World Journal of Advanced Research and Reviews
eISSN: 2581-9615 CODEN (USA): WJARAI
Cross Ref DOI: 10.30574/wjarr
Journal homepage: https://wjarr.com/

(REVIEW ARTICLE)

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# Oil palm production value addition in Nigeria: The way forward

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World Journal of Advanced Research and Reviews, 2024, 21(03), 2009–2017

Publication history: Received on 11 February 2024; revised on 22 March 2024; accepted on 25 March 2024

Article DOI: https://doi.org/10.30574/wjarr.2024.21.3.0899

## Abstract

This study appraised the way forward for oil palm production value addition in Nigeria. Oil palm has economic, cultural and traditional significance in many communities in Nigeria. In recent years, the oil palm sector in Nigeria has faced challenges related to sustainability, environmental conservation, and market access. The study identified the major players in the oil palm industry in Nigeria. It was shown that value addition processes in oil palm production are essential for enhancing the economic value of palm oil and its derivatives. It was obvious that challenges outlined in value addition processes of the oil palm industry include inefficient processing facilities, storage challenges, lack of cold chain infrastructure, limited access to credit and financing, inadequate research and development and environmental issues. The study revealed that Government interventions as a way forward play a crucial role in promoting value addition in the oil palm industry. This extends to research and development, infrastructure development, market access and trade facilitation, sustainable certification and standards, tax incentives, subsidies, extension services and environmental regulations. It was accounted that successful value addition projects in the oil palm sector in Nigeria have the potential to transform the local economy and improve livelihoods. A replication of the success stories is a way forward to value addition sustainability in the oil palm industry. Conclusion reached as ways forward include technological advancement, increased palm oil production, increased research and development, increased market expansion and steady government support and policy framework.

**Keywords:** Oil Palm; Palm oil; Value addition; Technology; Production; Way forward; Nigeria

## 1. Introduction

Nigeria's economy is predominantly rural, with over 60 percent of its population residing in rural regions. Among this population, 90 percent are engaged in subsistence farming as their primary source of employment. (Ughwe, Albert, Oghenero, and Ezekiel. 2022) Oil palm production is one among them.

Oil palm production in Nigeria is an economic history. Long before colonialism, indigenous communities in what is now Nigeria cultivated oil palm trees for their various uses. Oil palm was a staple crop in the subsistence agriculture of these communities. During the colonial period, the British recognized the economic potential of oil palm and established plantations in the region. These plantations were primarily focused on producing palm oil, a valuable commodity for export. The palm oil trade flourished during colonial rule, with Nigeria serving as a significant hub for the export of palm oil to Europe. The trade contributed to the economic development of the region (Akinyemi and Adepoju, 2018). After gaining independence in 1960, Nigeria continued to be a major producer of palm oil. Smallholder farmers in Nigeria and other regions played a vital role in palm oil production.

Oil palm has cultural and traditional significance in many communities in Nigeria. It is often used in ceremonies, rituals, and traditional cuisine. Oil palm cultivation has been a source of income and employment for the people of Nigeria,

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contributing to rural livelihoods and economic growth. In recent years, the oil palm sector in Nigeria has faced challenges related to sustainability, environmental conservation, and market access (Nweke and Onukala, 2017). However, there is also a growing recognition of the sector's potential for economic development and rural empowerment. The government of Nigeria, in collaboration with various stakeholders, has implemented initiatives to promote sustainable oil palm cultivation, increase production, and improve the value chain. Oil palm cultivation in Nigeria has seen modernization efforts, including the use of improved varieties, mechanization, and better processing techniques to enhance productivity and quality (Okon, 2017).

The purpose of this paper is to bridge various gaps in existing and non-existing information in the value addition challenges in oil palm production within the context of Nigeria. The paper aims to produce a pathway for sustainable economic growth, food security, and rural development in the nation.

