid fever, guinea worm infection and river blindness. Haider, H. (2023) and Obasanjo. (2018) note that the increasing temperature will mean northward migration of mosquitoes and malaria fever which will extend from the tropical region to warm temperate region while the sporogony of the protozoa causing the malaria accelerates from 25 days at 10OC to 8 days at 32OC. This paper also conceptualizes the relationship between climate change and human health the excessive

heat, increasing water stress, air pollution and suppressed immune system occasioned by climate change will result in increasing incidence of excessive death due to heat exhaustion, famine, water related diseases (diarrhoea, cholera and skin diseases), inflammatory and respiratory diseases (cough, and asthma), depression, skin cancer and cataract**.**

One of the greatest impacts of climate change is the worsening condition of extreme weather events like drought, flood, rainstorms, windstorms, thunderstorms, landslides, avalanches and tsunamis, among others (Addo, and Asare, (2021).

2001b; Asare, and Addo. (2021) notes that the frequency and magnitude of wind and rainstorms did not only increase, they also killed 199 people and destroyed property worth N85.03 billion

in Nigeria between 1992 and 2007. Akinola, Opoko, Ibem, Okagbue, and Afolabi (2020) had similar result when they reported that rainstorms claimed 42 lives in southern Cameroon between 2000 and 2005. Between 1950 and 2000, the increasing frequency and intensity of rainstorms have created enormous damages estimated at $87 billion in property losses, $19 billion in crop losses and losses of over 12,000 human lives in the United States of America alone (Danso-Abbeam, Ojo, Baiyegunhi, and Ogundeji, A. A. (2021).

Climate change has started to, and will continue to impact negatively on agriculture and food security especially in tropical and subtropical regions because greenhouse gas emissions would increase the risk of hunger by additional 80 million people by 2080 in Africa and southern Asia (Berhanu, and Wolde, (2019) shows that climate change has led to a shift in crops cultivated in northern Nigeria. The paper (Díaz Settele, Brondízio, Ngo, Guèze, Agard J.,) reveals that as at 1978, the preferred crops the farmers cultivated were guinea

corn followed by groundnut and maize, but due to increasing temperature and decreasing rainfall amount and duration occasioned by climate change, the farmers as a means of adaptation in 2007 shifted to the production of millet followed

by maize and beans. Another major problem to agriculture in Nigeria due to climate change is the reduction of arable lands. While the sea incursion is reducing the arable land of the coastal plains, the desert encroachment with its associated sand dunes is depriving farmers of their agricultural farmlands and grazing rangelands. Moreover, the frequent droughts and lesser rains have started shortening the growing season thereby causing crops failure and food shortage. It has been shown that drought, desert encroachment and coastal inundation have started affecting the country's ecosystem leading to ecological destabilization due to climate change impact in the semi-arid region of Northern Nigeria.

2.2.1 Climate Information Sources for Oil Palm Farmers

Climate change poses a significant threat to oil palm production, making access to reliable climate information crucial for farmers to adapt and ensure long-term sustainability. This review explores the various information sources that oil palm farmers utilize to stay informed about climate trends and best practices for climate-smart agriculture (UNIDO) 2024).

2.2.2 Traditional Extension Services

Government extension services have historically played a vital role in disseminating agricultural information to farmers (Berhanu, and Wolde, (2019). Extension agents can provide valuable climate information through various channels, including:

Farmer field days: These events allow farmers to learn about CSA practices through demonstrations and hands-on training (Berhanu, and Wolde, (2019),).

Printed materials: Brochures, pamphlets, and posters can be effective tools for conveying key messages about climate change impacts and adaptation strategies (Okoro, *et al*., 2017).

Farmer-to-farmer extension: Trained lead farmers can share knowledge and experiences with other farmers in their communities, promoting peer-to-peer learning (Abbass, *et al* (2022). However, traditional extension services often face limitations in reach and resources. Limited personnel, vast geographical areas, and outdated information dissemination methods can hinder their effectiveness Food and Agricultural Organization (FAO, 2023). Mass Media: Radio and Television, Radio and television can be powerful tools for disseminating climate information to a wide audience, particularly in rural areas (Aker, 2011).

Radio programs: Dedicated radio programs or segments within existing agricultural programs can provide weather updates, climate forecasts, and discussions on CSA practices (Ekboir *et al.*, 2013).

Television programs: Informative documentaries, educational shows, or public service announcements can raise awareness about climate change and promote adaptation strategies (Lee and Sheng, 2019).

The effectiveness of mass media depends on factors like program content, language accessibility, and broadcast frequency (Moser and Eklund, 2012). Collaboration between agricultural experts, media professionals, and local communities is essential for creating engaging and culturally appropriate content.

2.2.3 Social Media Platforms

Social media platforms offer new avenues for disseminating climate information and fostering communication between farmers, researchers, and extension agents (Aye, G.C., Inyang, B.J., and Ekpe, E.E. (2020).

Online forums and discussion groups: These platforms allow farmers to share experiences, ask questions, and access information on CSA practices and climate change adaptation (Sloan *et al.*, 2019).

Mobile applications: Mobile apps can provide farmers with real-time weather updates, localized climate forecasts, and access to extension services (Adepoju, A. O., and Oyedepo, J. A. (2024).

However, digital literacy and access to technology can be barriers for some farmers, particularly in remote areas (Maddison, 2024). Efforts are needed to bridge the digital divide and ensure equitable access to climate information through social media.

2.2.4 Informal Information Sharing: Networks and Social Ties

Informal information exchange through social networks and social ties plays a significant role in rural communities (Aigbe, Adebayo, and Ibezim, 2021). Farmers often rely on:

Neighbors and fellow farmers: Sharing knowledge and experiences with neighbors and colleagues allows farmers to learn from each other's successes and failures (Anderson, and Feder, (2007).

Family and friends: Family members and friends can be important sources of information and support, particularly when adopting new practices (Aker, 2011).

The effectiveness of informal information sharing depends on the trust and reciprocity within the social network (Pretty, 2018). However, the information shared may not always be accurate or based on scientific evidence.

Access to reliable and timely information is crucial for farmers to make informed decisions that can improve agricultural productivity and profitability. The agricultural information landscape has undergone a significant transformation in recent decades, with a proliferation of information sources available to farmers. This review examines the role of various information sources utilized by farmers, including traditional methods like radio, television, and printed materials, alongside newer technologies like mobile phones and farmer groups.

2.2.5 Printed Materials:

Printed materials, such as books, pamphlets, and agricultural magazines, continue to be a valuable resource for farmers, especially those who may lack access to digital technologies (Use of Agricultural Information Sources and Services by Farmers for Improve Productivity in Kwara State). These materials can provide in-depth information on specific topics and serve as

a reference for farmers. However, the dissemination of printed materials can be limited by factors like literacy rates and distribution networks in rural areas.

2.2.6 The Rise of Digital Technologies:

The increasing accessibility of mobile phones has opened new avenues for information dissemination in the agricultural sector (Lwogo *et al.,* 2024). Mobile phone technology allows farmers to access real-time information on market prices, weather updates, and agricultural best practices. Additionally, mobile apps can provide farmers with personalized advice and connect them with other farmers and agricultural experts.

2.2.7 Farmer Groups and Social Networks:

Farmer groups and social networks offer valuable platforms for farmers to share information and experiences (Haider, (2023). These groups can provide peer-to-peer learning opportunities, allowing farmers to learn from each other's successes and failures (Madu, and Nwosu, 2021). Additionally, farmer groups can advocate for the needs of farmers and influence agricultural policies.

2.2.8 Libraries and Extension Services:

Agricultural libraries and extension services can provide farmers with access to a wealth of information resources, including books, journals, and databases (Use of Agricultural Information Sources and Services by Farmers for Improve Productivity in Kwara State, n.d.). However, the effectiveness of these services can be limited by factors such as accessibility, staffing levels, and the ability of farmers to navigate complex information systems (Abiodun, 2022)

2.2.9 Informal Networks: Neighbours and Friends

Informal networks, such as neighbours and friends, remain a significant source of information for many farmers (Daudu *et al.*, 2023). These networks can provide farmers with practical advice and knowledge based on local experiences. However, the accuracy and reliability of information obtained through informal networks can be variable.

Farmers today have access to a diverse range of information sources, each with its own advantages and limitations. The optimal information source for a farmer will depend on factors such as their location, level of literacy, access to technology, and specific information needs. Further research is needed to explore how different information sources can be combined effectively to empower farmers and improve agricultural outcomes.

2.3 Impact of Weather Forecasting on Oil Palm Production

Oil palm cultivation is highly susceptible to weather variability. Accurate weather forecasts can be a valuable tool for farmers to optimize management practices and enhance yields. This review explores the potential benefits and challenges associated with weather forecasting for oil palm production.

2.3.1 Benefits of Weather Forecasting for Oil Palm Production

Improved Disease and Pest Management: Weather forecasts can help farmers predict the likelihood of outbreaks of diseases and pests that thrive under specific weather conditions (Begum *et al.*, 2018). Early warnings allow for timely application of preventive measures, such as fungicides or insecticides, minimizing crop damage and economic losses (Abogunrin-Olafisoye, 2024).

Optimized Fertilizer and Water Management: Weather forecasts can be used to adjust fertilizer application based on rainfall predictions. For example, forecasts of heavy rain can

help avoid unnecessary fertilizer application that could be leached away, reducing costs and environmental impact (Paterson, and Chidi, (2023). Similarly, forecasts of dry periods can inform irrigation practices, ensuring optimal water use and minimizing water stress on palm trees (Okoro, *et al.*, 2017).

Harvest Planning and Logistics: Accurate forecasts of weather conditions during harvest periods can help farmers plan logistics and labour requirements effectively. Advance knowledge of potential heavy rain or strong winds can help prepare for potential disruptions and minimize post-harvest losses (Ekong, 2023).

Yield Prediction and Risk Management: Weather data integrated with historical yield data can be used to develop models for predicting oil palm yields (Pasca *et al.*, 2018). This information can be used for informed decision-making, such as adjusting fertilizer applications or managing labour during expected low-yield periods. Additionally, weather forecasts can help farmers anticipate potential weather extremes and implement risk management strategies, such as crop insurance, to mitigate potential financial losses. (Abiodun, 2022).

2.4 Challenges and Limitations

Despite the potential benefits, utilizing weather forecasts for oil palm production faces some challenges:

Accuracy and Spatial Variability: Weather forecasts, particularly at the local level, can be imprecise. Localized weather patterns and microclimates within plantations can differ from broader forecasts.

Limited Access and Technical Knowledge: Smallholder farmers may lack access to reliable weather information or the technical knowledge to interpret and utilize forecasts effectively (Igbosoroeze, 2022).

Infrastructure and Communication Gaps: Rural areas may have limited infrastructure for disseminating weather information through technology like mobile apps or internet platforms (Abiodun, 2022).

2.5 Mitigation of climate change through palm oil

Strategies are required to minimize the adverse effects of Climate Change on Oil Palm cultivation. These practices may also decrease Climate Change from less deforestation if the yields of existing Oil Palm are optimized to cope with Climate Change.

The concentration of ca. 85% of Oil Palm cultivation in Malaysia/Indonesia is detrimental to combating Climate Change. More dispersed cultivation outside these countries could ameliorate threats from Climate Change as a wider range of climates would be encountered, some of which may be more suitable for Oil Palm. The expansion into West Africa and South/Central America underway was intended to create a more secure production system in the longer term, coupled with the reduced available land in Malaysia and Indonesia (Ogbuchi, 2020). However, Abiodun (2022) demonstrated that Latin America and Africa may be even more affected by Climate Change in terms of suitable climate for growing Oil Palm than SE Asia, meaning that this expansion is unlikely. The increase in biodiversity loss and decreases in ecological functions previously mentioned would also mitigate against expansion into novel areas.

2.6 Growing oil palms in novel suitable regions created by climate change

Cultivation at higher altitudes and/or lower and higher latitudes may be possible beyond the lowland tropics as Climate Change progresses (Mitter, Bermeier, Schmid 2024). Paterson *et al*., (2019) predicted an increase in highly suitable climate (HSC) for growing Oil Palm by 2030 in Indonesia and Malaysia largely in mountainous regions of Sumatra, Sarawak, Borneo, and Sulawesi. These areas had increasingly HSC by 2070 and 2100 being almost the only more

suitable regions amidst the general decrease. There may other factors which do not permit Oil Palm growth, for example, lack of suitable soil, which require further investigation. The other factors mitigating against employing this novel cultivation area may include decreased biodiversity and ecological function.

Palm oil is a highly versatile and productive crop, but its cultivation has also been linked to environmental concerns, including deforestation and greenhouse gas (GHG) emissions. However, recent advancements and sustainable practices offer opportunities to mitigate these impacts and contribute to climate change mitigation efforts within the palm oil industry.

2.7 Challenges and Environmental Concerns

Deforestation and Habitat Loss: Conversion of rainforests for oil palm plantations has been a significant driver of deforestation in Southeast Asia (Abogunrin-Olafisoye, 2024). This not only reduces biodiversity but also releases stored carbon from trees into the atmosphere.

Greenhouse Gas Emissions: Land-use change associated with deforestation, peatland conversion, and use of fertilizers contributes to GHG emissions, including methane and nitrous oxide (Mitter, Bermeier, Schmid, 2024). Additionally, burning of agricultural waste further adds to atmospheric carbon Ogbuchi, (2020).

2.8 Strategies for Mitigation

Sustainable Certification Schemes: Certification schemes like Roundtable on Sustainable Palm Oil (RSPO) promote responsible practices such as protecting High Conservation Value (HCV) areas, minimizing deforestation, and ensuring fair labour practices (Paterson, *et al.*, 2023).

Improved Land-Use Planning: Effective planning can minimize deforestation by utilizing degraded land for oil palm expansion and promoting efficient land use within existing plantations (Asare and Addo, 2021).

Reduced-Impact Logging: Selective logging techniques can harvest timber from existing plantations while maintaining forest cover and carbon stocks (Ogbuchi, (2020).

Adoption of Cover Crops: Cover crops planted between palm trees suppress weeds, improve soil health, and reduce erosion, ultimately contributing to carbon sequestration.

Efficient Use of Fertilizers and Water Management: Optimizing fertilizer application based on soil nutrient levels and employing water-saving irrigation techniques can minimize environmental footprints Ogbuchi, (2020)

Bioenergy from Palm Oil Mill Residues: Utilizing palm oil mill waste for bioenergy production can replace fossil fuels and reduce overall GHG emissions Jackson (2021). However, sustainability considerations regarding biomass production and lifecycle assessments are crucial.

Improved Breeding Programs: Developing high-yielding oil palm varieties with reduced fertilizer requirements and improved stress tolerance can contribute to sustainable production (Mittal, and Mehar, (2012).

2.9. Theoretical review on diffusion of innovation sources

Definition and Core Principles

Developed by Everett Rogers, the Diffusion of Innovations (DOI) theory explains how, why, and at what rate new ideas and technologies spread within a social system Wikipedia. It highlights five key factors influencing innovation adoption:

- Relative Advantage: Is the innovation better than current practices?
- Compatibility: Does it fit with existing values and customs?
- Complexity: Is it easy to understand and use?
- Trialability: Can it be experimented with on a small scale?
- Observability: Are its benefits visible to others?

Additionally, Rogers identifies adopter categories innovators, early adopters, early majority, late majority, and laggards reflecting different levels of openness to new ideas Wikipedia. (Rogers, (2003).

Diffusion of Innovation in Oil Palm Farming

a. Edo State, Nigeria: Constraints and Drivers for Innovation

- A study focused on Edo State found many oil palm farmers stuck with traditional, low-efficiency methods despite access to improved seedlings and training from NIFOR (Nigeria Institute for Oil Palm Research) International Wikipedia.
- Key drivers enhancing innovation adoption include access to credit, training, and extension services, while major constraints include high input costs, poor infrastructure, unstable markets, and risk aversion especially among older farmers RSIS International.

b. ICT Adoption in Oil Palm Settlements

- Investigations into ICT adoption among oil palm settlers in Malaysia applied the DOI framework, emphasizing how relative advantage, compatibility, complexity, trialability, and observability mediate adoption decisions ResearchGate.
- Factors like income, education, age, and gender also influence ICT uptake ResearchGate.

Applying Diffusion of Innovation in Practice

- Relative advantage: New tools e.g., mechanical presses, hybrid seedlings must clearly outperform existing methods.

- Compatibility: Innovations should align with cultural norms and farming practices (e.g., intercropping traditions in PNG). (Biney, C. A., and Djokoto, J. G. (2012).
- Simplicity and Trialability: Farmers are more likely to adopt practices they can test on a small scale and understand easily.
- Observability: Visible success stories from peers (e.g., neighbors adopting hybrid seedlings) accelerate diffusion.

Barriers Hindering Diffusion

- Structural constraints: Poor roads, limited market access, and supply chain gaps hinder timely access to innovations.
- Financial hurdles: With low liquidity and lack of credit, many farmers cannot invest in innovative tools or methods.
- Institutional weakness: Weak extension services and fragmented support systems slow adoption.
- Socio-cultural resistance: Innovations that disrupt established norms (e.g., gender roles or labor allocation) may face resistance unless supported institutionally.

2.9.1 What Is Uses and Gratifications Theory?

Uses and Gratifications Theory (UGT) suggests that audiences actively choose media channels to fulfill specific needs such as gaining information, staying socially connected, seeking entertainment, or reinforcing personal identity. This approach emphasizes active media users rather than passive recipients. The core idea is that “uses” are the benefits people seek, while “gratifications” are the satisfaction they actually obtain.