### *Objectives of the Study*

The general objective of the study is to appraising the value addition dynamics in oil palm production in Nigeria. The specific objectives are to

- Explain an overview of Oil Palm Production in Nigeria
- Identify Value Addition Key players in the Oil Palm Sector
- Enumerate various processes of value addition in oil palm industry
- Address challenges in value addition
- Examine government policies and initiatives
- Showcase Success Stories

## 2. Key Players in Oil Palm Production in Nigeria

*Nigerian Institute for Oil Palm Research (NIFOR):* NIFOR is a government research institute that conducts research and development activities related to oil palm cultivation, processing, and technology development (NIFOR, 2021). *Palm Oil Processing Companies:* Several palm oil processing companies and mills operate in Nigeria, including both large-scale commercial mills and smaller processing units (e.g. PRESCO). *Smallholder Farmers and Cooperatives:* Smallholder farmers and cooperative groups play a significant role in oil palm cultivation in Nigeria. These farmers often form cooperatives to access resources, training, and markets collectively. *Private Investors and Agribusinesses:* Private investors and agribusinesses, including both domestic and international companies, may invest in oil palm plantations, processing facilities, and related ventures in Nigeria. *Government Initiatives and Agencies:* Various government agencies at the federal and state levels in Nigeria, including the Federal Ministry of Agriculture and Rural Development and Nigeria. Ministry of Agriculture and Natural Resources, play roles in policy development, regulation, and support for the oil palm industry (Nwafor, 2019). *Non-Governmental Organizations (NGOs):* NGOs and development organizations often work in partnership with local communities and government agencies to promote sustainable and inclusive practices in the oil palm sector.

## 3. Value Addition Processes

Value addition processes in oil palm production are essential for enhancing the economic value of palm oil and its derivatives, improving product quality, and increasing market competitiveness. These processes encompass various activities, from cultivation and harvesting to processing and marketing. This comprehensive overview explores the key value addition processes in oil palm production. They include:

### 3.1. Cultivation and Harvesting

- Sustainable Farming Practices: Sustainable palm oil production involves adopting environmentally responsible cultivation practices, including zero-deforestation commitments and biodiversity conservation (Koh and Wilcove, 2007).
- Improved Cultivar Selection: Selecting high-yielding and disease-resistant palm oil cultivars contributes to increased oil yields (Basiron and Sundram, 2003).

### 3.2. Processing

- Milling and Oil Extraction: Milling of palm fruit bunches using mechanical processes results in the extraction of crude palm oil (CPO) and palm kernel oil (PKO) (Hartley, 1988).

- Refining: Refining CPO through processes such as degumming, bleaching, deodorizing improves oil quality, removing impurities and enhancing stability (Basiron and Sundram, 2003).
- Fractionation: Fractionation separates palm oil into different fractions, such as olein and stearin, to create products with distinct melting points (Ghazali et al., 2004).

### 3.3. Packaging and Branding

- Attractive Packaging: Proper packaging ensures product protection and consumer convenience, enhancing the appeal of palm oil products (Echendu et al., 2013).
- Branding and Labeling: Effective branding and labeling create a unique identity for palm oil products, increasing consumer trust and recognition (Chin et al., 2014).

### 3.4. Marketing and Market Access

- Marketing Strategies: Marketing efforts, including advertising and distribution, help reach a wider audience and promote palm oil products (Idowu and Falola, 2016).
- Compliance with Certifications: Meeting certifications like RSPO (Roundtable on Sustainable Palm Oil) enables access to international markets and demonstrates commitment to sustainability (RSPO, 2021).

### 3.5. Quality Control and Assurance

- Quality Standards: Implementing quality control measures ensures consistent product quality and safety standards throughout the value chain (Nnamonu, 2018).

### 3.6. Product Development

Diversifying product offerings, such as palm oil-based cosmetics and pharmaceuticals, adds value to the palm oil industry (Esimaje and Adjeroh, 2013).

### 3.7. Technology Adoption and Research

- Technological Advancements: Adopting modern processing technologies and equipment improves efficiency and product quality (Basiron and Sundram, 2003).
- Research and Development: Ongoing research contributes to advancements in crop management practices, processing techniques, and product innovation (NIFOR, 2021).