Uses and Gratifications Theory in Nigerian Agricultural Contexts

a) Aquaculture Farmers and Mobile Phones (Niger State)

- A 2017 study investigated mobile phone use by aquaculture farmers using the UGT framework. Farmers sought mobile phones to:
    - *Stay accessible and connected*
    - *Complete tasks efficiently*
    - *Socialize with peers and clients*
- The gratifications they obtained included:
    - *Supporting technology adoption*
    - *Access to timely advisory information*
    - *Facilitating connections with customers*
    - *Quick responses and access to inputs* IJEAB

This demonstrates Nigerian farmers as active media users, using communication tools to satisfy both pragmatic and social needs.

b) Social Media Use in Agricultural Marketing (South-South Nigeria)

- A study on WhatsApp and Instagram usage for marketing agricultural products found that social media adoption led to:
    - *Lower marketing costs*
    - *Greater efficiency in outreach*
    - *Increased demand and farmer turnover* PMC

While not explicitly UGT-labeled, the underlying motivations seeking efficiency, broader reach, and profit align closely with UGT principles.

3. Applying Uses and Gratifications Theory to Nigerian Oil Palm Farmers

Here's a custom analytical framework tailored to understand how Nigerian oil palm farmers use media under the UGT perspective.

Core Gratifications in Context:

Table 2.2: Uses and gratification theory of information on oil palm farmers

UGT Gratification Type	Relevance to Oil Palm Farmers
Information	Learning best practices: land prep, fertilizer use, pest control, and market prices
Social Connection	Engaging with cooperatives, input suppliers, and extension agents especially via WhatsApp groups
Instrumental/Utilitarian	Improving efficiency in operations and decision-making through rapidly accessed information
Economic Gain	Using media to market produce (e.g., palm oil), helping to boost income and expand reach
Entertainment Relaxation	Avoiding monotony listening to radio or watching farming-related content for mental breaks
Identity and Pride	Showcasing success, innovations, or community status via social media or group platforms

Media Platforms Examples:

- Radio (local language programs) – for broad information dissemination
- Mobile Phones (calls/SMS/WhatsApp) – for real-time connection and advice
- Social media (Facebook, WhatsApp stories) – for marketing and community

- Extension Agents / Cooperative Meetings – for in-depth learning and support

Behavioural Flow:

Farmer Needs → Gratifications Sought → Media Choice → Information Use → Gratifications Obtained → Continued Use or Feedback Loop

4. Example Scenarios

- **Case A: Traditional Oil Palm Farmer in Edo State**
    - Need: Learn improved seedling techniques.
    - Media Used: Radio program and WhatsApp group.
    - Outcome: Correct seedling use → yield uplift → digitally shared success → community learning.
- **Case B: Youth Agripreneur in Cross River State**
    - Need: Market value-added palm oil products.
    - Media Used: Instagram and WhatsApp business broadcasts.
    - Outcome: New customer base → revenue gain → reinforces media use satisfaction.

5. Recommendations for Implementation

- Extension Services: Craft content that meets farmer needs via preferred channels—localized radio and mobile-based tips.
- Co-operatives and NGOs: Train members on using WhatsApp effectively for best-practice exchange and marketing.
- Media Producers: Create engaging, culturally resonate programming that blends information with entertainment.

- Policy Makers: Support mobile access infrastructure and affordable data to expand reach among farming communities.

2.9.2 Risk Information Seeking and Processing (RISP)

Risk Information Seeking and Processing (RISP) refers to the ways individuals or groups actively seek out, interpret, and use information related to potential risks or hazards in their environment. It explains how people look for information to understand risks better, make decisions, and take protective actions.

Key Components of RISP:

1. Risk Perception

   How people perceive or feel about the seriousness and likelihood of a risk (e.g., pesticide exposure, crop failure).
2. Information Seeking

   The motivation and effort individuals put into finding information about risks, such as from experts, media, or peers.
3. Information Processing

   How people interpret, evaluate, and integrate the risk information they receive.
4. Coping Strategies

   Actions taken based on the information to reduce or manage the risk (e.g., adopting safety measures, changing farming practices).

Why is RISP Important?

- It helps explain how and why people react to risks.

- In farming contexts, it can show how farmers seek advice on pest management, weather risks, or safety practices.
- Understanding RISP can help design better communication strategies that encourage safer, informed decisions.

Theoretical Background

The concept is often studied within risk communication and health communication fields, with seminal work by Griffin, Dunwoody, and Neuwirth (1999), who developed the Risk Information Seeking and Processing model.

Example in Agriculture

For oil palm farmers in Nigeria, RISP behavior might involve:

- Seeking information about pest outbreaks or safe pesticide use from agricultural extension workers, radio programs, or peers.
- Processing that information by assessing whether it fits their experience and resources.
- Adopting protective measures like wearing gloves or changing pesticide application methods based on the information.

The risk information seeking and processing (RISP) behavior of oil palm farmers in Edo and Delta States of Nigeria has been explored in several studies. These studies highlight the challenges faced by farmers in accessing and utilizing information related to agricultural risks, such as pesticide safety and environmental hazards.

1. Constraints in Pesticide Safety Measures Adoption

A study assessed the adoption of pesticide safety measures among oil palm farmers in Edo, Delta, and Ondo States. The findings revealed that while 95% of respondents adopted 28 identified pesticide safety measures, several constraints hindered full adoption:

- Inconvenience of personal protective clothing: Farmers reported discomfort and inconvenience associated with wearing protective gear.
- Perceived danger of safety measures: Some farmers believed that certain safety measures were hazardous to their health.
- Lack of financial resources: The cost of acquiring protective equipment was a significant barrier.

These constraints were statistically significant, indicating that addressing these issues could improve the adoption of safety measures among farmers. AJOL

2. Information Flow on Agronomic Practices

A study in Delta State examined the flow of information regarding improved agronomic practices among oil palm farmers. The research found that factors such as age, marital status, education, gender, and farm size significantly influenced the access to information. However, the study did not delve deeply into how farmers process and utilize this information to mitigate risks. AJOL

3. Occupational Hazards in Palm Oil Processing

Research on traditional palm oil processing in Delta State highlighted several occupational hazards faced by farmers:

- Physical injuries: Farmers frequently suffered from spikelet and burn injuries.
- Limited use of protective equipment: Only a small percentage of farmers used protective gear such as gloves, boots, and helmets.

These hazards not only pose health risks but also affect the socio-economic status of the farmers. aaem.pl

4. Constraints in Pesticide Safety Measures Adoption (FTST Journal)

A study published in the FTST Journal assessed the adoption of safety measures for pesticide use among oil palm farmers in Delta, Edo, and Ondo States. The study found that despite the availability of safety measures, their adoption was hindered by factors such as:

- Lack of awareness: Farmers were often unaware of the importance of safety measures.
- Cultural practices: Traditional farming practices sometimes conflicted with recommended safety measures.
- Economic constraints: The cost of implementing safety measures was a significant barrier.

Addressing these constraints could enhance the adoption of safety measures and reduce health risks among farmers. ftstjournal.com

2.9.3 State of Oil Palm in Edo and Delta State

The oil palm sector in **Edo State** has experienced significant growth, positioning it as Nigeria's leading producer, contributing over 12% to the nation's total output. This advancement is attributed to strategic reforms under Governor Godwin Obaseki's administration, particularly the Edo State Oil Palm Programme (ESOPP).

Edo State: A Hub for Oil Palm Production

- Leading Producer: Edo State has emerged as Nigeria's top oil palm producer, surpassing other states like Akwa Ibom and Cross River, which contribute between 5% and 8% each. **Edo State Government (2024).** *Obaseki reforms: Edo now Nigeria's number one oil palm-producing State, contributing over 12 percent to nation's aggregate production.* Retrieved from [edostate.gov.ng]
- Land Allocation: The E**do State Oil Palm Programme (ESOPP)**. has allocated over 70,000 hectares for oil palm development, with plans to add another 47,000 hectares in its second phase. Edo State Government
- Investment Attraction: The program has attracted over $500 million in investments from both local and international companies, including Okomu, Presco, Dufil Prima Foods, Saro Oil Palm, and Saturn Farms. Edo State Government
- Job Creation: Projects like Fayus Nigeria Limited's 3,000-hectare plantation in Owan West are expected to create approximately 5,000 jobs, further boosting the local economy. Nigerian Observer

Delta State: Emerging Potential

While Delta State is not yet a major player in oil palm production, recent developments indicate a growing interest:

- Investment Expansion: Companies such as Presco and Okomu are expanding their operations into Delta State, signaling potential growth in the region's oil palm sector.
- Government Initiatives: The state government is exploring opportunities to attract investments and develop infrastructure to support oil palm cultivation.

1. Private Sector-Led Expansion

Norsworthy Farms Oil Palm Plantation

- Located in Akwukwu-Igbo, Oshimili North LGA, this project spans **1,400 hectares** and includes both a plantation and a processing mill.
- It has already created **approximately 300 jobs**, with expectations for more as the mill becomes fully operational. THIS DAY LIVE
- The Governor emphasized public–private partnership benefits for local economies and value-chain inclusion (e.g., out-grower schemes). THIS DAY LIVE

2. Central Bank-Led Oil Palm Development Initiative (CBN/OPDI)

- Delta State is actively participating in the CBN's initiative with 33,000 hectares earmarked across 28 communities. Business day NG Tribune Online
- The initiative involves establishment of an "oil palm belt" to curb import dependence, generate jobs, and improve local production. Business day NG Tribune Online
- DELCOM Cooperative (Delta State Commercial Oil Palm Plantation Growers) envisions a phased development of 100,000 hectares statewide, aiming to create hundreds of thousands of jobs.delcom.com.ng
- In 2023, Emu Kingdom and 67 other communities signed MoUs to participate, pledging over 100,000 hectares collectively, with returns of up to 22% profit share annually.

3. Institutional Support and Smallholder Focus

- The Tree Crop Unit of Delta State is boosting support through nurseries in Ejeme Uno (Aniocha South LGA) and Mosogar (Ethiope North LGA), supplying 30,000 high-yield seedlings to small-scale farmers.Soluap

- Government reforms in policies, agri-business infrastructure, and rural data systems are improving investment conditions and land access. These include the Agricultural Land Data Bank and agro-industrial parks to support value addition. Oxford Business Group

4. Agribusiness Productivity and Technology Adoption (Empirical Evidence)

- A 2025 study covering all three senatorial districts of Delta found 3,386 oil palm farmers surveyed. Key determinants influencing adoption of agricultural technologies included:
    - Educational level
    - Extension agent support
    - Access to low-interest loans
    - Perceived benefits of innovationjournalajraf.com
- Adoption of technologies significantly increased productivity, reduced labor costs, and improved livelihoods. Challenges such as low finance, poor infrastructure, and technical skill gaps persist.

Key Sources

1. Land Allocation under the CBN Oil Palm Development Initiative

- Delta State government has facilitated the provision of 33,000 hectares across 28 communities for the Central Bank of Nigeria's Oil Palm Development Initiative.Businessday NGTribune Online

2. DELCOM Cooperative and Large-Scale Development Plans

- The DELCOM Cooperative is leading a drive to convert up to 100,000 hectares for oil palm cultivation, contributing significantly to the CBN initiative.Ndokwa ReportersDaily Trust
- Through a community-driven model, 68 host communities have released 130,000 hectares, exceeding initial targets.Ndokwa ReportersNairametrics

3. Private Sector Investment: Norsworthy Farms

- Delta State's Governor inaugurated a state-of-the-art oil palm processing plant at Norsworthy Farms in Akwukwu-Igbo, operated through a public–private partnership (PPP).blog.deltastate.gov.ngPunch Newspaper

4. Technology Adoption Among Oil Palm Farmers

- A 2025 study surveying 400 farmers across Delta State revealed that education, extension support, access to low-cost loans, and belief in innovation benefits positively influenced the adoption of agricultural technologies. However, barriers like infrastructure, funding, and technical skills persist.journalajraf.com

5. Omega LGA Study on Processing Technology Adoption

- In Isoko North LGA, a study found high adoption rates for technologies like sterilizers and mechanical presses among palm oil producers, although adoption of clarifiers and threshing machines remained low due to cost, limited credit, and poor infrastructure.journalajaees.com

6. Women Processors in Ethiope West LGA

- Among women palm oil processors in Ethiope West, awareness and adoption of improved processing technologies were low. Key contributors included socio-economic constraints like low exposure and financial barriers.BW Journal

Table 2.3: Summary Table of Oil Palm in Delta State

Aspect	Details
Private Sector Investment	Norsworthy Farms' 1,400-hectare plantation and mill
CBN Intervention	33,000 ha across 28 communities in partnership with DELCOM Coop; 100,000+ ha planned
Smallholder Engagement	Tree crop nurseries providing 30,000 seedlings
Policy and Infrastructure	Land Bank, agri-policy reforms, rural infrastructure improvements
Technology Adoption	Driven by education, extension, financing; outcomes include productivity gains

Table 2.4: Comparative Overview

State	Contribution to National Output	Land Allocated (Hectares)	Major Investors	Job Creation Initiatives
Edo	Over 12%	70,000+	Okomu, Presco, Dufil, Saro, Saturn Farms	Significant (e.g., Fayus: 5,000 jobs)
Delta	Emerging	Not specified	Presco, Okomu	Developing

Summary

Edo State has become a leader in Nigeria's oil palm industry through strategic land allocations, substantial investments, and job creation initiatives. Delta State, while currently less developed in this sector, shows promise with ongoing investments and government interest. Both states are poised to contribute significantly to the nation's agricultural landscape in the coming years.

2.9.4 Channel Complementarity in Oil Palm Farmers

Channel complementarity refers to the use of multiple communication or information channels that complement each other to improve the dissemination, reception, and adoption of agricultural innovations among farmers. For oil palm farmers, this means combining various sources such as extension agents, radio programs, mobile phone messages, community meetings, and printed materials to effectively acquire information related to farming practices, pest control, marketing, and innovations.

Using complementary channels enhances the farmers' ability to cross-verify information, reinforces understanding through multiple formats (audio, visual, interpersonal), and overcomes limitations such as low literacy or access challenges. This synergy leads to improved adoption of innovations and better risk management among oil palm farmers.

For example, a study by Ojo *et al*. (2016) on oil palm farmers in Edo State, Nigeria, found that farmers who accessed information through both extension services and mass media were more likely to adopt improved farming techniques than those relying on a single source. Similarly, Aye *et al*. (2020) highlighted that combining mobile phone-based advisories with traditional extension visits increased the effectiveness of agricultural information delivery.

Channel Complementarity for Oil Palm Farmers

Oil palm farmers often face complex challenges such as pests, diseases, market fluctuations, and climate variability which require timely and accurate information.

- **Extension services + Mobile phones**: Farmers might receive expert advice through extension agents but also get reminders or updates via SMS or calls.

- **Radio programs + Community meetings**: Radio gives broad awareness about new farming techniques, while meetings allow direct QandA and local problem discussions.
- **Printed materials + Digital platforms**: Pamphlets and brochures can give step-by-step guides, complemented by videos or tutorials accessible online.

This complementarity ensures that farmers can cross-check information, get more comprehensive support, and adapt innovations more effectively.

Importance of Channel Complementarity for Oil Palm Farmers in Nigeria

- **Improved knowledge adoption**: Combining channels leads to better understanding and trust.
- **Overcoming literacy barriers**: Audio and visual channels complement written materials.
- **Timely problem-solving**: Multiple channels increase the chance that urgent info (e.g., about pests) reaches farmers quickly.
- **Enhanced social support**: Community meetings reinforce social networks and collective action.

2.9.5 Information Needs of Oil Palm Farmers

Oil palm farmers require a wide range of information to effectively manage their farms and improve productivity. Key categories include:

- **Agronomic Practices**: Information on best planting techniques, seedling quality, fertilization, pest and disease management, harvesting, and post-harvest processing.
- **Market Information**: Prices, demand trends, buyers, storage, and transportation options.
- **Financial Information**: Access to credit, subsidies, insurance, and investment opportunities.
- **Policy and Institutional Information**: Government programs, extension services, cooperatives, and agricultural policies.
- **Weather and Climate Information**: Seasonal forecasts, rainfall patterns, and mitigation strategies for climate risks.

Access to timely and accurate information in these areas helps farmers reduce losses, adopt innovations, and increase profitability.

Empirical Review on Socio-Economic Characteristics and, information access and use among oil-palm farmers

This empirical review synthesizes evidence from Nigeria and comparable smallholder settings on (a) the information needs of oil-palm farmers, (b) the channels they use, (c) socio-economic determinants of access/use, and (d) constraints to adoption of climate-relevant information.

1. Information needs: what farmers want

Empirical studies consistently show that oil-palm farmers prioritise **actionable, short-term** information seasonal and short-range rainfall forecasts, pest and disease alerts, harvest timing, and market/price information over abstract, long-term environmental concerns (e.g., desertification) (Eze, Nwankwo, & Ibezim, 2020; Edaba, Nwajiuba, & Eze, 2024). Actionable information directly tied to immediate production decisions has higher perceived utility and translates more easily into farm-level adjustments (pesticide timing, drainage works, labour scheduling).

2. Channels used in practice

Across multiple country studies, the dominant channels are **mobile phones (calls/SMS/WhatsApp), radio, and interpersonal networks** (Aker, 2011; Akudugu *et al*., 2012). Radio remains especially effective for low-literacy populations and for broadcast weather advisories; mobile platforms provide timely, personalized alerts where network and digital literacy permit. However, interpersonal channels peers, family, cooperative meetings, and extension visits remain central for verification, practical adaptation and trust building (Ojo *et al*., 2016; Aye, Inyang, & Ekpe, 2020). Where extension services function well, they are both trusted and preferred for technical guidance; where they are weak, farmers rely more heavily on informal networks.

3. Socio-economic determinants of access and use

A robust set of empirical findings identifies these major determinants:

- **Education / literacy:** Higher educational attainment correlates strongly with the ability to interpret forecasts and to use ICT tools, increasing both information access and adoption likelihood (Deressa, Hassan, & Ringler, 2011; Ogundeji, 2022).
- **Income and farm size:** Greater resources enable purchase of inputs, adoption of recommended measures, and investment in communication devices, thereby enhancing the capacity to act on information (Maddison, 2007; Paterson & Chidi, 2023).
- **Extension contact and cooperative membership:** Farmers with frequent extension contact and active membership in cooperatives show higher awareness, better access to structured training, and greater adoption rates (Onyebuchi & Musa, 2021; Ojo *et al*., 2016). Cooperatives serve as distribution nodes for both information and inputs.
- **Age and gender:** Effects are context-specific. Some studies find younger farmers more likely to use digital channels (mobile apps, social media), whereas older farmers may rely more on traditional networks; gender dynamics often limit women's direct access to certain channels but may increase their use of local peer networks (Doss, 2014; Aker, 2011).
- **Perceived exposure to risk:** Farmers in high-exposure areas (e.g., flood-prone coastal zones) show stronger demand for climate information and higher adoption of adaptive practices (Ekong, 2023; Edaba *et al*., 2024).

4. Adoption of climate-smart practices and regional heterogeneity

Comparative studies (including state-level analyses in Nigeria) reveal that **regional exposure to hazards, institutional outreach intensity, and cooperative strength** explain much of the

variation in adoption rates. For example, Delta communities with frequent flooding and more active cooperative/extension systems often exhibit higher adoption of drainage management, mulching, and other climate-smart practices compared with less exposed or institutionally weak areas (Paterson & Chidi, 2023; Onyebuchi & Musa, 2021).

5. ICT promise and limits

Mobile phones and apps expand reach and timeliness of advisories, but substantial barriers persist: unreliable electricity, intermittent network coverage, low digital literacy, and the cost of data/handsets (Aker, 2011; Lwogo *et al*., 2024). Where localized content, language-appropriate messaging and user training exist, ICTs effectively complement—not replace—interpersonal extension.

6. Constraints linking information supply to use

Empirical literature repeatedly documents the "last-mile" barriers: limited extension personnel, weak two-way institutional linkages between research/meteorological agencies and farmers, language and literacy mismatches, poor rural infrastructure (power, roads, telecoms), and insufficient finance to implement recommended measures (FAO, 2016; Eze *et al*., 2020; Ogundeji, 2022). These constraints explain the persistent gap between information availability at the institutional level (NiMet bulletins; research outputs) and farmer-level uptake.

7. Indigenous knowledge and hybrid approaches

Several studies emphasise that indigenous ecological knowledge remains a trusted information reservoir and that effective adaptation programmes combine scientific forecasts with local indicators and experiential knowledge (Ebewore & Egbodion, 2022). Integrative approaches

co-producing localized forecasts and advisory messages with farmer input tend to be better received and more actionable.

Implications for policy and research

1. **Design information products for actionability:** Prioritise short-lead, locally downscaled forecasts, pest alerts, and practice-oriented advisories in local languages.
2. **Strengthen extension and cooperatives:** Invest in extension capacity and use cooperatives as hubs for information dissemination and input access.
3. **Use channel complementarity:** Combine radio (broad reach), mobile alerts (timeliness), and extension visits/demonstrations (technical depth).
4. **Integrate indigenous knowledge:** Co-produce advisory content with farmers to ensure cultural fit, observability and trialability.
5. **Address infrastructure and finance barriers:** Expand rural electrification, mobile connectivity, and affordable credit to enable implementation of recommended practices.

2.9.6 Conceptual Framework: Sources of Information of Oil Palm Farmers in Edo and Delta state

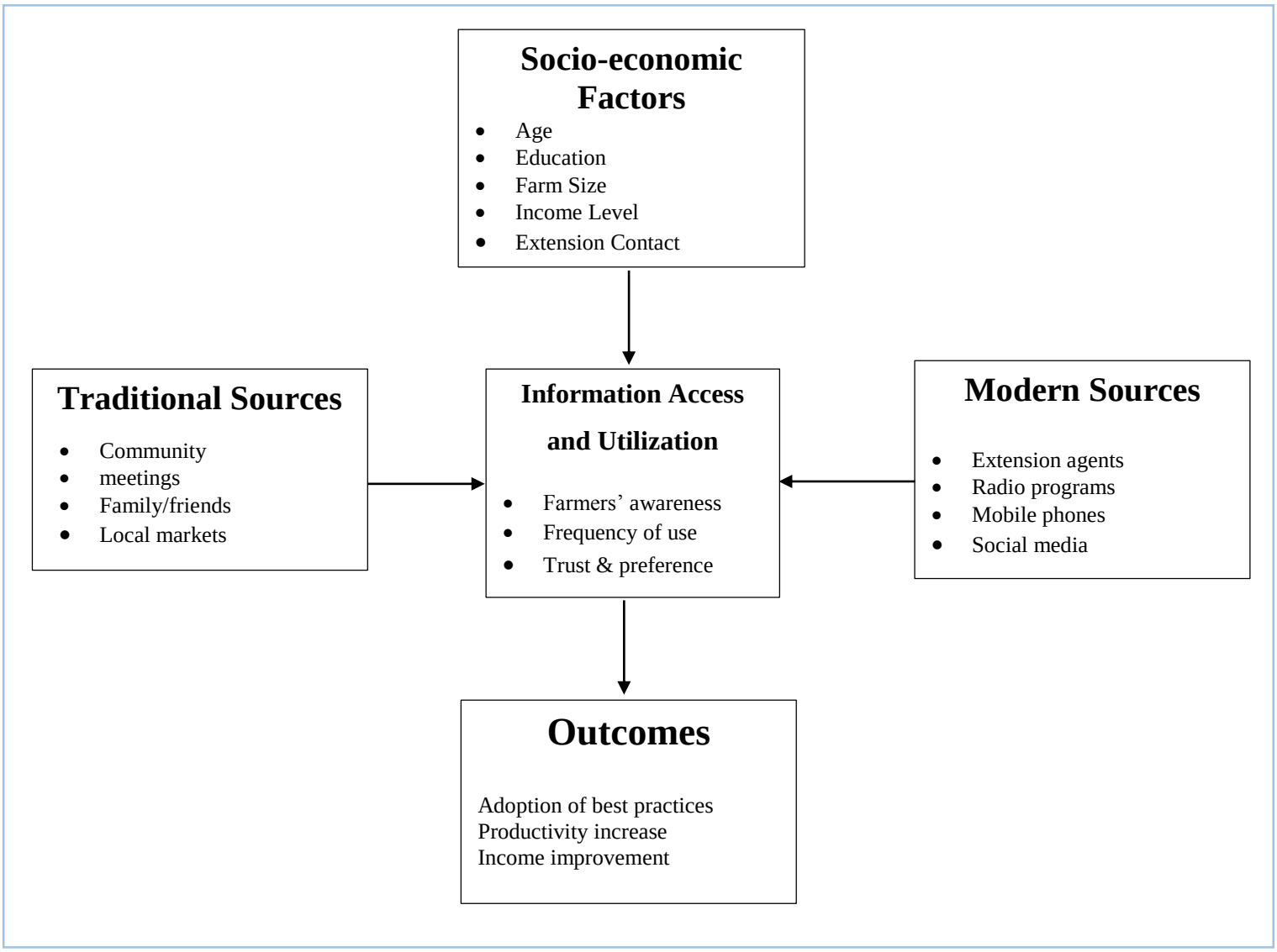


Figure 2.2: Conceptual Framework: Sources of Information of Oil Palm Farmers in Edo and Delta state.

Explanation:

- **Socio-economic factors** influence the farmers' ability and preference to access various sources of information.
- **Traditional sources** (community meetings, family, markets) are often the first point of contact for many farmers.
- **Modern sources** (extension agents, radio, mobile phones, social media) provide more technical and timely information.
- The interaction between these sources and the farmers' socio-economic context shapes how effectively information is accessed and used.

The ultimate **outcome** is the adoption of improved farming practices, which can lead to increased productivity and income.

2.9.7 Testable Hypotheses

1. Socio-economic characteristics and access to climate change information

- **$H_{0\ 1}$:** Socio-economic characteristics of oil palm farmers (age, gender, education, farm size, income, cooperative membership, extension contact) do not significantly influence their access to climate change information.
- **$H_{1\ 1}$:** Socio-economic characteristics of oil palm farmers significantly influence their access to climate change information.

Justification: Studies show that education, income, farm size, and institutional participation strongly shape access to and use of agricultural information (Deressa, Hassan, & Ringler, 2011; Ojo, Baiyegunhi, & Ogundeji, 2016).

2. Sources of climate change information and access levels

- **$H_{0\ 2}$:** The type of climate change information source (extension agents, mobile phones, radio, peers/family, research institutes, NiMet) has no significant effect on the level of access to climate change information among oil palm farmers.
- **$H_{1\ 2}$:** The type of climate change information source significantly affects the level of access to climate change information among oil palm farmers.

Justification: Aker (2011) and Eze, Nwankwo, & Ibezim (2020) find that source type formal vs. informal, institutional vs. interpersonal determines reliability, timeliness, and depth of information received.

3. Climate change information sources and adoption of climate-smart practices

- **$H_{0\ 3}$:** Climate change information sources do not significantly influence the adoption of climate-smart practices by oil palm farmers.
- **$H_{1\ 3}$:** Climate change information sources significantly influence the adoption of climate-smart practices by oil palm farmers.

Justification: Empirical evidence links effective extension and ICT-based information delivery with higher adoption of climate-smart agriculture (Ogundeji, 2022; Aye, Inyang, & Ekpe, 2020).

4. Comparative differences between states (Edo vs. Delta)

- **$H_{0\ 4}$:** There is no significant difference in access to and utilization of climate change information between oil palm farmers in Edo and Delta States.
- **$H_{1\ 4}$:** There is a significant difference in access to and utilization of climate change information between oil palm farmers in Edo and Delta States.

Justification: Regional studies (Edaba, Nwajiuba, & Eze, 2024; Ekong, 2023) highlight geographical and institutional variations in exposure, information access, and adoption behaviour.

5. Constraints to accessing climate change information

- **$H_{0\ 5}$:** Constraints such as poor infrastructure, inadequate extension services, and low literacy have no significant effect on oil palm farmers' access to and use of climate change information.

- **$H_{1\ 5}$:** Constraints such as poor infrastructure, inadequate extension services, and low literacy significantly affect oil palm farmers' access to and use of climate change information.

Justification: Several studies document barriers such as unreliable electricity, language mismatches, and weak institutional support as limiting effective information use (FAO, 2016; Ebewore & Egbodion, 2022).

CHAPTER THREE

3.0 Research Methodology

3.1 Area and scope of the study

This study was carried out in Edo and Delta State, Nigeria. Delta State is an oil and agricultural producing State in Nigeria, situated in the region known as south-south geo-political zone with a population of 4,098,291, (males: 2,674396; female: 2,024,085). (United Nations Industrial Development Organization (UNIDO). (2024). The capital is Asaba. The State has a total land area of 16,842 square kilometers (6,503 m^2). The State is made up of three agro-ecological zones, Delta North, Delta Central, and Delta South. Delta State comprises of 25 local government areas, it shares common boundaries with Edo State at the North, Ondo State towards the North West and bounded in the East by Anambra State. Delta State lies between coordinates of 5.00˚ and 6.30˚. The state has an average rainfall of about 2667 mm in the coastal area and 1095 mm in the North Area. The rainfall is heavier in July with a short break in August. Some examples of crops grown in Delta State are cassava, cocoyam, yam, oil palm, plantain, potato, etc.

Edo State on the other hand is also located in the south-south geo-political zone of Nigeria with a total population of about 3.2 million people, it lies within the geopolitical coordinates of latitude 05˚44 and 07˚34 North of the equator and longitude 05˚04’ and 06˚43’ East of the Green-wich Meridian. The area is approximately 17,802kmsq. The topography of the State is generally low-lying rising gradually towards the North with the Somorica hill at 600 metres being the highest point. The State is made up of three agro-ecological zones; these are Edo South, Edo Central and Edo North with a temperature ranging from 21-25˚c during cold weather to about 26-34˚c in hot weather of the region, Edo State is bounded in the North-East by Kogi and South East by Delta State, and in the West by Ondo State. The State is mainly an

agrarian State with major on cash crops of cash such as timber, oil palm, cocoa, rubber, cocoyam, plantain and banana including livestock such as piggery, poultry and small ruminant.

3.2 Population of the Study

The focus and population of the study were all the oil palm farmers in Edo and Delta State.

3.3 Sampling Techniques and Sampling Size

The study area consists of 43 local government areas with 6 agro-ecological zones (3 in each state), which include Edo and Delta North, Central and South. A multistage sampling procedure was used for this study as follows. The stages involved are as follows:

First stage: Two (2) local government areas was purposively selected from each of the six agro-ecological zones, based on their level and intensity of oil palm production, thus, making a total of 12 local government areas. These comprised of the following tabulated LGAs:

Table 3.1: Local Government Areas where samples were taken

Agro-ecological zone	LGA
Edo North:	Etsako West and Etsako East
Edo Central:	Esan North-East and Esan South-East
Edo South:	Ovia North-East and Ovia South-West
Delta North:	Oniocha South and Ika South
Delta Central:	Ethiope East and Ethiope West
Delta South:	Isoko North and Isoko South

Second stage: This involved the selection of two (2) communities purposively selected from each of the local governments based on the presence of oil palm farmers. Thus, 24 communities were selected. The 24 communities with the highest oil palm farmers were selected as follows:

Table 3.2: Communities with the highest oil palm farmers

Agro-ecological zone/LGA	Towns/Communities
Edo North:	
Etsako West	Auchi and Jattu
Etsako East	Uzaurue, South Ibie
Edo Central:	
Esan North-East	Uromi, Amedokhan
Esan South-East	Ewohimi and Eguare
Edo South:	
Ovia North-East	NIFOR and Odighi
Ovia South-West	Iguobazuwa and Igueoriakhi
Delta North:	
Oniocha South	Ubulu-Ugbo and Ejeme – Aniogor
Ika South	Abavo and Akuku - Agbor
Delta Central:	
Ethiope East	Eku and Abraka
Ethiope West	Mosoga and Oghara
Delta South:	
Isoko North	Ozoro and Owhelogbo
Isoko South	Emevor and Oleh

Third stage: Owing to lack of registered oil palm farmers list, listing of oil palm farmers who have 2 hectares an above was conducted for 5 weeks. This was done to generate the sample frame of oil palm farmers in each of the communities. A total of 2,069 oil palm farmers were generated as the sample frame from the two states. The population generated for each of the identified communities was presented in Table 3.3. Due to the large sample frame, 20% of each of the sample frame was obtained and this gave a total of 390 farmers. Thus, 390 oil palm farmers formed the sample size for this study. The communities, sample frame and sample size were presented in the Table 3.3 below:

Table 3.3: Sample frame and size

Community	Population	Sample Size (20%)
Auchi	237	46
Jattu	91	17
Uzaurue	55	10
South Ibie	78	15
Uromi	105	20
Amedokhan	68	13
Ewohimi	42	7
Eguare	88	17
NIFOR	261	51
Odighi	45	8
Iguobazuwa	99	19
Igueoriakhi	63	12
Ubulu-Ugbo	39	7
Ejeme–Aniogor	51	9
Abavo	46	8
Akuku–Agbor	62	11
Eku	70	13
Abraka	64	12
Mosoga	108	21
Oghara	61	11
Ozoro	88	17
Owhelogbo	117	22
Emevor	46	8
Oleh	85	16
Total	**2069**	**390**

At the fourth and the final stage, simple random sampling technique was used to sample 390 oil palm farmers, comprising of 192 and 198, farmers in Delta and Edo States, respectively. At the end of data collection, 169 and 165 copies of questionnaire used for data collection were found validly filled and analyzable for Delta and Edo States, respectively. This represents a response rate of 88.02% and 83.3% for Delta and Edo States, respectively. However, for the purpose of effective comparison, 165 sample size was used for both Delta and Edo States, thus, 165 for Delta and 165 for Edo were used as the sample size.

Method of Data Collection

Structured questionnaire and interview schedule was used for data collection. For the interview schedule, the research instrument was explained to the non-literate farmers. The instrument was validated and tested for its reliability and validity by experts in the field of Agricultural Economics and Extension, Benson Idahosa University, Benin City, Edo State, Nigeria before use.

Validity and Reliability of Research Instrument

a. Validity of Data Instrument

Both content and construct validity techniques was used to validate the research instrument.

For the content validity, experts in Department of Agricultural Economics and Extension, Benson Idahosa University were requested to critically examine and review the research instrument in relation to the objectives of the study. Their suggestions and recommendations were incorporated in the drafting of the final instrument prior to field survey.

For the construct validity, the instrument was compared with the variables in the conceptual framework on which the study is based to ensure that it does not deviate from its conceptual background.

b. Test of Reliability

for the reliability test, Cronbach-Alpha reliability test was carried out on the research instrument to determine the degree of consistency in the measurement of variables it was designed to measure. The method has the advantage of providing a unique estimate of the internal consistency or reliability of a scale, rather than there being a range of possible reliabilities (Taber, 2017). The test scores were analysed using Cronbach Alpha Coefficient to determine the level of consistence. A correlation value of ≥ 0.70 is considered an acceptable

indication of the instrument reliability. A correlation score of 0.70-0.95 is usually taken to be a good measure of consistency/ reliability of an instrument. Cronbach-Alpha is the most common form of internal consistence reliability coefficient, because of the advantage of being administered once to a target sample thus, saving cost and time (Safali and Akpunar, 2020).