### 3.8. Sustainable Practices

- Environmental Responsibility: Embracing sustainability practices, such as zero-deforestation commitments, minimizes environmental impacts and enhances the sustainability of palm oil production (Sodhi, 2011).

### 3.9. Infrastructure Development

- Cold Chain Infrastructure: Investing in cold chain infrastructure reduces post-harvest losses and ensures product quality during storage and transportation (Seymour and McDougall, 2007).

### 3.10. Market Linkages and Value Chain Integration

- Strengthening Value Chains: This involves integrating smallholder farmers, processors, marketers strengthens value chains and streamlines production and distribution (Oyinlola, 2019).
- These value addition processes collectively contribute to increasing the economic value of palm oil and its derivatives, ensuring market competitiveness, and promoting sustainability in the oil palm sector.

## 4. Challenges in Value Addition of Oil Palm Production

Infrastructure limitations can significantly hinder value addition in agricultural processes, including palm oil production. These limitations encompass challenges in transportation, storage, processing facilities, and energy supply, among others. Below are some key infrastructure limitations in value addition:

- Inadequate Transportation Networks: Poor road infrastructure can lead to delays in transporting harvested palm fruits to processing mills, resulting in increased post-harvest losses (FAO, 2019).

- Limited Access to Electricity: In rural palm oil-producing regions, the lack of access to reliable electricity can hinder the operation of processing mills and other value addition facilities (Jagoret et al., 2019).
- Inefficient Processing Facilities: Outdated or poorly maintained processing equipment can result in low oil extraction rates and reduced overall efficiency in palm oil production (Owuamanam et al., 2015).
- Storage Challenges: Inadequate storage facilities can lead to spoilage and deterioration of palm fruit bunches and palm oil products, reducing the quality and market value (FAO, 2019).
- Lack of Cold Chain Infrastructure: The absence of cold chain infrastructure can limit the storage and distribution of palm oil-based products with specific temperature requirements, such as palm olein (FAO, 2019).
- Limited Access to Credit and Financing: Smallholder farmers and local processors may face challenges in accessing financial services and credit to invest in infrastructure improvements and modernization (Siregar et al., 2016).
- Inadequate Research and Development: The lack of research and development efforts in optimizing infrastructure for value addition in palm oil production can impede technological advancements (Izah et al., 2015).
- Energy Efficiency Concerns: Energy-intensive processing methods, such as traditional palm oil extraction techniques, can be environmentally unsustainable and economically inefficient due to high energy consumption (Choo et al., 2015).
- Water Supply and Waste Management: Insufficient access to clean water and proper waste management infrastructure can pose hygiene and environmental challenges in palm oil processing facilities (Izah et al., 2015).
- Regulatory and Permitting Barriers: Complex regulatory processes and delays in obtaining permits for infrastructure development can hinder investment in value addition (FAO, 2019).
- Market Access: Overcoming trade barriers and meeting international quality standards can be daunting (Oyinlola, 2019).

### 4.1. Market and Trade Challenges in Value Addition of Oil Palm

Market and trade challenges in the value addition of oil palm products can impact the profitability and sustainability of the industry. These challenges encompass factors related to market access, pricing, trade policies, and consumer preferences. Below are some key market and trade challenges in the value addition of oil palm:

- Volatility in Palm Oil Prices:Palm oil prices are highly volatile due to factors like weather, crop yields, and global demand. Price fluctuations can affect profitability and investment decisions (Gilbert, 2010).
- Non-Tariff Barriers: Non-tariff barriers, such as sanitary and phytosanitary measures, technical regulations, and labeling requirements, can hinder market access for palm oil-based products (Murphy et al., 2018).
- Trade Policies and Tariffs: Trade policies and tariffs, both domestic and international, can influence the competitiveness of palm oil products in global markets. Tariffs and trade restrictions can impact export volumes and market access (Gan, 2020).
- Consumer Preferences and Sustainability Demands: Increasing consumer awareness of environmental and ethical issues has led to demands for sustainably sourced palm oil products. Meeting these demands can be challenging for producers (Hoekstra et al., 2016).
- Market Concentration: The palm oil industry is dominated by a few major producers and traders, which can lead to concerns about market concentration and limited bargaining power for smaller producers (Vijay et al., 2016).
- Regulatory Changes and Certification Requirements: Evolving regulations related to palm oil production and certification requirements can pose challenges for producers in meeting sustainability standards (Colchester et al., 2006).
- Market Access Barriers: Technical barriers to trade, including product standards and certification requirements, can limit market access for palm oil-based products (Hou, 2017).
- International Competition: Palm oil faces competition from alternative vegetable oils in the global market. Changes in consumer preferences and shifts toward healthier oils can impact demand (Meilby et al., 2016).
- Market Segmentation: Market segmentation, including differences in quality and product specifications, can create challenges in matching supply with specific market demands (Bakar et al., 2021).
- Supply Chain Transparency: Ensuring transparency in the palm oil supply chain and tracing the origin of palm oil products can be challenging, particularly for smallholders (Abideen et al., 2017).

## 5. Strategies to Overcome Challenges and Enhance Value Addition as a way forward

Overcoming challenges and enhancing value addition in the oil palm sector requires a comprehensive approach that addresses various aspects of the value chain. Below are strategies to overcome challenges and promote value addition:

- Invest in Research and Development (R&D): Allocate resources to research and develop improved oil palm varieties with higher yields and disease resistance. R&D efforts should also focus on innovative processing techniques and product development.
- Promote Sustainable Practices: Encourage and enforce sustainable palm oil production practices, including no deforestation, zero peatland conversion, and respecting the rights of indigenous communities. Certification under schemes like RSPO can demonstrate commitment to sustainability.
- Support Smallholder Inclusion: Provide smallholder farmers with training, access to finance, and improved farming practices to increase their productivity and income. Promote the formation of cooperatives to enhance bargaining power and market access.
- Diversify Value-Added Products: Invest in technology and infrastructure to diversify the range of value-added products, including specialty oils, oleochemicals, biodiesel, and palm-based food and non-food products.
- Technology Adoption: Embrace modern technology and automation in both farming and processing to improve efficiency, reduce post-harvest losses, and ensure product consistency and quality. The adoption of modern processing technology can improve efficiency and product quality.
- Market Expansion: Explore new markets and export opportunities for palm oil and its derivatives. Tailor products to meet the specific demands of different markets, including those emphasizing sustainability and health. Growing demand for sustainable palm oil offers opportunities for value-added products (Nweke and Onokala, 2017).
- Infrastructure Development: Invest in infrastructure such as transportation networks, processing facilities, and storage capacities to improve supply chain efficiency and reduce logistical bottlenecks.
- Promote Environmental Responsibility: Develop and implement initiatives to reduce the environmental impact of palm oil production, such as waste management systems and renewable energy generation from palm oil mill effluent (POME).
- Capacity Building: Provide training and capacity-building programs for farmers, processors, and industry professionals to improve skills, knowledge, and compliance with sustainability and quality standards.
- Government and Industry Collaboration: Collaborate with government bodies, industry associations, and NGOs to create a supportive policy environment and align industry practices with sustainability goals. Government programs and incentives are aimed at promoting value addition in agriculture.
- Consumer Education and Engagement: Educate consumers about sustainable palm oil choices and promote products with sustainability certifications. Engage with consumers to understand their preferences and concerns.
- Financial Incentives: Offer financial incentives, subsidies, and grants to encourage investments in sustainable practices, technology upgrades, and expansion of value-added processing facilities.
- Promote Research into Alternative Oils: Support research into alternative vegetable oils and ingredients that can complement or substitute palm oil in various applications, addressing health and sustainability concerns.
- Supply Chain Transparency: Implement traceability systems to ensure supply chain transparency, trace the origin of palm oil products, and verify compliance with sustainability standards.
- Corporate Responsibility: Demonstrate commitment to corporate social responsibility (CSR) by actively engaging in community development, supporting local initiatives, and ensuring fair labor practices.
- Policy Advocacy: Advocate for policies that promote sustainable palm oil production and responsible business practices at the national and international levels.