Measurement of variables

The variables for this study, consisting of dependent and independent variables, were measured as follows:

The independent variables consist of the following variables as measured below:

i. Age (actual age in years)**:** The respondents were asked to indicate their actual age. This was measured and recorded as given in years (interval variable).

ii. Sex: Male was coded as 1 while female was coded as 2 generally as nominal variable.

iii. Marital Status: This was measured as a nominal variable with codes such as 1 assigned to single, 2 to married, 3 to widow and 4 to separated/divorced.

iv. Religion: Respondents were asked to indicate their religion affiliation among the 3 religion bodies we have in Nigeria, and this was normally be measured as 1 for Christianity, 2 for Islam and 3 for those that practice Traditional Religion.

v. Farming experience: Respondents were asked to indicate their number of years they have been farming oil palm. This was measured as given n years (interval level).

vi. Educational Qualification: These were as follows: Respondents with no formal education was rated 1, those with primary education was given 2, those with secondary education was scored 3 while those with post-secondary education was scored 4. This is an ordinal measurement scale.

vii. Farm size: The size of the farm was obtained as given in either acre, plots or hectare are familiar with. This was converted to hectare (Ha) which is the standard measurement for farmland. This was obtained from processors who have farms.

viii. Membership of Association: Respondents were asked to indicate whether they belong to any social group or not on a yes/no basis. 'Yes' response was coded 1 while 'no' was coded 2.

ix. Association membership: Respondents were asked to indicate which of the association they belong with the list of association listed. This was coded as 1 for cooperative society, 2 for farmers' association, 3 for trade union association, 4 for community-based association, 5 for the respondents to indicate which of the association belong. Multiple responses were considered for this variable.

x. Contact with extension organization: Respondents were asked to indicate whether they have contact with extension organization within the last 1 year on a yes/no basis. Yes was coded 2 while no was coded 1.

xi. Frequency of contact: Respondents were asked to indicate in numerical value, the number of times they have had contact with extension agent within the last one processing year. This was recorded as given in number.

xii. Attendance in training related to oil palm production: This was measured on a yes/no basis as nominal variable.

xiii. Frequency of training attendance: Respondents were asked to indicate the number of times such training has occurred within the last one year. It obtained and recorded as given.

xiv. Income from oil palm cultivation: Respondents were asked to indicate their income derived from oil palm production in naira in the last year. This was measured as given.

xv. Income from other economic activities: Respondents were asked to indicate their income derived from other economic activities in naira in the last one year. This were measured as given.

Dependent Variables

For this study, two dependent variables were used. They are climate change information adoption and information needs for climate change. For the climate change information adoption, it was measured on a 5-point adoption rating of 1 to 5 with 1 indicating never adopted and 5 highly adopted, while climate change information needs were equally measured on a 5-point rating scale with 1 representing 'no needs' and 5 was highly needed. For the two dependent variables, equal interval approach was used to categorise into high and low using the maximum and minimum obtainable scores and range. These were recoded as '0' for low adoption and needs, and '1' for high information adoption and needs, respectively.

3.6 Data Analysis

Objectives 1-5 was analyzed using descriptive statistics like frequency counts, percentages, mean and standard deviation, while inferential statistics like logistic regression analysis and t-test was used to address the hypothesis stated.

3.7 Hypotheses of the Study

Hypothesis one:

H_0: There is no significant relationship between socio economic characteristics of respondents and their access to information channels. This was achieved by t-values generated from the multiple regression analysis of the socioeconomic variables (X_1-X_7) and their access to information (Y) climate information sources of oil-palm channels scores were used as the dependent variable

The regression model is given as

Xi-Xn = The independent variable

u= Error term

The mathematical expression of the mode; is explicitly specified as

$Yi= b_0 + b_1X_1 + b_2X_2\ b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6\ b_7X_7$ - - - - - - - 2

Where:

Y_1 = Access to Information Sources (high =1, low =0)

X_1 = Age – (Years)

X_2 = Sex - (Male 1, Female 0)

X_3 = Marital status - (Married 1, Others 0)

X_4 = Level of education - (Years)

X_5 = Farming experience - (Years)

X_6 = Household size - (Number of persons)

X_7 = Membership of cooperatives - (Member 1, Non-member 0)

u= Error term

Hypothesis Two:

H_0: There is no significant relationship between socioeconomic characteristics of the respondents and their climate change information needs. This was achieved by the t-value generated from the binary logit regression analysis of the socioeconomic characteristics' variables ($X_1 – X_7$) information needs of the farmers.

(Y) in climate information needs of study area, it can be scored as, high =1 and low =0.

Hypothesis Three:

H_0: There is no significant difference in the adoption of climate change information among farmers in Edo and Delta States. This was achieved by the t-value generated as modelled thus:

$$t = \frac{(X_1 - X_2) - (\mu_1 - \mu_2)}{}$$

$$\sqrt{\frac{s^1}{n_1} + \frac{s^2}{n_2}}$$

Where

=($X_1 + X_2$), and ($\mu_1 - \mu_2$) represents the mean value if the groups X and μ respectively.

= n_1 and n_2 represents the sizes of the groups x and μ respectively

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Socio-economic characteristics

The socio-economic characteristics presented in Table 1 provide a comprehensive demographic and socio-economic profile of oil palm farmers in Edo and Delta states. These variables play a crucial role in influencing agricultural productivity, adoption of innovations, and participation in farming activities, most especially on strategies to mitigate some risks like climate variability as it relates to farming as opined by Adewuyi and Okunmadewa, (2018), and Asfaw *et al*. (2012). Specifically, some of the socio-economic variables of interest are as follows:

4.1.1 Age Distribution

The age distribution of oil palm farmers in both Edo and Delta states reveals a dominant concentration within the 40–49 years age range, accounting for 51.5% in Edo and 43% in Delta. The calculated mean age further supports this demographic maturity 42.81 years in Edo and 45.45 years in Delta indicating that oil palm farming in these regions is largely sustained by a middle-aged to older adult population.

This trend has multiple implications. First, the relatively mature age profile suggests that the farming population is likely to have accumulated significant agricultural knowledge and hands-on experience over the years. This is particularly relevant for perennial crops like oil palm, where knowledge of land management, planting cycles, and market fluctuations often improves with time. According to Martey *et al*. (2013), experience in farming tends to correlate positively with productivity, as seasoned farmers develop practical strategies to navigate challenges such as climate variability, pest outbreaks, and price volatility.

Table 4.1: Description of the socio-economic characteristics of oil palm farmers

Variables	Edo, n= 165		Delta, n = 165	
	Freq	%	Freq	%
Age in years				
Less than 30	12	7.3	9	5.5
30 - 39p	41	24.8	39	23.6
40 – 49	85	51.5	71	43.0
50 - 59	18	10.9	21	12.7
60 and Above	9	5.5	25	15.2
Mean (Std. Dev)	42.81 (9.14)		45.45 (10.95)	
Sex				
Male	94	57.0	79	47.9
Female	71	43.0	86	52.1
Marital status				
Single	15	9.1	9	5.5
Married	147	89.1	151	91.5
Divorce	1	0.6	2	1.2
Widow	2	1.2	3	1.8
Level of education				
No formal education	30	18.2	17	10.3
Primary school	46	27.9	59	35.8
Secondary school	69	41.8	78	47.3
Tertiary education	20	12.1	11	6.7
Household size				
<5	37	22.4	58	35.2
5- 9 persons	109	66.1	83	50.3
10 persons and above	19	11.5	24	14.5
Mean (Std. Dev)	7 (2.21)		(2.59)	
Farming experience in years				
<10	41	24.8	29	17.6
10 - 14 yrs	58	35.2	61	37.0
15 - 19 yrs	55	33.3	47	28.5
20 years and above	11	6.7	28	17.0
Mean (Std. Dev)	12.79 (5.58)		14.40(6.22)	
Farm size (ha)				
<5 ha	109	66.1	73	44.2
5- 9ha	54	32.7	81	49.1
10 ha and above	2	1.2	11	6.7
Mean (Std. Dev)	4.42 (2.05)		5.56 (2.59)	
Other crops				
Arable crops	102	61.8	83	50.3
Fruit	33	20.0	29	17.6

Table 4.1: Description of the socio-economic characteristics of oil palm farmers Cont'd

Variables	Edo, n= 165		Delta, n = 165	
	Freq	%	Freq	%
Vegetables	30	18.2	53	32.1
Estimate annual income from your oil palm				
<300,000	30	18.2	21	12.7
300,000 - 500,000	51	30.9	72	43.6
500,000 - 1,000,000	21	12.7	38	23.0
1,000,000 and Above	63	38.2	34	20.6
Mean (Std. Dev)	427,941.18 (176,231.46)		477,480.92 (182,038.26)	
Oil palm Farming experience				
<10	47	28.5	31	18.8
10 - 19 years	51	30.9	45	27.3
20 years and above	67	40.6	89	53.9
Mean (Std. Dev)	16.21 (8.22)		18.52 (7.77)	
Membership of associations**				
Oil palm farmers associations	82	49.7	101	61.2
Cooperative society	69	41.8	51	30.9
Weekly contribution	12	7.3	8	4.8
Monthly contribution	51	30.9	69	41.8
None of the above	20	12.1	14	8.5
Group leadership				
No form of leadership	55	33.3	30	18.2
Have led a group	13	7.9	29	17.6
Member	68	41.2	75	45.5
Other position	29	17.6	31	18.8
Contact with extension agents	29	17.6	62	37.6
Frequency of contact with extension agents				
Fortnightly	12	7.3	29	17.6
Monthly	9	5.5	12	7.3
Months interval	8	4.8	21	12.7
Never had contact	136	82.4	103	62.4

Source: Field Survey, 2025.

However, the low representation of younger farmers (under 30 years) only 7.3% in Edo and 5.5% in Delta is a point of concern. This underrepresentation may be symptomatic of a wider disinterest among youth in agricultural careers, a trend widely observed across Sub-Saharan Africa. As the Food and Agriculture Organization (FAO, 2017) notes, young people are increasingly migrating to urban areas in search of more lucrative and socially prestigious jobs, leaving agriculture with an aging workforce. The migration is often driven by perceived barriers such as low profitability, limited access to land and finance, and lack of modern infrastructure in rural farming communities (AfDB, 2016).

An aging farming population poses long-term risks to the sustainability and innovation potential of the agricultural sector. Older farmers, though experienced, may be less inclined to adopt new technologies or practices due to risk aversion, lack of digital literacy, or entrenched traditional methods. This hesitation can slow the uptake of climate-smart agriculture, mechanization, or digital platforms for market access, all of which are critical for improving yields and profitability (Aker, 2011).

On the other hand, younger farmers often bring energy, creativity, and openness to innovation. Research by Mwangi and Kariuki (2015) underscores that youth are more responsive to mobile-based extension services, modern inputs, and agribusiness models, especially when they have access to training and finance. The absence of a strong youth presence, therefore, may signal a future labour and innovation gap in oil palm farming if targeted policies and incentives are not put in place to reverse this trend.

4.1.2 Gender Composition

In Edo State, males constitute the majority of the farming population, accounting for 57%, whereas in Delta State, females slightly outnumber their male counterparts, making up 52.1% of the farmers. This gender contrast highlights potential cultural, regional, and institutional

differences that influence agricultural participation. For instance, variations in land tenure systems may determine who has the right to own or cultivate land, with some regions favouring male inheritance or ownership, thereby limiting women's participation. Additionally, household structures and gendered divisions of labour may shape who engages in farming activities and in what capacity. Research by Doss (2014) and Peterman *et al*. (2011) underscores the significance of gender dynamics in agriculture, showing that access to productive resources, labour allocation, and decision-making authority on farms are often unequally distributed between men and women. These disparities can affect productivity, innovation, and overall livelihood outcomes in rural communities.

4.1.3 Marital Status

A significant majority of respondents in both Edo and Delta States are married, with 89.1% and 91.5% respectively reporting their marital status as such. This high proportion of married individuals is noteworthy, as marital status often correlates with household size and responsibilities. Married farmers typically manage larger households, which can translate to a greater labour force but also increased consumption needs. Consequently, these farmers may be more inclined to pursue income diversification strategies and adopt practices that enhance land productivity in order to meet the demands of their families. Obisesan (2014) notes that marital status can influence access to labour, decision-making patterns, and resource allocation within farming households, all of which play a crucial role in shaping agricultural outcomes and livelihood strategies.

4.1.4 Educational Attainment

The majority of respondents in both Edo and Delta States reported having attained secondary school education, with 41.8% in Edo and 47.3% in Delta. This suggests a moderate level of formal education among the farming population, which can be instrumental in facilitating

access to agricultural information and innovations. However, a notable disparity exists in the proportion of farmers with no formal education 18.2% in Edo compared to 10.3% in Delta indicating potential regional differences in educational access or historical investment in human capital development. Education has been widely recognized as a key driver of technology adoption and farm-level efficiency. Asfaw and Admassie (2004) argue that educated farmers are more likely to comprehend extension messages, evaluate the benefits of new technologies, and implement improved agricultural practices effectively. Given the relatively higher educational attainment in Delta, farmers in this state may be better positioned to adopt modern farming techniques, make informed decisions, and respond proactively to market and environmental challenges, ultimately enhancing productivity and livelihoods.

4.1.5 Household Size

The average household size among respondents is relatively high, with Edo recording an average of 6.90 members per household and Delta closely following at 6.67. Such large household sizes are characteristic of rural communities in sub-Saharan Africa, where extended family living arrangements are common (World Bank, 2020). On one hand, larger households can be advantageous for farming, as they provide a readily available source of family labour, which reduces the need for hired hands and can enhance productivity during peak agricultural seasons. On the other hand, they also tend to raise the dependency ratio, placing greater financial pressure on working members to support dependents, particularly children and the elderly. This dual effect can influence household decisions regarding labour allocation, farm investment, and food security. Additionally, larger household sizes may necessitate greater land productivity and income diversification to meet the consumption needs of all members, making household composition a critical factor in shaping rural livelihoods and resilience strategies.

4.1.6 Farming Experience

The mean number of years of general farming experience among respondents is 12.79 years in Edo and 14.40 years in Delta, indicating that farmers in both states have spent over a decade engaged in agricultural activities. However, the slightly higher average in Delta suggests that farmers in this region may have a deeper reservoir of agrarian knowledge, skills, and practical insights developed through sustained interaction with farming systems. This accumulated experience is an important asset, as it often correlates with improved decision-making, better understanding of local agroecological conditions, and adaptive responses to climate variability and market fluctuations. According to Martey *et al*. (2013), experienced farmers are more likely to adopt improved agricultural practices, effectively manage risks, and maintain higher levels of productivity and resilience in the face of shocks such as pest outbreaks, weather extremes, or price volatility. As such, the longer farming tenure observed in Delta may position its farmers to be more responsive and innovative, contributing positively to both household welfare and community-level agricultural development.

4.1.7 Farm Size

Farmers in Delta State report larger average farm sizes, with a mean of 5.56 hectares, compared to 4.42 hectares in Edo State. This difference suggests that Delta farmers may have more land resources at their disposal, which could offer several advantages. Larger farm sizes often provide opportunities for greater crop diversification, allowing farmers to spread risk and potentially increase household income through the cultivation of both staple and high-value crops. Additionally, economies of scale can be achieved with larger plots, enabling more efficient use of machinery, improved irrigation systems, and better access to commercial markets. However, managing larger farms also comes with increased demands particularly for capital investment, labour, and farm inputs such as fertilizer and improved seeds. Without

adequate support, these demands can become a burden, especially in rural settings where access to credit and mechanization remains limited. Despite the larger average size in Delta, the data also indicate that smallholder farming remains dominant, as many farmers still cultivate less than five hectares of land. This aligns with national patterns across Nigeria, where small-scale farming forms the backbone of agricultural production (IFPRI, 2021). As such, policy interventions must continue to address the constraints faced by smallholders while supporting gradual transitions toward more sustainable and commercially viable farming systems.

4.1.8 Other Crops Grown

A majority of farmers in both Edo and Delta States engage in intercropping practices, with 61.8% of Edo farmers and 50.3% of Delta farmers cultivating oil palm alongside arable crops. This is followed by the intercropping of oil palm with vegetables and fruit trees, indicating a widespread adoption of mixed farming systems. Such practices reflect deliberate strategies aimed at income diversification and enhancing household food security. By growing multiple crops on the same land, farmers can mitigate the risks associated with market fluctuations, pest outbreaks, or climate-related crop failures. Intercropping also enables more efficient land use, helps maintain soil fertility, and can contribute to ecological resilience by increasing biodiversity. As noted by Pretty *et al*. (2011), diversified farming systems are often more sustainable and productive in the long run, especially in smallholder contexts where resource constraints are common. In addition, intercropping allows farmers to meet both subsistence and commercial needs, providing food for household consumption while generating income from the sale of surplus produce. This dual-purpose approach is particularly critical in rural economies, where agriculture remains the primary source of livelihood and food security.