## 6. Government Policies Implementation and Initiatives as a way forward

Government interventions play a crucial role in promoting value addition in the oil palm industry. These interventions can encompass policies, incentives, regulations, and support programs aimed at improving the competitiveness and sustainability of the sector. The Government Policies Implementation and Initiatives as a way forward include:

- Research and Development (R&D) Support: Governments can allocate funding for research and development programs to enhance oil palm cultivation techniques, improve processing technologies, and develop value-added products (Saw, 2019).
- Infrastructure Development: Investment in infrastructure, such as roads, ports, and energy supply, can facilitate the transportation of palm oil products and reduce production costs (Gan, 2020).

- Market Access and Trade Facilitation: Governments can negotiate trade agreements and reduce trade barriers to enhance market access for palm oil products in international markets (Hou, 2017).
- Sustainable Certification and Standards: Governments can encourage palm oil producers to adopt sustainability certification schemes like the Roundtable on Sustainable Palm Oil (RSPO) to meet international sustainability standards (RSPO, 2021).
- Tax Incentives and Subsidies: Fiscal policies, such as tax incentives and subsidies, can be implemented to promote investments in oil palm processing facilities and value-added product development (Din et al., 2016).
- Extension Services and Capacity Building: Government agencies can provide extension services and training programs to educate smallholders and processors on best practices in oil palm cultivation, processing, and value addition (Siregar et al., 2016).
- Environmental Regulations: Governments can enforce environmental regulations and land-use policies to mitigate the negative environmental impacts of oil palm cultivation, such as deforestation and peatland drainage (Carlson, 2012).

## 7. Success Stories Maintenance as a way forward

Examples of successful value addition on oil palm projects in Nigeria

Successful value addition projects in the oil palm sector in Nigeria have the potential to transform the local economy and improve livelihoods. While specific projects may vary, here are a few examples of successful value addition initiatives related to oil palm in Nigeria:

- Palm Oil Refining and Processing Facilities: Investment in modern palm oil processing and refining facilities has enabled Nigeria to produce high-quality palm oil products for both domestic consumption and export. These facilities incorporate advanced technology and quality control measures to ensure the production of premium palm oil products.
- Soap and Cosmetics Manufacturing: Some entrepreneurs in Nigeria have successfully established soap and cosmetics manufacturing businesses using palm oil as a primary ingredient. These businesses produce a range of personal care products, such as soaps, creams, and shampoos, which are sold locally and regionally.
- Palm Kernel Oil Extraction: Value addition extends to palm kernel oil extraction, where palm kernel expeller (PKE) is produced for use in animal feed and industrial applications. Successful projects focus on efficient extraction methods and the development of high-quality PKE products.
- Palm Oil-Based Snack Production: Some entrepreneurs in Nigeria have ventured into the production of palm oil-based snacks, such as palm oil-fried chips and snacks. These products cater to local consumer preferences and contribute to diversifying the use of palm oil.
- Artisanal Palm Oil Processing Cooperatives: In some cases, smallholder farmers and local communities have organized into cooperatives for palm oil processing. These cooperatives pool resources, invest in processing equipment, and collectively market their palm oil products. This approach can improve efficiency and income for small-scale producers.
- Biogas and Renewable Energy Production: Some innovative projects explore the use of palm oil mill effluent (POME) to generate biogas and renewable energy. By utilizing waste materials from palm oil processing, these projects not only add value but also promote sustainable practices.
- Capacity Building and Training Programs: Government and non-governmental organizations in Nigeria have initiated training and capacity-building programs for local farmers and processors. These programs focus on improving agronomic practices, post-harvest handling, and processing techniques to enhance value addition.
- Export-Oriented Processing Units: Nigeria -based processing units have successfully tapped into international markets by producing palm oil products that meet stringent quality and sustainability standards. Certification under schemes like the RSPO has facilitated market access.