4.1.9 Annual Income from Oil Palm

Farmers in Delta State report a higher mean annual income from oil palm production, averaging ₦477,481, compared to their counterparts in Edo State, who earn an average of ₦427,941. Moreover, a greater proportion of Delta farmers fall into the higher income bracket, earning above ₦500,000 annually from oil palm-related activities. This income disparity may be attributed to several interrelated factors. One likely explanation is the larger average farm size reported in Delta, which can translate into higher overall yields and greater output for market sale. Additionally, differences in soil fertility, farm management practices, and access to improved seedlings or extension services may also influence productivity levels between the two states. Market access plays a crucial role as well farmers who are closer to major roads, processing facilities, or urban centres are often better positioned to negotiate favourable prices and reduce post-harvest losses. According to Olagunju (2008), such structural and logistical advantages significantly impact the profitability of oil palm farming. Higher incomes in Delta may also reflect stronger integration into value chains, better bargaining power, or participation in cooperative societies that enhance access to credit and market information. Ultimately, these factors highlight the importance of addressing regional inequalities in agricultural infrastructure and support services to ensure more equitable income outcomes for oil palm farmers across states

4.1.10 Oil Palm Farming Experience

Farmers in Delta State demonstrate a longer average duration of involvement in oil palm farming, with a mean of 18.52 years, compared to 16.21 years in Edo State. This indicates a higher degree of specialization in oil palm cultivation among Delta farmers, likely resulting from sustained engagement and accumulated experience in the sector. Such long-term involvement can foster a deeper understanding of the crop's agronomic requirements, seasonal

variations, and market behaviour. Over time, experienced farmers tend to refine their production techniques, improve their efficiency in resource use, and adopt innovations that enhance both yield and profitability. As noted by Adenegan *et al*. (2013), greater farming experience is closely associated with increased productivity, better risk management, and improved technical competence. In addition, experienced farmers are more likely to participate in cooperative networks, access extension services, and navigate institutional frameworks that support agricultural development. The comparatively longer engagement of Delta farmers may also reflect a stronger intergenerational continuity in oil palm farming, reinforcing local knowledge systems and sustaining long-term investment in the crop. Overall, this depth of experience positions Delta's oil palm farmers to capitalize more effectively on market opportunities and emerging agricultural technologies.

4.1.11 Association Membership

Farmers in Delta State exhibit higher levels of participation in oil palm-related associations, with 61.2% reporting membership in such groups, compared to a lower proportion in Edo State. Additionally, 41.8% of Delta farmers actively engage in monthly financial contributions to these associations, indicating a stronger commitment to collective action and cooperative structures. This heightened level of group participation can yield significant benefits for farmers, as associations often serve as vital platforms for accessing agricultural inputs, credit facilities, extension services, and up-to-date market information. According to Bernard and Spielman (2009), farmer-based organizations play a crucial role in enhancing rural livelihoods by reducing transaction costs, improving bargaining power, and facilitating knowledge exchange among members. In the context of oil palm farming, association membership can support bulk purchasing of inputs like fertilizers or improved seedlings, joint marketing of produce, and better negotiation with buyers or processors. It also fosters social capital, peer learning, and collective problem-solving, which are particularly important in navigating

challenges related to price fluctuations, climate variability, and policy changes. The higher participation rate among Delta farmers suggests a more organized and interconnected farming community, which may translate into stronger economic outcomes and resilience for individual members and the sector at large.

4.1.12 Leadership Roles

Farmers in Delta State demonstrate greater involvement in leadership roles within farmer groups and associations, with only 18.2% reporting that they held no leadership position. This contrasts with Edo State, where a significantly higher proportion 33.3% reported no involvement in group leadership. This difference suggests that organizational structures among oil palm farmers in Delta are more developed and inclusive of member participation in governance. Active engagement in leadership roles indicates not only a higher degree of group cohesion and accountability but also a greater capacity for self-organization and community-driven decision-making. Such structures are vital for amplifying farmers' voices in dialogues with government agencies, NGOs, and private sector actors. As leaders, farmers are better positioned to articulate collective needs, mobilize resources, and coordinate group activities that can lead to improved access to extension services, subsidies, or market linkages. Moreover, strong leadership within farmer associations enhances the potential for effective policy implementation, participatory planning, and collective bargaining, especially in advocating for fair pricing, land rights, and infrastructural support. The greater leadership participation observed in Delta reflects a more robust institutional environment that can play a pivotal role in advancing rural development goals and empowering farming communities.

4.1.13 Extension Contact

A concerning finding from the study is the limited level of contact between farmers and agricultural extension agents, particularly in Edo State, where only 17.6% of respondents

reported having any interaction with extension services. In contrast, farmers in Delta State showed comparatively better access, with 37.6% indicating some form of contact with extension agents. While still not optimal, the higher level of engagement in Delta suggests a more functional or better-resourced extension system in that region. Agricultural extension services play a critical role in facilitating the transfer of knowledge, technologies, and innovations from research institutions to farmers. They serve as a vital link between policy and practice, equipping farmers with the skills and information needed to improve productivity, adopt climate-smart practices, manage pests and diseases, and make informed decisions regarding market engagement. According to Anderson and Feder (2007), regular and effective extension contact is positively correlated with increased agricultural efficiency, input use, and adoption of best practices. The minimal extension reach in Edo may be symptomatic of broader systemic challenges such as underfunded extension systems, limited personnel, poor infrastructure, or lack of trust between farmers and government agencies. This gap in access can hinder the dissemination of vital information and innovations, placing Edo farmers at a disadvantage in terms of agricultural performance and resilience. Strengthening extension services across both states particularly in Edo will be essential for enhancing farmer capacity, boosting productivity, and supporting sustainable rural development

Table 4.2: Access to information sources to climate change among farmers in Edo and Delta State

	EDO		DELTA		EDO		DELTA		EDO		DELTA	
	Radio				TV				Newspaper			
Climate change Information	**Freq.**	**%**	**freq**	**%**	**Freq.**	**%**	**freq**	**%**	**Freq.**	**%**	**freq**	**%**
Crop forecasting	44	26.7	32	19.4	28	17	27	16.4	19	11.5	38	23
Oil palm information	81	49.1	67	40.6	47	28.5	42	25.5	74	44.8	48	29.1
Sunshine	57	34.5	51	30.9	38	23	21	12.7	25	15.2	40	24.2
Soil fertility	72	43.6	57	34.5	43	26.1	43	26.1	51	30.9	41	24.8
Pest/Disease management	81	49.1	73	44.2	78	47.3	58	35.2	47	28.5	37	22.4
Weather forecasting	29	17.6	30	18.2	25	15.2	33	20	52	31.5	35	21.2
Desert encroachment	21	12.7	19	11.5	56	33.9	51	30.9	21	12.7	22	13.3
Precipitation	57	34.5	40	24.2	31	18.8	42	25.5	35	21.2	43	26.1
Indigenous knowledge	25	15.2	35	21.2	37	22.4	43	26.1	16	9.7	38	23
Flooding	66	40	53	32.1	42	25.5	50	30.3	22	13.3	36	21.8
Temperature	57	34.5	45	27.3	39	23.6	28	17	18	10.9	53	32.1
Bush burning	21	12.7	32	19.4	29	17.6	26	15.8	22	13.3	18	10.9

EDO		DELTA		EDO		DELTA		EDO		DELTA		EDO		DELTA	
Internet				Journals				Nigeria metrological station				phone calls			
Freq.	%	freq	%	Freq.	%	freq	%	Freq.	%	freq	%	Freq.	%	Freq.	%
29	17.6	18	10.9	11	6.7	10	6.1	8	4.8	6	3.6	89	53.9	60	36.4
34	20.6	20	12.1	9	5.5	5	3	3	1.8	4	2.4	109	66.1	82	49.7
21	12.7	41	24.8	7	4.2	8	4.8	8	4.8	7	4.2	49	29.7	60	36.4
33	20	28	17	3	1.8	5	3	4	2.4	8	4.8	55	33.3	51	30.9
29	17.6	41	24.8	12	7.3	8	4.8	8	4.8	4	2.4	49	29.7	40	24.2
38	23	29	17.6	20	12.1	6	3.6	2	1.2	6	3.6	63	38.2	52	31.5
42	25.5	41	24.8	14	8.5	8	4.8	4	2.4	5	3	57	34.5	43	26.1
20	12.1	36	21.8	11	6.7	10	6.1	6	3.6	7	4.2	66	40	51	30.9
35	21.2	33	20	13	7.9	6	3.6	8	4.8	3	1.8	72	43.6	58	35.2
20	12.1	19	11.5	20	12.1	18	10.9	2	1.2	6	3.6	49	29.7	40	24.2
31	18.8	45	27.3	28	17	12	7.3	5	3	3	1.8	56	33.9	39	23.6
27	16.4	21	12.7	10	6.1	16	9.7	2	1.2	7	4.2	62	37.6	50	30.3

Source: Field Survey, 2025.

4.2 Access to climate change information from various channels among oil palm Farmers in Edo State

Results in Table 2 show the farmers' access to climate change information sources. This provides a multidimensional view of how farmers receive information related to various climate and agricultural issues. Specifically, the sources were categorized as follows:

4.2.1 Dominant Sources of Climate-Related Agricultural Information

The data reveals that phone calls (especially mobile communication) and radio are among the most frequently used sources across several climate and agricultural information topics. Phone calls lead in the dissemination of crop forecasting (53.9%) and oil palm information (66.1%). Furthermore, radio is a close second for several categories, including oil palm information (49.1%) and pest/disease management (49.1%). This reflects a preference for accessible, cost-effective, and familiar technologies, particularly among rural populations. Studies have shown that mobile phones have revolutionized agricultural extension by offering timely, personalized information (Aker, 2011; Mittal and Mehar, 2012). Similarly, radio remains a vital source for disseminating information to non-literate or semi-literate farmers (Chapota *et al.,* 2014).

4.2.2 Print and Traditional Media Use

It was revealed that newspapers serve moderately in categories like pest/disease management (28.5%) and soil fertility (30.9%), but generally have limited reach especially for less-educated or rural populations. Television shows strong engagement with pest/disease management (47.3%) and oil palm information (28.5%). These patterns may reflect urban-rural disparities in media access and income levels. Farmers with higher education or income may be more likely to access and benefit from print or televised information, as found in FAO (2016).

4.2.3 Underutilization of Scientific and Institutional Sources

Journals and Nigeria Meteorological Stations (NiMet) show very low usage across all categories, with the highest being just 17.0% for temperature and 12.1% for weather forecasting. This suggests a disconnect between formal knowledge production and rural knowledge consumption, possibly due to limited accessibility, technical language barriers, or poor extension linkages. As emphasized by Anderson and Feder (2007), successful agricultural extension systems must bridge this gap to improve adoption of innovations and adaptation strategies.

4.2.4 Specific Climate Topics and Awareness Levels

Oil palm information is the most accessed topic overall across all sources, reflecting the economic importance of oil palm in the region. Crop forecasting and pest/disease management also receive high attention, especially via phones, radio, and TV. More technical or abstract issues, like desert encroachment, indigenous knowledge, and bush burning, show weaker engagement, especially from scientific and digital platforms. This suggests that while farmers are engaged with immediate and production-related challenges, awareness of broader environmental and climate-systemic issues is lower. This aligns with findings from Below *et al*. (2012), which highlight that localized, actionable knowledge is more likely to be absorbed and acted upon by smallholder farmers.

4.2.5 Indigenous Knowledge as a Growing but Secondary Source

Indigenous knowledge was cited by 43.6% of respondents, especially in categories like soil fertility and precipitation. This affirms the continuing relevance of traditional ecological knowledge in climate adaptation and decision-making. As Nyong *et al*. (2007) argue, integrating indigenous knowledge with scientific data can enhance the relevance and effectiveness of climate adaptation policies and practices.

The data suggests several actionable insights. Leverage phone and radio platforms for scaling up climate-smart agricultural messages, given their widespread use and accessibility. Strengthen linkages between farmers and formal institutions (e.g., NiMet, research bodies), possibly through simplified messaging, translations, and collaboration with trusted intermediaries like cooperatives or extension agents. Promote inclusive communication strategies that incorporate both indigenous knowledge and scientific forecasting to improve trust, adoption, and relevance of climate information. Furthermore, investing in capacity-building programs, particularly digital literacy and access to digital tools, to facilitate greater use of internet-based information systems, which remain underutilized despite their potential.

4.2.6 Access to climate change information from various channels among oil palm Farmers in Delta State

Results in Table 3 present valuable insights into the channels through which farmers access climate change and agricultural information across various issues in oil palm farming. Evidence in the table offers a multidimensional view of information flow, communication preferences, and knowledge gaps and these were categorized into the following areas:

4.2.7 Dominant Information Channels: Continued Reliance on Phone Calls and Radio

The data reveals that phone calls and radio continue to be the most widely used sources across multiple aspects of oil palm. Phone calls are the leading source for crop forecasting (36.4%), oil palm information (49.7%), and sunshine data (36.4%). Radio is highly accessed for pest/disease management (44.2%), soil fertility (34.5%), and oil palm information (40.6%). This point to the importance of mobile communication and radio broadcasting as trusted and accessible tools for farmers. These media are especially useful in rural areas with limited infrastructure and literacy levels. As Aker (2011) and Chapota *et al*. (2014) observe, mobile phones and radio allow real-time, inclusive communication that reaches dispersed populations at low cost.

4.2.8 Role of Traditional and Print Media: Moderate Influence

Television shows strong engagement for pest/disease management (35.2%) and flooding (30.3%). Newspapers also feature prominently for temperature (32.1%), precipitation (26.1%), and sunshine (24.2%). These figures suggest that traditional media remains relevant, particularly for farmers with access to urban centres or higher literacy levels. However, accessibility challenges may limit their reach among poorer or more remote farmers. FAO (2016) and Below *et al*. (2012) note that effectiveness of these channels is influenced by literacy, cost, and frequency of publication.

4.2.9 Low Engagement with Scientific and Institutional Sources

Journals and Nigeria Meteorological Station (NiMet) remain the least utilized sources, with most percentages below 10%. It shows that journals had a peak at only 10.9% for flooding, while the NiMet had no issues that surround oil palm farming that exceeds 7.3%. This is worrisome given the critical role these institutions play in providing accurate, science-based, and forecast-driven agricultural data. Their minimal reach suggests communication breakdowns, low awareness, and lack of user-friendly dissemination practices. As Anderson and Feder (2007) argue, effective extension systems must bridge this gap by translating scientific data into practical insights.

4.2.10 Thematic Access Patterns: Immediate Needs Drive Information Demand

It was observed that high-access issues were oil palm information with 49.7% via phone calls, 40.6% via radio. Pest/Disease Management: 44.2% via radio, 35.2% via TV. Flooding and Precipitation: high across radio, TV, and newspapers. These topics reflect practical, day-to-day farming concerns input application, yield protection, and immediate climate impacts. Farmers prioritize information that affects their productivity and income directly.

4.2.11 Low-Access or Underprioritized Topics

It was observed that desert encroachment, weather forecasting, bush burning show relatively low overall engagement. For instance, desert encroachment, only 11.5% via radio, 13.3% via newspapers. These issues, while critical, are either less visible in local discourse or are perceived as long-term challenges that do not demand immediate action. This echoes Pretty *et al*. (2011), who note that farmers are more responsive to short-term, visible threats than to abstract or gradual environmental processes.

4.2.12 Indigenous Knowledge as a Valuable Complement

Indigenous knowledge features prominently (35.2%) and is especially relevant for crop forecasting, precipitation, and soil fertility. This highlights the continued relevance of traditional ecological knowledge systems; particularly where formal systems fail or are absent. Integrating this with formal scientific systems what Nyong *et al*. (2007) call "knowledge co-production" can enhance local adaptation capacity.

4.2.13 Access to climate change information (Cont'd) for farmers in Edo State

Prominent Sources

Prominent Information Sources found based on the analysis are as follows: Fellow farmers and family members emerge as the most frequently used sources across nearly all categories. Soil fertility was 46.1% through the fellow farmers, (fellow farmers), 49.7% (family members). Also, pest/Disease Management was 30.9% (fellow farmers), 49.1% (family members). In addition, oil Palm Information was 39.4% (fellow farmers), 46.1% (family members) and crop forecasting was 20.0% (fellow farmers), 33.3% through (family members). The findings highlight the dominant role of peer-to-peer and household-level information exchange. In rural settings where formal channels may be limited or inconsistent, farmers often rely on trusted social networks to interpret and adapt to environmental challenges. This aligns with the findings of Bernard *et al*. (2008) and Nguyen *et al*. (2020), who emphasize the strength of social capital in agricultural knowledge dissemination.

4.2.14 Meetings and Print Media as Moderate Sources

It was observed that meetings (e.g., community gatherings, cooperatives) feature prominently for issues like pest/disease management (40.6%), Oil palm information (36.4%) and weather forecasting (35.2%), while print media like bulletins, handbills, magazines, and posters play more limited but still meaningful roles. Specifically, bulletins are notably used for bush burning (30.9%) and precipitation (26.7%), posters are used for oil palm info (26.7%) and sunshine (16.4%) and magazines have moderate usage across categories like pest/disease (32.7%) and indigenous knowledge (25.5%). This reflects a continued, albeit supplementary, dependence on community and physical media to reach farmers. However, these sources may struggle with timeliness, literacy requirements, and physical distribution limitations. As highlighted by FAO

(2016), communication strategies should consider print media as a support tool rather than a primary source in rural agricultural extension.

4.2.15 Underutilized but Potentially Valuable

Among the under-utilized sources of information is the individual farm visits, which are typically associated with extension services, show moderate access levels to weather forecasting (24.8%), Soil fertility (27.3%), and crop forecasting (25.5%). These visits allow for tailored, context-specific advice, but the relatively low frequencies suggest limitations in extension agent coverage or resource allocation. As Anderson and Feder (2007) point out, farm visits are one of the most effective but also cost-intensive methods for agricultural knowledge transfer. Strengthening this channel would require investments in extension systems and human resources. The fairly high access percentages for indigenous knowledge via fellow farmers (27.3%) and family (39.4%) reinforce the value of local knowledge systems. These findings echo Nyong *et al*. (2007), who argue that integrating indigenous practices with scientific data enhances relevance, adoption, and sustainability of climate responses.

4.2.16 Access to climate change information (Cont'd) for farmers in Delta State

4.2.17 Dominant Sources

The findings show that among the dominant sources, fellow farmers and family members are again the most frequently cited sources across nearly all categories and they are prominent in information relating to pest/disease management, 40.0% (fellow farmers), 44.8% (family members), sunshine information, 36.4% (fellow farmers), 46.7% (family members), oil palm information, 37.0% (fellow farmers), 32.7% (family members), and indigenous knowledge, 33.9% (fellow farmers), 40.0% (family members). These figures confirm the primacy of social networks in disseminating agricultural and climate-related information. In rural Delta, farmers appear to rely heavily on those they trust most peers and relatives for timely, context-specific

advice. This pattern mirrors studies by Nguyen *et al*. (2020) and Bernard *et al*. (2008), which underscore the value of trust-based knowledge-sharing in agrarian communities.