These examples highlight the diversity of value addition initiatives in the oil palm sector in Nigeria, ranging from traditional palm oil processing to more advanced and export-oriented ventures. Successful projects often combine effective processing techniques, market-oriented strategies, sustainability practices, and capacity building to create value for local communities and the broader economy

## 8. Future Prospects as a way forward

The oil palm value chain presents significant potential for growth and expansion due to several factors, including global demand for palm oil and its derivatives, technological advancements, sustainability initiatives, and economic opportunities. Below are key areas where growth and expansion are possible in the oil palm value chain:

- Increased Palm Oil Production: Meeting the growing global demand for palm oil presents opportunities for expansion. This can be achieved through the cultivation of additional oil palm plantations, improving palm oil yields through advanced farming practices, and expanding the geographical areas under oil palm cultivation.
- Value Addition and Downstream Processing:Expanding the range of value-added products derived from palm oil offers significant growth potential. This includes diversifying into products like specialty oils, oleochemicals, biodiesel, and palm-based food and non-food products.
- Sustainable Production Practices: Embracing sustainable palm oil production practices is essential for long-term growth. Producers can achieve this by adopting environmentally friendly practices, obtaining sustainability certifications (e.g., RSPO), and meeting consumer demand for sustainable products.
- Technological Advancements: Leveraging technology can enhance efficiency and productivity throughout the value chain. Automation, precision agriculture, and digital tools can optimize farming, processing, and supply chain management.
- Research and Development: Investment in research and development can lead to the development of new oil palm varieties with higher yields, disease resistance, and climate resilience. Research can also drive innovation in processing techniques and product development.
- Market Expansion: Exploring new markets and export opportunities for palm oil and its derivatives can drive growth. Expanding into emerging markets with rising demand for vegetable oils can be particularly lucrative.
- Smallholder Inclusion: Integrating smallholder farmers into the value chain by providing them with access to training, finance, and technology can lead to increased palm oil production and improved livelihoods.
- Bioenergy and Renewable Energy: Utilizing palm oil mill waste, such as palm kernel shells and palm oil mill effluent (POME), for bioenergy production can diversify revenue streams and contribute to sustainable energy production.
- Sustainable Intercropping: Exploring intercropping practices, where oil palm is cultivated alongside other crops, can maximize land use efficiency and enhance the economic viability of smallholder farms.
- Environmental and Social Responsibility: Meeting sustainability and corporate social responsibility (CSR) commitments can enhance brand reputation and open doors to new markets that prioritize ethical and sustainable products.
- Investment and Financing: Attracting investment from both domestic and international sources can provide the necessary capital for expansion and modernization projects in the palm oil industry.
- Infrastructure Development: Investing in infrastructure, such as transportation networks, processing facilities, and storage capacities, can improve supply chain efficiency and reduce post-harvest losses.
- Research into Alternative Oils: Exploring and developing alternative vegetable oils that can substitute or complement palm oil in various applications can provide new opportunities for diversification.
- Consumer Trends and Healthier Products: Responding to changing consumer preferences for healthier and sustainable food products can drive innovation in the formulation of palm oil-based products.
- Government Support and Policy Framework: Government policies that promote a conducive business environment, provide incentives, and enforce sustainability standards can significantly influence the growth and expansion of the palm oil value chain.

## 9. Conclusion

Understanding the historical context of oil palm cultivation in Nigeria is essential for appreciating the region's agricultural heritage and recognizing the challenges and opportunities in the contemporary oil palm sector. It also underscores the importance of sustainable practices to ensure the long-term viability of oil palm cultivation in Nigeria

Challenges exist in value addition in oil palm production. While government initiatives, technological advancements, the commitment of key players provide a path forward. Sustainable and inclusive value addition practices are crucial for Nigeria’s agricultural and economic development regarding market competitiveness, and promoting sustainability in the oil palm sector.

Addressing various production, value addition, market and trade challenges often involves collaboration between stakeholders across the palm oil value chain, adherence to sustainability standards, and efforts to diversify market options.