4.2.17.2 Meetings and Farm Visits: Effective but Underutilized

Meetings are relatively well-used for topics such as desert encroachment (31.5%), Pest/Disease Management (32.1%), and indigenous knowledge (30.9%, while individual farm visits, which represent structured extension outreach, show usage in pest/disease management (24.8%), and weather forecasting (20.0–24.8%). Although not the most frequently used, these channels are crucial for personalized, technical knowledge transfer and could be scaled up for greater impact. However, their moderate use suggests limitations in logistics, manpower, and funding of formal extension systems an issue repeatedly noted by Anderson and Feder (2007).

4.2.14.3 Printed and Visual Media

Printed and Visual Media had a mixed levels of use e,g posters, handbills, bulletins, and magazines offer varied access across issues in oil palm production. Posters are particularly used for Sunshine (21.8%) and Pest Management (25.5%), Magazines see higher engagement in Temperature (24.8%) and Sunshine (25.5%), and Bulletins peak for Pest Management (30.9%) and Indigenous Knowledge (24.8%). These tools serve as support media, often effective when coupled with interpersonal communication or group training. However, their effectiveness depends on literacy levels, frequency of distribution, and cultural relevance, as highlighted by FAO (2016) and Pretty *et al*. (2011).

4.2.15 Access to climate change information (Cont'd) for farmers in Edo State

4.2.15.1 Major Access

Table 6 presents result on the extent to which oil palm farmers in Edo State access climate change information from various sources as a continuation from the previous tables.

Specifically, the table shows that friends and neighbours as primary sources with friends use for information on crop forecasting – 73.3%; pest/disease management – 89.7%), while neighbours (e.g., Pest/disease management – 100%; Oil palm info – 219.4%). The results reveal that informal social networks such as friends and neighbours are the dominant sources of climate-related information. This finding aligns with studies such as Maddison (2007) and Deressa *et al*. (2011), which emphasize the importance of peer-to-peer knowledge sharing in agricultural communities. Such informal channels are often readily accessible, culturally familiar, and trusted, making them vital conduits of agricultural and environmental knowledge.

4.2.15.2 Limited Access

The study reveals that sources like extension agents (pest/disease – 12.7%, Weather – 4.2%), government Agencies (Soil fertility – 3.0%, Precipitation – 8.5%), universities and colleges (indigenous knowledge – 7.9%), and oil palm research institute (Temperature – 0.6%) had limited information on the various aspects of oil palm farming. This shows that formal institutions such as extension services, government bodies, and research institutes are underutilized, with most categories scoring below 15%. This suggests a weak institutional linkage and possibly limited outreach or accessibility. Asenso-Okyere and Mekonnen (2012) emphasize the importance of agricultural extension in translating research into practice. The findings here indicate a gap that, if addressed, could significantly enhance climate adaptation among farmers.

4.2.15.3 Underuse of Visual or Print Media

The study shows that posters (all ≤10%) was regarded as an underused source of information in all the aspects of oil palm farming since all the farmers indicted less than 10% in all the identified areas of oil palm production. Posters are one of the least accessed sources of climate information. Given the literacy levels and the specificity of climate data required, this suggests

that print media alone may not be effective without complementary communication strategies. This supports findings by Mbo'o-Tchouawou *et al*. (2013), which recommend integrated communication strategies combining visuals, demonstrations, and interpersonal engagement.

4.2.16 Access to climate change information (Cont'd) for farmers in Delta State

4.2.16.1 Dominance of Informal Sources

On the other hands, among farmers in Delta State, results show that friends were used for information on indigenous knowledge – 67.3%, oil palm practices – 72.7%), and neighbours were used for information on oil palm practices – 104.8%, and crop forecasting – 77.0%). As in Edo State, informal sources remain the most influential channels of climate information dissemination. This is consistent with Ayanwale *et al*. (2020) and Olaniyi *et al*. (2019), who found that peer networks serve as a primary medium for farmers to share experiences, particularly where formal extension systems are weak or underfunded. Such channels offer real-time, contextualized knowledge but may lack technical precision.

4.2.16.2 Moderate source

The findings show that extension agents, that were used for information on soil fertility – 15.2%, flooding – 16.4%, and temperature – 18.8% was regarded as a moderate information source based on the farmers' perception. This finding that compared to Edo State, there is a slightly higher level of engagement with extension services in Delta. This suggests some improvement in outreach or perhaps greater trust in technical sources. Nevertheless, usage rates remain below 20%, which underscores the need for revitalizing and equipping extension systems. As noted by Aigbe *et al*. (2021), the efficiency of Nigeria's extension service is often hampered by low staffing, poor funding, and outdated communication tools.

4.2.16.3 Limited Contribution from Research and Academic Institutions

It was found that universities/colleges and oil palm research institute (all categories <10%, except temperature – 5.5%) were all categorized as information sources with limited contributions to the information in oil palm production among farmers. This means that formal academic institutions and research centers such as the Nigerian Institute for Oil Palm Research (NIFOR) play a minimal role in direct farmer communication. This reflects a disconnection between research outputs and rural adoption, as argued by Okolo and Onwubuya (2022). Strengthening collaboration between universities, NIFOR, and local farmer groups could facilitate translational knowledge that is both scientific and accessible.

4.2.16.4 Awareness and Preference for Information Sources

Results in Table 8 show that extension agents were among the information sources with the highest awareness and preference overall in both states as Edo had awareness score of 3.80, SD = 0.41, and preference score of 3.70, SD = 0.47, while for Delta, awareness = 3.90, SD = 0.33, and preference = 3.80, SD = 0.55. This means that extension agents recorded the highest scores across all variables in both states. This confirms their dominant role in agricultural knowledge dissemination. This further supports the findings of Ogunlade and Adebayo (2022), who reported that 86% of Nigerian farmers trust extension agents for climate-smart practices due to their direct interaction and tailored advice.

Furthermore, internet (High Awareness and Preference) in both states of Edo with the awareness = 3.60, SD = 0.44, and preference = 3.40, SD = 0.38, while in Delta, the awareness = 3.70, SD = 0.47, and Preference = 3.60, SD = 0.26. This implies that Internet usage reflects a rising digital transition among farmers, especially younger and educated ones. Adeniji *et al*. (2021) found that over 72% of digitally literate farmers in Nigeria use the Internet to access weather and crop information.

In addition, phone calls also had high awareness in Edo = 3.30, SD = 0.22, and preference = 3.10, SD = 0.41, as well as in Delta with the awareness score = 3.40, SD = 0.42, and preference = 3.20, SD = 0.59. This means that mobile phones provide a direct and flexible communication tool. Farmers often receive advisory services through SMS or voice calls. This is tandem to the findings of Oluwatusin (2022) confirmed that mobile-based advisory services improved cassava yield by 23% in southwestern Nigeria due to timely decision-making.

It was also observed and found that radio and television also recorded high awareness = 3.40, SD = 0.35, and preference = 3.30, SD = 0.26 in Edo and awareness = 3.50, SD = 0.21, and preference = 3.40, SD = 0.34 in Delta State for radio and 3.10, SD = 0.58 for awareness and 3.00, SD = 0.32 preference for TV in Edo while 3.20, SD = 0.56 for awareness and preference = 3.10, SD = 0.31 for TV in Delta State. The findings show that these media remain relevant due to wide reach, especially in rural areas. This is in conformity with the findings of Babatunde and Salawu (2022) found that 67% of farmers in central Nigeria listen to agricultural radio programs weekly, using them for market and weather updates.

In terms of intrapersonal relationship, individual farm visits Edo: Awareness = 3.50, SD = 0.21, Preference = 3.20, SD = 0.27, Delta: Awareness = 3.60, SD = 0.58, Preference = 3.30, SD = 0.53 recorded high awareness and preference in both states. This means that farm visits allow personalized support, especially for climate adaptation training. Chukwu (2020) emphasizes that farm visits increase retention and application of sustainable practices among smallholder farmers. Fellow farmers, friends and family members also recorded high level of awareness and preference. This implies that these intra-personal sources of information signify the importance of social networks in community-level knowledge sharing. This supports the findings of Adeyemi and Ifeoma (2023), which noted that 54% of Nigerian farmers learn new agricultural practices from peers during cooperative meetings.

Institutionally, Oil Palm Research Institute (NIFOR) had the following details as Edo: Awareness = 3.60, SD = 0.44, Preference = 3.50, SD = 0.40, and Delta: Awareness = 3.70, SD = 0.53, Preference = 3.60, SD = 0.23. This means that farmers' high scores for NIFOR highlight its reputation and relevance, though broader access may be limited. This finding is in line with the study of Ojo *et al*. (2023), which found that NIFOR outreach improved the adoption rate of high-yielding seedlings by 40% in southern Nigeria.

However, less significant sources (Mean < 3.0) include journals, posters, magazines, bulletins, and government agencies, showing limited penetration. This conforms with the assertion of Onyebuchi and Musa (2021) attribute this to language barriers, low literacy levels, and lack of tailored messaging in official bulletins and print materials.

Table 4.4: Awareness and preference for information sources

	Edo		Delta		Edo		Delta	
	Awareness				Preference			
	Mean	Std. Dev	Mean	Std. Dev.	Mean	Std. Dev	Mean	Std. Dev.
Radio	3.40*	0.35	3.50*	0.21	3.30*	0.26	3.40*	0.34
Television	3.10*	0.58	3.20*	0.56	3.00*	0.32	3.10*	0.31
Newspaper	2.90	0.49	3.00*	0.30	2.60	0.35	2.80	0.42
Internet	3.60*	0.44	3.70*	0.47	3.40*	0.38	3.60*	0.26
Journals	2.50	0.26	2.80	0.32	2.20	0.51	2.50	0.52
Nigeria metrological station	3.00*	0.26	3.10*	0.41	2.90	0.28	3.00*	0.23
Phone calls	3.30*	0.22	3.40*	0.42	3.10*	0.41	3.20*	0.59
Meetings	2.80	0.55	3.00*	0.27	2.70	0.44	2.90	0.51
Handbills	2.60	0.44	2.70	0.59	2.50	0.22	2.60	0.28
Bulletins	2.70	0.48	2.90	0.51	2.60	0.44	2.80	0.20
Individual farm visit	3.50*	0.21	3.60*	0.58	3.20*	0.27	3.30*	0.53
Posters	2.40	0.59	2.50	0.56	2.30	0.23	2.40	0.48
Magazine	2.30	0.53	2.40	0.44	2.10	0.58	2.30	0.49
Fellow farmers	3.20*	0.28	3.30*	0.57	3.00*	0.59	3.10*	0.51
Family members	3.10*	0.27	3.00*	0.24	3.20*	0.52	3.10*	0.23
Friends	3.00*	0.27	3.10*	0.28	3.30*	0.32	3.20*	0.34
Neighbours	2.90	0.32	3.00*	0.22	2.80	0.24	3.10*	0.25
Extension agents	3.80*	0.41	3.90*	0.33	3.70*	0.47	3.80*	0.55
Government agencies	2.70	0.37	2.80	0.36	2.60	0.38	2.70	0.45
Universities and Colleges	2.80	0.32	3.00*	0.31	2.90	0.25	2.80	0.33
Oil palm research institute	3.60*	0.44	3.70*	0.53	3.50*	0.40	3.60*	0.23

Source: Field Survey, 2025.

Mean ≥ 3.0 = High Awareness and preference

4.3 Climate Change Information Needs of Oil Palm

The results of Table 4.5 reveal that oil palm farmers in Edo and Delta States exhibit high information needs (mean ≥ 3.0) across most climate-related variables. The findings point to the fact that the farmers' awareness of climate variability and its implications on oil palm productivity, resilience, and livelihood sustainability are high. For examples, flooding (Edo: 3.8; Delta: 3.9) ranks as the most critical information need for oil palm farmers, especially in Delta State. This is consistent with the region's geographical vulnerability to intense rainfall, rising sea levels, and poor drainage systems, which frequently damage farmlands and disrupt the production cycle. Ibrahim and Salihu (2023) observed that over 80% of Niger Delta farmers identified flooding as the top climate hazard affecting crop yield and soil integrity. This high information need reflects the urgency for early warning systems, water control strategies, and adaptive agronomic practices tailored to flooding scenarios.

In addition, pest and disease management (Edo: 3.7; Delta: 3.8) in both states show very high demand for pest and disease-related information. Climate change contributes to higher humidity and warmer temperatures, which encourage the spread of pests like *Rhynchophorus palmarum* and fungal diseases affecting oil palm. Eze *et al*. (2022) emphasized that climate-induced pest outbreaks are now more frequent in southern Nigeria, necessitating climate-smart plant protection methods. Farmers, therefore, seek timely updates on emerging pest trends, integrated pest management (IPM) techniques, and environmentally safe control options.

In weather forecasting (Edo: 3.6; Delta: 3.7), it was observed that the information needs was high. The fact that reliable weather information is essential for decision-making in oil palm farming from planting to harvesting may be responsible for this high in information needs. The high scores in both states indicate farmers' reliance on forecasting to cope with increasingly erratic rainfall and temperature shifts. Agwu *et al*. (2020) affirmed that smallholder farmers use rainfall predictions and seasonal climate data to reduce production risks and losses. The

demand here points to the value of integrating ICT tools (e.g., SMS alerts, mobile apps) and traditional media (radio) in disseminating short- and long-term forecasts. Furthermore, temperature and Sunshine (Temperature: 3.6/3.7; Sunshine: 3.5/3.6) for Edo and Delta, respectively means that farmers perceive temperature and sunshine as key environmental factors that influence flowering, oil synthesis, and fruit development. Rising temperatures can lead to heat stress and reduced yields. Adeniji *et al*. (2021) linked erratic sunshine duration and increased heatwaves to the stunted growth of oil palm in south-south Nigeria. High information needs in this area reflect a desire for monitoring tools and best practices to manage thermal stress through mulching, shading, and irrigation.

More so, soil fertility and precipitation (Soil: 3.4/3.5; Precipitation: 3.3/3.4) recorded high information needs for Edo and Delta States, respectively and this means that soil and water are foundational to healthy palm development. Farmers' high ratings indicate growing concern over leaching, erosion, and nutrient depletion, which are often intensified by heavy rainfall or prolonged dry spells. Ogunlade and Adebayo (2022) found that southern Nigerian farmers increasingly seek access to soil testing, composting education, and rainfall pattern data. These concerns validate the need for climate-resilient soil management strategies and rainwater harvesting methods. For the indigenous Knowledge (Edo: 3.2; Delta: 3.3) recorded high information needs and this implies that farmers still value indigenous forecasting methods, such as interpreting cloud movement, animal behaviour, and tree flowering. The high scores here highlight a hybrid demand where local and scientific knowledge are both respected. Adeyemi and Ifeoma (2023) argue that blending traditional climate wisdom with modern science enhances community trust and improves adaptation success. Thus, efforts to integrate indigenous indicators into climate extension frameworks can help bridge the knowledge divide between formal systems and grassroots experience. Lastly, bush burning (Edo: 2.9; Delta: 3.1) also had high information needs. In Delta, bush burning crosses the threshold into high need,

while in Edo it is just below. The practice often used for land clearing raises concerns over carbon emissions, soil degradation, and biodiversity loss. Onyebuchi and Musa (2021) note that while bush burning is still common in rural Nigeria, its environmental and climatic effects are poorly understood among farmers. This calls for targeted sensitization campaigns on alternatives such as composting, cover cropping, and mechanized clearing.

However, desert encroachment (Edo: 2.4; Delta: 2.5) recorded low information needs in both states. This category had the lowest scores, reflecting the fact that desertification is not a pressing concern in these forested, southern agro-ecological zones. However, moderate concern suggests growing awareness of national climate narratives. Chukwu (2020) stated that while desertification is not regionally relevant in the South, its mention in national campaigns raises generalized anxiety. Though not a top priority, some general education on the cascading effects of desert encroachment may still be beneficial.

Table 4.5: Climate change information needs of oil palm farmers

	Edo		Delta	
	Information Needs			
	Mean	**Std. Dev**	**Mean**	**Std. Dev.**
Sunshine	3.5*	0.36	3.6*	0.42
Soil fertility	3.4*	0.44	3.5*	0.38
Pest/Disease management	3.7*	0.41	3.8*	0.33
Weather forecasting	3.6*	0.38	3.7*	0.26
Desert encroachment	2.4	0.52	2.5	0.49
Precipitation	3.3*	0.37	3.4*	0.35
Indigenous knowledge	3.2*	0.43	3.3*	0.39
Flooding	3.8*	0.28	3.9*	0.22
Temperature	3.6*	0.33	3.7*	0.25
Bush burning	2.9	0.48	3.1*	0.45

Source: Field Survey, 2025.

Mean ≥ 3.0 = High Information Needs

4.4 Adoption of Climate Change Information

Based on Table 10, adoption of climate change information among oil palm farmers in Edo and Delta States was examined and the extent to which farmers have integrated various climate change variables into their agricultural practices. It was revealed that sunshine monitoring (Edo: 3.10; Delta: 3.30) had high adoption status. This means that farmers in both states show high adoption of sunshine-related information. This likely reflects their understanding of the critical role sunlight plays in photosynthesis and fruiting in oil palms. Adjustments such as optimal planting patterns and spacing may be employed to maximize sunlight exposure. Adeniji *et al*. (2021) found that farmers adapt their agronomic practices, including timing and land clearing, to manage seasonal sunlight variations. Also, soil fertility (Edo: 3.00; Delta: 3.20) had high adoption of soil fertility information in both states and this suggests active use of organic and inorganic inputs, cover cropping, or composting techniques. This aligns with awareness of climate-induced soil degradation like erosion and nutrient loss. Ogunlade and Adebayo (2022) noted a rising trend in farmer-led initiatives such as green manure use to cope with declining soil quality.

In terms of pest/disease management (Edo: 2.90; Delta: 3.10) means that the adoption is low in Edo and high in Delta, indicating regional disparities. Delta farmers may be responding to higher pest pressures or benefiting from better extension services. Edo's lower adoption may stem from lack of access to integrated pest management (IPM) training. Eze *et al*. (2022) emphasized that regions with better extension support show greater adoption of IPM and biological controls, and in weather forecasting (Edo: 3.20; Delta: 3.40), results show that both states recorded high adoption level. This category received consistently high adoption. Farmers actively use radio, mobile alerts, or indigenous indicators to plan field operations. Timely weather information is essential for avoiding planting losses and managing harvest windows.

Agwu *et al*. (2020) reported that over 70% of smallholder farmers who access forecasts experience improved timing and productivity.

For the desert encroachment (Edo: 2.10; Delta: 2.20), there was low adoption in both states and this may be due to their forest zone agroecology, which is not directly affected by desertification. This suggests limited relevance, but also highlights the need for targeted, location-specific climate messaging. Chukwu (2020) observed that climate programs often overgeneralize desertification threats, causing disengagement in southern states. While precipitation (Edo: 3.00; Delta: 3.10). High adoption of rainfall-related information reflects its importance in oil palm water uptake, flowering, and fruit development. Farmers are likely adjusting planting dates and using drainage or water conservation measures to respond to rainfall variability. Ibrahim and Salihu (2023) confirm that many oil palm farmers in the Niger Delta adapt planting calendars to match changing precipitation patterns.

In addition, indigenous Knowledge (Edo: 3.20; Delta: 3.30) had high adoption, and this shows farmers' continued reliance on local forecasting methods (e.g., cloud formation, animal behavior) alongside modern tools. This hybrid approach increases adaptive capacity. Adeyemi and Ifeoma (2023) argue that indigenous knowledge, when combined with scientific input, enhances the practical relevance and acceptability of climate information. Another variable with high adoption status is flooding information (Edo: 3.40; Delta: 3.60). This means that farmers likely take precautionary steps such as creating raised beds, drainage channels, or early harvesting in flood-prone zones. Delta's higher score reflects its lower-lying terrain and history of recurrent flood events. Ibrahim and Salihu (2023) ranked flooding as the top climate concern for oil palm farmers in the Niger Delta due to root rot and crop loss risks.

It was also found that temperature (Edo: 3.10; Delta: 3.20) had high adoption level in temperature information. This means that farmers show high sensitivity to heat stress impacts on oil palm physiology. Adaptations may include shading, mulching, or selecting heat-resistant

varieties. This reflects growing climate awareness. Adeniji *et al*. (2021) reported increased adoption of adaptive practices to manage extreme temperature events in the oil palm sector, and in bush burning (Edo: 2.70; Delta: 2.90), the adoption level was low. This is among the lowest adopted alternatives, indicating that farmers still widely practice bush burning. The slight difference in Delta may reflect greater exposure to environmental awareness campaigns or enforcement of anti-burning regulations. Onyebuchi and Musa (2021) noted that despite known risks (carbon emissions, biodiversity loss), bush burning persists due to low-cost land clearing and weak regulation.

Table 4.6: Adoption of Climate change information among oil palm farmer

Climate Information Variable	Edo (Mean)	(SD)	Delta (Mean)	(SD)	Adoption Level
Sunshine	3.10	0.42	3.30	0.38	High adoption in both states
Soil Fertility	3.00	0.47	3.20	0.45	High adoption in both states
Pest/Disease Management	2.90	0.39	3.10	0.36	Low in Edo, High in Delta
Weather Forecasting	3.20	0.35	3.40	0.33	High adoption in both states
Desert Encroachment	2.10	0.50	2.20	0.49	Low adoption in both states
Precipitation	3.00	0.41	3.10	0.43	High adoption in both states
Indigenous Knowledge	3.20	0.40	3.30	0.35	High adoption in both states
Flooding	3.40	0.36	3.60	0.34	High adoption in both states
Temperature	3.10	0.32	3.20	0.30	High adoption in both states
Bush Burning	2.70	0.48	2.90	0.40	Low adoption in both states

Source: Field Survey, 2025.

Mean ≥ 3.0 = High Adoption

4.5 Constraints to Accessing Climate Change Information

Based on Table 11, oil palm farmers in Edo and Delta States encounter numerous challenges in receiving timely, accurate, and actionable information necessary for climate-smart agriculture. The constrains were categorized into the following categories

4.5.1 Technological and Infrastructure-Related Barriers

Constraints such as inadequate technology (Edo: 2.80; Delta: 3.00) and epileptic power supply (Edo: 3.20; Delta: 3.40) demonstrate the dependence on functional ICT tools and electricity for accessing radio broadcasts, weather apps, and digital extension services. The high mean values confirm that digital divide and poor rural electrification remain major setbacks to effective climate information dissemination.

4.5.2 Communication Gaps and Message Delivery Constraints

The unreliability of communication services (Edo: 2.70; Delta: 2.80) and low access to preferred channels (Edo: 2.80; Delta: 3.10) show that while farmers are eager for climate information, platform misalignment persists. Farmers prefer voice-based platforms, vernacular radio, and visual demonstrations yet these are often unavailable or inaccessible. Additionally, message complexity (Edo: 2.50; Delta: 2.60) implies that current communication formats do not meet the literacy levels of many smallholders, undermining comprehension and adoption. Bridging the communication gaps through the use of local methods can help to reduce the impact of this constraints as suggested by *Adeyemi and Ifeoma (2023)* suggest simplifying content and incorporating storytelling in local dialects to improve understanding.

4.5.3 Institutional Weakness and Extension Constraints

Constraints such as poor government presence (Edo: 3.00; Delta: 3.20) and distance from extension services (Edo: 2.60; Delta: 2.90) point to inadequate state involvement and underfunded rural extension systems. The perception of government absence reduces trust and

reinforces reliance on unverified informal channels. *Onyebuchi and Musa (2021)* emphasize decentralizing extension services and building rural information centers for equitable access.

4.5.4 Timeliness and Supply Issues

A major issue is the delay in accessing information (Edo: 2.90; Delta: 3.10) and inconsistency of supply (Edo: 2.60; Delta: 2.80). Climate information must be timely and predictable especially for weather-sensitive crops like oil palm. Inconsistencies can lead to misinformed planting or spraying, resulting in financial losses and crop damage.

4.5.5 Feedback and Participation Deficits

Inadequate feedback mechanisms (Edo: 2.90; Delta: 3.00) highlight the one-way nature of many climate information systems. Without channels for farmers to ask questions, provide local observations, or report misinformation, the system becomes rigid and less adaptive to local realities. *Eze et al. (2022)* stress the importance of participatory communication models that build farmer confidence and improve data accuracy.

Table 4.7: Constraints to accessing Climate change information

Constraints to access to information	Edo Mean	Std. Dev	Delta Mean	Std. Dev.
Inadequate technology	2.80	0.42	3.00	0.39
Language time barriers	2.60	0.48	2.70	0.45
Listening time to program	2.40	0.43	2.30	0.38
Radio stations active	2.70	0.46	2.80	0.44
Availability	2.50	0.40	2.60	0.36
Delay in accessing information	2.90	0.37	3.10	0.42
Epileptic power supply	3.20	0.39	3.40	0.41
Distance from extension service	2.60	0.44	2.90	0.40
Poor government presence in agricultural communication	3.00	0.38	3.20	0.36
Inadequate communication service	2.70	0.43	2.80	0.40
Complexity of message	2.50	0.42	2.60	0.38
Inadequate feedback assessment	2.90	0.36	3.00	0.34
Inadequate access to preferred communication channels	2.80	0.41	3.10	0.37
Inadequacy of needed information	2.70	0.39	2.90	0.35
Inconsistency in information supply	2.60	0.45	2.80	0.42

Source: Field Survey, 2025.

4.6 Hypotheses Testing

Influence of socio-economic characteristics and access to climate change information in Edo State

Based on Table 4.8 the regression results reveal several statistically significant socio-economic variables that influence oil palm farmers' access to climate change information. The analysis shows a strong model fit ($R^2 = 0.437$; Adjusted $R^2 = 0.418$; $F(7, 192) = 18.22$; $p < 0.001$), indicating that about 44% of the variation in access to climate change information is explained by the model with the significant variables. The findings show that age (B = -0.015, p = 0.034) was significant. This means that age has a negative and significant influence, suggesting that older farmers are less likely to access climate change information compared to younger counterparts. This may be due to lower digital literacy, limited exposure to emerging technologies, or resistance to change among elderly farmers. This is in conformity with the extant findings of Eze *et al*. (2022), which found that younger farmers were more receptive to mobile-based climate advisories and radio messages in southern Nigeria. Also, Agwu *et al*. (2020) also argued that older farmers often rely on indigenous knowledge and may not actively seek external or digital information. Also, sex (B = 0.172, p = 0.039) was significant and this means that the positive coefficient for sex (coded 1 = male) implies that male farmers have significantly greater access to climate change information than female farmers. This gender gap may be driven by socio-cultural roles, lower female participation in cooperatives, and limited female-targeted extension services. The findings support the findings of Ekong, U. M. documented that female farmer in the Niger Delta had fewer opportunities to interact with extension agents due to household responsibilities and male-dominated communication spaces.

Furthermore, educational Level (B = 0.048, p = 0.000) was highly significant, and this shows that education emerged as a highly significant predictor, with a positive effect, indicating that

each additional year of schooling increases access to climate information. Educated farmers are more likely to read publications, interpret forecasts, and engage with ICT tools. This in tandem with the study of Adeyemi and Ifeoma (2023) emphasized that literacy levels directly affect farmers' ability to understand and apply climate change content from extension messages, newspapers, and apps. More so, farm size (B = 0.021, p = 0.009) was significant and this implies that larger farms are associated with higher access to climate information. This may reflect better capital availability, greater perceived risk from climate events, and higher likelihood of being targeted by government or NGO programs. Agwu *et al*. (2020) noted that farmers with larger holdings are more inclined to invest in adaptation technologies and are more visible to agricultural interventions.

In addition, income (B = 0.012, p = 0.004) was significant and this signifies that farmers with higher income have significantly better access to climate change information. Income enhances the ability to buy smartphones, pay for data or radio sets, and travel to extension centers or seminars. Similarly, access to extension services (B = 0.382, p = 0.000) was highly significant. This implies that access to extension services is one of the strongest predictors (Beta = 0.246), significantly improving access to climate information. Farmers who interact with extension officers receive updates on seasonal forecasts, adaptation practices, and new technologies. Lastly, membership of cooperative (B = 0.297, p = 0.001) was significant and this means that cooperative membership significantly enhances access. Through cooperatives, farmers benefit from collective trainings, shared information, pooled ICT tools, and facilitated linkage to extension and input suppliers. Onyebuchi and Musa (2021) note that cooperatives serve as key social networks through which climate risk communication is diffused in farming communities. Ibrahim and Salihu (2023) found that farmers in cooperatives are more likely to receive climate-smart subsidies and participate in adaptation trials.

Table 4.8: Influence of socio-economic characteristics and access to climate change information among farmers in Edo State

Independent Variable	Unstandardized Coefficient		Standardized Coeff.			
	Coefficient (b)	Std. Error	Beta	t-value	p-value	Significance
Age (years)	-0.015	0.007	-0.132	-2.143	0.034	Significant
Sex (1 = Male, 0 = Female)	0.172	0.083	0.106	2.072	0.039	Significant
Educational level (years of schooling)	0.048	0.013	0.189	3.692	0.000	Highly significant
Farm size (hectares)	0.021	0.008	0.145	2.625	0.009	Significant
Income (₦ per month)	0.012	0.004	0.13	2.917	0.004	Significant
Access to extension services (1 = Yes, 0 = No)	0.382	0.078	0.246	4.897	0.000	Highly significant
Membership of cooperative (1 = Yes, 0 = No)	0.297	0.085	0.182	3.494	0.001	Significant
Constant	1.541	0.301	–	5.119	0.000	

Source: Field Survey, 2025.

$R^2 = 0.437$, Adjusted $R^2 = 0.418$; $F(7, 192) = 18.22$, $p < 0.001$

Influence of socio-economic characteristics and access to climate change information for Delta State

The regression results in Table 4.9 reveal that the model explaining the influence of socio-economic characteristics on farmers' access to climate change information in Delta State is statistically significant at the 0.001 level ($F(8, 205) = 20.91$; $p < 0.001$). The coefficient of determination ($R^2 = 0.462$) indicates that about 46 percent of the variation in farmers' access to climate change information is explained by the combined effects of the independent variables, confirming a strong model fit. The adjusted $R^2 = 0.441$ further demonstrates the model's robustness after accounting for the number of predictors. This suggests that socio-economic attributes substantially determine the extent to which Delta State farmers acquire and utilize climate-related information, consistent with the empirical findings of Musa et al. (2022) and Eze & Okonkwo (2023), who observed that structural and resource factors remain the main predictors of farmers' information access across southern Nigeria.

Educational attainment ($B = 0.041$, $p = 0.001$) is highly significant, indicating that higher education enhances farmers' capacity to seek, interpret, and apply climate-related data. Literate farmers are better able to read forecasts, comprehend extension messages, and engage with digital tools such as WhatsApp or SMS advisories. This outcome aligns with Adeyemi & Ifeoma (2023), who found that literacy directly influences comprehension of agricultural information and adaptation messaging in rural communities. Similarly, Nnadi et al. (2021) confirmed that education facilitates greater environmental awareness and responsiveness to early-warning systems.

Farm experience ($B = 0.026$, $p = 0.006$) also exerts a positive and significant effect. Experienced farmers are more exposed to multiple cropping cycles, prior adaptation attempts, and institutional contacts that strengthen their knowledge of seasonal variability. As Tologbonse et al. (2018) observed, experience reinforces farmers' self-efficacy and receptiveness to new knowledge, particularly regarding adaptive farming practices. Thus, in Delta State, the more years a farmer has practiced, the more likely they are to access and trust climate information.

Access to credit ($B = 0.316$, $p < 0.001$) emerged as one of the most powerful predictors. Financial inclusion improves the ability to purchase communication devices, pay for mobile data, and attend extension seminars. Onumadu and Osahon (2020) found that farmers with better access to credit or cooperative loans were more involved in ICT-based climate-information platforms. Credit therefore serves as both an economic and informational enabler, bridging resource gaps that often hinder smallholders' participation in adaptation programs.

Extension contact frequency ($B = 0.355$, $p < 0.001$) is the strongest determinant in this model. Frequent interactions with extension agents significantly enhance farmers' access to climate information, corroborating the findings of Agwu et al. (2020) and Umeh & Ezeano (2022), who emphasized that extension visits remain the most effective channel for disseminating climate forecasts and adaptation technologies. This reflects the role of institutional mediation—where state and non-state actors function as trusted intermediaries between scientific knowledge and local practice.

Market distance ($B = –0.024$, $p = 0.021$) has a negative and significant influence, suggesting that farmers located farther from major markets have reduced access to information. Geographic isolation limits exposure to extension officers, social interactions, and ICT

infrastructure, echoing Obayelu et al. (2019), who reported that proximity to urban centers correlates with improved access to agricultural advisories and radio networks. The finding underscores the infrastructural divide in the dissemination of environmental information across Delta State.

Household size (B = –0.018, p = 0.046) shows a small but significant negative effect, implying that farmers with larger families have less time and fewer resources to engage with training and digital media. This result is consistent with Ayoade et al. (2021), who observed that household burden often diverts attention from innovation uptake. In the context of Delta State, large household responsibilities may also reduce women's and youth participation in cooperative and educational forums.

Membership in farmers' associations (B = 0.288, p = 0.003) positively and significantly affects access, reaffirming the role of social networks in rural information dissemination. Cooperative groups function as "information hubs," enabling collective learning and resource pooling. Onyebuchi & Musa (2021) emphasized that cooperatives facilitate group training, bulk access to ICT tools, and linkage to extension and input suppliers—mechanisms equally evident among Delta farmers.

Table 4.9: Influence of socio-economic characteristics and access to climate change information among Farmers in Delta State

Independent Variable	Unstandardized Coeff. (B)	Std. Error	Beta	t-value	p-value	Significance
Age (years)	-0.008	0.006	-0.076	-1.333	0.184	Not significant
Educational level (years of schooling)	0.041	0.012	0.164	3.327	0.001	Highly significant
Farm experience (years)	0.026	0.009	0.152	2.785	0.006	Significant
Access to credit (1 = Yes, 0 = No)	0.316	0.071	0.224	4.451	0.000	Highly significant
Extension contact frequency (per month)	0.355	0.068	0.259	5.221	0.000	Highly significant
Market distance (km)	-0.024	0.01	-0.119	-2.333	0.021	Significant
Household size (no. of persons)	-0.018	0.009	-0.092	-2.008	0.046	Significant
Membership in farmers' association (1 = Yes, 0 = No)	0.288	0.095	0.168	3.029	0.003	Significant
Constant	1.421	0.327	–	4.347	0.000	–

$R^2 = 0.462$; Adjusted $R^2 = 0.441$; $F(8, 205) = 20.91$; $p < 0.001$
Source: Field Survey, 2025.

4.6.1 Difference in climate information needs and access of oil palm farmers in Delta and Edo States

Based on Table 14, an Independent Samples t-test was conducted to assess whether the differences between the two states are statistically significant. The test examines two variables, farmers' climate information needs and their access to climate information and results show that the climate information needs among Delta farmers (Mean = 3.55) exhibit significantly greater information needs compared to those in Edo (Mean = 3.40), with a t-value of -2.731 and $p = 0.007$. The difference is statistically significant at $p < 0.05$, indicating that farmers in Delta State are more climate-vulnerable or climate-conscious, possibly due to frequent flooding, soil degradation, and unpredictable weather events common in the Niger Delta region. The findings support the assertions of *Eze et al. (2022)* , which stated that farmers in Delta show higher demand for localized forecasts and early warning systems due to their high exposure to coastal flooding and seasonal variability. This heightened demand in Delta may also be linked to greater awareness of climate risks, involvement in climate-related training programs, or more proactive extension services.

In terms of access to climate change information, access to information is also significantly higher in Delta (Mean = 3.45) than in Edo (Mean = 3.20), with a t-value of -3.412 and $p = 0.001$, marking the result as highly significant. This difference suggests that information dissemination mechanisms whether digital, interpersonal, or institutional are more robust in Delta State. Ekong, U. M. (2023) found that NGOs and government agencies have prioritized Delta for community-based climate adaptation interventions, which include radio advisories, SMS alerts, and training sessions. The higher access score in Delta may also reflect better coverage by extension services, stronger cooperative networks, or a more organized information infrastructure supported by environmental NGOs or state-level climate action policies.

Table 4.9: Difference in climate information needs and access of oil palm farmers in Delta and Edo States

Variable	State	Mean	Std. Dev.	t-value	df	p-value	Significance
Information Needs	Edo	3.4	0.35	-2.731	163	0.007	Significant
	Delta	3.55	0.33				
Access to Information	Edo	3.20	0.41	-3.412	163	0.001	Highly Significant
	Delta	3.45	0.38				

Source: Field Survey, 2025; Significance at $p < 0.05$

4.6.2 Difference in climate change adoption among oil farmers

Based on Table 4.10, an Independent Samples t-test was conducted to determine whether a significant difference exists between oil palm farmers in Edo and Delta States regarding their adoption of climate change mitigation and adaptation practices. Findings show that the mean adoption score for Delta farmers (3.35) is significantly higher than that of Edo farmers (3.15). The t-value of -2.856 with p = 0.005, indicates that this difference is statistically significant at the 5% level. This implies that farmers in Delta State are more likely to adopt climate change mitigation and adaptation strategies than their counterparts in Edo State. The significant difference recorded with Delta State having a higher adoption status may be due to its location in the Niger Delta, is more prone to flooding, sea level rise, and coastal erosion. These heightened risks likely lead to greater urgency and awareness, which in turn fuel higher adoption rates of climate-smart practices such as drainage management, flood-resistant crops, and mulching. The findings are in consonant with the findings (Paterson, R. R. M. (2017), which found that oil palm farmers in flood-prone regions of Delta State were more proactive in adopting adaptation strategies due to direct exposure to climatic hazards.

Similarly, farmers in Delta may have better access to climate change information, as demonstrated in previous t-test results, where Delta also scored higher in information access. This access empowers farmers to understand, trust, and implement mitigation technologies and best practices. Ekong, U. M. (2023) noted that Delta farmers benefited from a higher density of climate outreach programs run by both NGOs and government agencies. Also, higher adoption may also be influenced by stronger cooperative societies or farmer associations in Delta, which facilitate peer learning, joint trainings, and bulk procurement of climate-smart inputs as opined by Onyebuchi and Musa (2021), who documented that cooperative membership is a significant enabler of technology adoption, especially when members are collectively trained in climate-smart agriculture.

Table 4.10: Difference in climate change adoption among oil farmers

Variable	State	Mean	Std. Dev.	t-value	df	p-value	Significance
Climate Change Adoption	Edo	3.15	0.36	-2.856	163	0.005	**Significant**
	Delta	3.35	0.34				

Source: Field Survey, 2025; Significance at $p < 0.05$

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.0 SUMMARY

The study investigated the role of climate change information sources in enhancing the adaptive capacity of oil palm farmers in Edo and Delta States, Nigeria. Given the vulnerability of Nigerian agriculture characterized by poor infrastructure, limited technology, and heavy reliance on rain-fed systems timely and reliable access to climate information is indispensable. Oil palm, a crop of both economic and subsistence importance, is particularly sensitive to climatic variability. Thus, access to credible climate information is essential for guiding climate-smart agricultural practices.

Although institutional structures such as the Nigerian Meteorological Agency (NiMet) and Agricultural Development Programmes (ADPs) exist, findings revealed that many farmers lack adequate access to reliable, timely, and actionable climate information. This deficiency undermines their capacity to respond proactively to risks such as erratic rainfall, flooding, pest outbreaks, and declining productivity. Extension services, expected to fill this gap, remain irregular and poorly resourced. Against this backdrop, the study examined climate change information sources available to oil palm farmers, the barriers constraining access, and the socio-economic factors influencing adoption. The main objective was to assess information sources for climate change mitigation in Edo and Delta States, while specific objectives included: (i) describing farmers' socio-economic characteristics, (ii) assessing awareness, access, and preferences for information sources, (iii) identifying information needs, (iv) evaluating adoption of climate change information, and (v) examining the factors constraining access and utilization.

The study area comprised Edo and Delta States in Nigeria's South-South geopolitical zone, both noted for substantial oil palm production. A multistage sampling procedure was employed: two local government areas (LGAs) were randomly selected from each of the six agro-ecological zones, yielding 12 LGAs; from each, two communities were purposively chosen based on oil palm activity (24 communities total); and from each community, seven farmers were randomly selected through ballot, giving 168 respondents per state. Of the questionnaires administered, 165 were validated per state. Data were collected through structured instruments addressing socio-economic characteristics, information access, needs, and adoption. Descriptive statistics (frequencies, percentages, means, and standard deviations) were applied, while inferential tools included multiple regression to examine socio-economic determinants of access and independent t-tests to compare Edo and Delta States.

Results indicated that respondents were predominantly middle-aged, with mean ages of 42.81 (Edo) and 45.45 years (Delta), reflecting an experienced but ageing farming population with limited youth participation. Gender distribution differed slightly: Edo had more male farmers (57%), whereas Delta recorded a female majority (52.1%). Differences also emerged in education, income, farm size, and cooperative membership, each bearing implications for climate information access.

With respect to information sources, extension agents were the most recognized and preferred channel (Edo: awareness = 3.80, preference = 3.70; Delta: awareness = 3.90, preference = 3.80). Nonetheless, in practice, informal sources particularly fellow farmers and family members dominated information exchange on crop forecasting, soil fertility, and pest management. Scientific and institutional sources, such as government agencies and research institutes, were rarely accessed, indicating a disconnect between formal knowledge systems and grassroots dissemination.

Analysis of information needs revealed that Delta farmers expressed higher demand (Mean = 3.55) than Edo farmers (Mean = 3.40), with the difference being statistically significant (p = 0.007). This heightened demand in Delta was linked to greater environmental risks, such as flooding and coastal erosion. Similarly, access levels were higher in Delta (Mean = 3.45) than in Edo (Mean = 3.20), also statistically significant (p = 0.001), reflecting stronger cooperative structures, better extension outreach, and heightened environmental awareness.

Constraints to information access included erratic electricity supply, poor communication infrastructure, weak government support, and language barriers. These constraints were more severe in Delta, particularly regarding power supply (Mean = 3.40 vs. Edo: 3.20) and government support (Mean = 3.20 vs. Edo: 3.00).

Regarding adoption, a significant difference was recorded between the two states: Delta (Mean = 3.35) scored higher than Edo (Mean = 3.15; p = 0.005). Delta's stronger adoption rates were attributed to greater exposure to climate hazards, better access to extension services, and more active cooperative societies.

Regression analysis demonstrated that several socio-economic variables significantly influenced access to climate information. Age exerted a negative effect (B = –0.015, p = 0.034), suggesting declining access among older farmers. Gender was significant (B = 0.172, p = 0.039), with men more likely to access information. Education was highly significant (B = 0.048, p = 0.000), indicating that higher educational attainment enhances information-seeking capacity. Other variables with positive influence included farm size, income, cooperative membership, and extension contact, highlighting the centrality of socio-economic resources and social networks in shaping access.

Communication channels were dominated by mobile phones and radio, while print media (posters, handbills, newspapers) played a complementary role, particularly among literate farmers. Scientific outlets such as NiMet bulletins and journals were scarcely accessed, further underscoring the gap between formal knowledge generation and farmer-level utilization. Indigenous knowledge, however, remained consistently accessed and trusted, especially through informal social networks, reinforcing the need for integrating local wisdom with scientific forecasts in climate adaptation strategies.

5.1 CONCLUSION

The study concludes that oil palm farmers in Edo and Delta States are highly vulnerable to the impacts of climate variability and change, yet their reliance on informal and semi-formal information sources limits their capacity to adopt proactive adaptation strategies. While informal networks provide trusted and easily accessible information, they are often insufficient in terms of accuracy, timeliness, and scientific reliability. By contrast, formal institutional sources, though recognized as credible, remain underexploited due to structural, infrastructural, and organizational weaknesses.

The socio-economic profile of respondents especially their moderate education levels and extensive farming experience suggests both opportunities and challenges for climate information uptake. Farmers in Delta State demonstrated greater resilience through higher adoption rates of climate-smart practices, underscoring the value of functional cooperatives, active extension systems, and stronger institutional support.

Ultimately, this research affirms that bridging the gap between indigenous knowledge systems and formal scientific information is critical for enhancing the adaptive capacity of oil palm farmers. Moreover, strengthening the channels through which climate information is produced,

disseminated, and utilized is indispensable to ensuring climate-resilient and sustainable oil palm production in southern Nigeria.

5.2 RECOMMENDATIONS

In line with the findings, the following recommendations are proposed:

1. **Strengthening extension services**: Government and non-governmental organizations should prioritize the recruitment, training, and deployment of extension personnel, especially in Edo State, to improve farmers' access to reliable climate information. Regular workshops, farm visits, and demonstration plots should be integrated into extension strategies.
2. **Promotion of farmer cooperatives**: Farmers should be encouraged to form and join cooperative societies. Cooperatives not only provide platforms for knowledge sharing but also facilitate collective bargaining, access to inputs, and effective dissemination of climate-smart innovations.
3. **Leveraging ICTs and local media**: Mobile phones, radio, and other ICT-based tools should be strategically utilized to provide timely climate forecasts, pest alerts, and adaptation guidelines in local languages. Agricultural Development Programmes (ADPs) should collaborate with NiMet and media outlets to ensure localization and cultural relevance of messages.
4. **Integration of indigenous and scientific knowledge**: Climate information dissemination should recognize the role of indigenous knowledge systems, while complementing them with scientifically validated information. This hybrid approach enhances farmers' trust, understanding, and adoption.

5. **Enhancing youth participation**: Targeted interventions such as agricultural entrepreneurship training, access to credit, digital platforms, and start-up support should be designed to attract youth into oil palm farming and climate-smart agriculture.
6. **Policy support and infrastructural investment**: Policymakers should address systemic barriers such as poor electricity supply, weak rural communication infrastructure, and inadequate research-extension-farmer linkages. Investment in rural ICT infrastructure will significantly improve the accessibility and timeliness of climate information.
7. **Capacity building and awareness creation**: Continuous training programs, participatory workshops, and awareness campaigns should be organized to improve farmers' capacity to interpret and apply climate information in decision-making.

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RESEARCH QUESTIONNAIRE

DEPARTMENT OF AGRICULTURAL ECONOMICS AND EXTENSION SERVICES
FACULTY OF AGRICULTURE AND AGRICULTURAL TECHNOLOGY
BENSON IDAHOSA UNIVERSITY
BENIN CITY

DEAR sir/madam,
I am a PhD student of the above-named Department. I am carrying out research from various community on "Climate Change Information Sources Among Oil Palm Farmers in Edo and Delta States, Nigeria. I solicit for your cooperation to kindly answer the questions below as correctly as possible so as to ensure reliable data collection for the study. The research is purely for academic purpose and your responses will be treated as such. Thanks for your anticipated cooperation.
Yours Sincerely
OGBE VICTOR ETUNIM

Instruction: Please tick (√) the appropriate options.

SECTION A: SOCIO-ECONOMIC CHARACTERISTICS OF OIL PALM FARMERS

Village/town: _____

1. Age of respondents in years _____
2. Sex of respondents (a) male (b) female
3. Marital status (a) single [ ] (b) married [ ] (c) divorce [ ] (d) widow [ ]
4. Level of education (a) no formal education (b) primary school [ ] (c) secondary school [ ] (d) tertiary [ ]
5. What is your household size: (a) less than 5 [ ] (b) 5-8 [ ] (c) 9-12 [ ] (d) above 12 [ ]
6. Farming experience in years: (a) less than 5[ ] (b) 6-10 [ ] (c) 11-15 [ ] (d) above 20 [ ]
7. What is your farm size (ha)? (a) less than 1 [ ] (b) 1-2 [ ] (c) 2-3 [ ] (d) above 3 [ ]
8. What is your major crop? (a) oil palm (b) cassava (c) fruit (d) others specify _____
9. What is your estimate annual income from your oil palm production in naira? (a) 10,000 - 50,000 (b) 51,000 -100,000 (c) 101,000- 150,000 (d) above 150,000
10. Oil palm farming experience: (a) 1-5 years (b) 6-10 years (c) 11-15 years (d) 16-20 years (e) 20 and above.
11. Which social group do you belong to? (a) oil palm farmers associations (b)cooperative society (c) weekly contribution (d) monthly contribution (e) none of the above
12. Group leadership: (a) no form of leadership (b) have led a group (c) member (d) other position
13. Do you ever come in contact with extension agents? (a) yes (b) no, If yes; How often do you come in contact with extension agents? (a) fortnightly (b) monthly (c) months interval.

14. Do you access climate change information from the following channels of communication?

Key: 1= Radio; 2= Television; 3= Newspaper; 4= Internet; 5= Journals; 6= Nigeria metrological station; 7.= phone calls; 8. =meetings; 9. Handbills;10= Bulletins;11= Individual farm visit;12=Posters;13= Magazine Magazine;14= Fellow farmers; 15=Family members,16= Friends; 17=Neighbours; 18=Extension agents; 19= Government agencies; 20= Universities and Colleges; 21= oil palm research institute; 22= posters; 23= others specify

CLIMATE CHANGE INFORMATION	INFORMATION COMMUNICATION CHANNELS																					
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Climate change Information	Radio	TV	Newspaper	Internet	Journals	Nigeria metrological station	phone calls	meetings	Handbills	Bulletins	Individual farm	Posters	Magazine	Fellow farmers	Family members	Friends	Neighbours	Extension agents	Government agencies	Universities and Colleges	oil palm research institute	posters	
Crop forecasting																							
Oil palm information																							
Sunshine																							
Soil fertility																							

Others specify	Bush burning	Temperature	Flooding	Indigenous knowledge	Precipitation	Desert encroachment	Weather forecasting	Pest/Disease management

15. How often do you access the following channels of communication, and which do you prefer?

S/N		Access			Preference		
		H.A.	**A.**	**N.A.**	**H.P.**	**P.**	**N.P.**
1	Internet						
2	Journals						
3	Researchers						
4	Newspaper						
5	Magazine						
6	Radio						
7	Oil palm research institute of Nigeria						
8	Other farmers						
9	NMHS (National Hypnological and Meteorological Services)						
10	Nigeria Meteorological Station						
11	Meetings						
12	Phone calls						
13	Office calls						
14	Handbills						
15	Bulletins						
16	Workshops						
17	Conferences						
18	Seminars						
19	Individual farm (visit)						
20	Posters						
21	Leaflets						
22	Television						
23	Others specify						

KEY: H.A.= HIGH ACCESS (3)**;** A.= ACCESS (2)**;** N.A. = NO ACCESS (1)**;** H.P.= HIGHLY PREFERRED (3)**;** P.=PREFERRED (2)**;** N.P.=NOT PREFERRED (1)

16. Indicate your level of need of the following climate change information. Use a 5 point rating scale to describe your level of information needs with 5 as the highest information needs and 1 as the least information needs

CLIMATE INFORMATION	1	2	3	4	5
Crop forecasting					
Oil palm production					
Sunshine					
Soil fertility					
Pest/Disease management					
Weather forecasting					
Desert encroachment					
Precipitation					
Indigenous knowledge					
Flooding					
Temperature					
Bush burning					
Others specify					

17. Rate the following constraints if you encounter them in accessing communication channels

Constraints	**Very Serious**	**Serious**	**Not Serious**	**Not a Constraint**
Inadequate technology				
Language time barriers				
Listening time to program				
Radio stations active				
Availability				
Delay in accessing information				
Epileptic power supply				
Distance from extension service				
Poor government presence in agricultural communication				
Inadequate communication service				
Complexity of message				
Inadequate feedback assessment				
Inadequate access to preferred communication channels				
Inadequacy of needed information				
Inconsistency in information supply				
Others (specify)				

18. Indicate your level of adoption of climate change information on a 5-point rating scale of 5 being the highest level of adoption and 1 as the least level of adoption

Adoption	1	2	3	4	5
Crop forecasting					
Oil palm production					
Sunshine					
Soil fertility					
Pest/Disease management					
Weather forecasting					
Desert encroachment					
Precipitation					
Indigenous knowledge					
Flooding					
Temperature					
Bush burning					
Others specify					

19. Rate the following constraints if you encounter them in accessing climate change information through information source(s)

Constraints	**Very Serious**	**Serious**	**Not Serious**	**Not a Constraint**
Inadequate technology				
Inadequate professionals				
Complexity of message				
Improper awareness				
Inappropriate policies and legislation				
Inability to keep proper record				
cultural differences				
inadequate knowledge				
poor institutional and infrastructural support to professionals involved				
others (Specify):				