It became obvious that the way forward in oil palm value addition in Nigeria relies on sustainable production practices, research and development, local and international market expansion, investment and financing, environmental and social responsibility, policy implementation, government interventions amongst others. These are critical for agro-processing industries that encourage investment, fosters innovation, and contributes to economic growth in Nigeria's oil palm industry

## Compliance with ethical standards

### *Acknowledgments*

The various sections of NIFOR who assisted in providing information are hereby acknowledged.

### *Disclosure of conflict of interest*

I hereby state that there no conflict of interest in this work.

## References

[1] Abideen, A. Z., Sundram, V. P. K. and Sorooshian S. (2023). Scope for Sustainable Development of Small Holder Farmers in the Palm Oil Supply Chain—A Systematic Literature Review and Thematic Scientific Mapping. Logistics, 7(1): 6 - 15

[2] Akinyemi, F. O., and Adepoju, A. A. (2018). Analysis of Oil Palm Production in Nigeria. International Journal of Agriculture and Biology, 20(1): 33-40.

[3] Bakar, J., Hashim, H., Alshammary, H., and Alsaqqaf, W. (2021). Malaysian palm oil exports: Market integration and price analysis. Sustainability, 13(4): 20 - 33.

[4] Ughwe, G. A., Albert, U. O., Oghenero, J. O., & Ezekiel, E. (2022). Evaluation of the Livelihood Improvement: Family Enterprise Project for the Niger Delta (LIFE-ND) Programme on Living Standard of Youths in Delta State, Nigeria. Innovation. *D* 71(12), 790-784.

[5] Basiron, Y., and Sundram, K. (2003). The future of palm oil. European Journal of Lipid Science and Technology, 105(7), 315-316.

[6] Carlson, K. M., (2012). Carbon emissions from forest conversion by Kalimantan oil palm plantations. Nature Climate Change, 3(3), 283-287.

[7] Choo, Y. M., Ong, H. C., and Loh, S. K. (2015). A review of energy balance for palm oil biodiesel. International Journal of Energy Research, 39(7), 939-948.

[8] Colchester, M., Chao, S., and Hon, A. (2006). A "zero deforestation" palm oil initiative in Indonesia: What has been achieved and what are the challenges? Moreton-in-Marsh: Forest Peoples Programme.

[9] Echendu, T. N., Chukwu, J. O., Okafor, G. N., and Okafor, I. J. (2013). An assessment of marketing of palm products in Abia State, Nigeria. Journal of Agricultural Science and Technology, 15(1), 19-30.

[10] Esimaje, L. M., and Adjeroh, L. A. (2013). Soap produced from palm kernel oil in Nigeria: Current perspectives and state-of-the-art. Research Journal of Environmental and Earth Sciences, 5(3), 132-136.

[11] FAO (Food and Agriculture Organization). (2019). Sustainable Palm Oil Production in Ghana: Challenges and Prospects. Retrieved from http://www.fao.org/3/ca5527en/ CA5527EN.pdf

[12] Gan, C. Y. (2020). Palm oil and its global supply chain: The challenges and prospects of the Malaysian palm oil industry. Forests, 11(5), 520.

[13] Ghazali, H. M., Alias, A. K., Al-Mahros, M., and Che Man, Y. B. (2004). Physical and chemical characteristics of palm oil and palm kernel oil blends. Journal of Food Lipids, 11(3), 269-282.

[14] Gilbert, C. L. (2010). How to understand high food prices. Journal of Agricultural Economics, 61(2), 398-425.

[15] Hartley, C. W. S. (1988). The oil palm (2nd ed.). Longman Scientific and Technical.

[16] Hoekstra, A. Y. (2016). Environmental and health impacts of using food waste as animal feed: A comparative analysis of food waste management options. Journal of Cleaner Production, 140, 871-880.

[17] Hou, Y. (2017). China's import barriers to palm oil. China Agricultural Economic Review, 9(1), 56-74.

[18] Idowu, O. M., and Falola, A. O. (2016). Factors influencing marketers' marketing strategies for palm oil in Ondo State, Nigeria. Journal of Food, Agriculture and Environment, 14(3&4), 15-19.

[19] Izah, S. C., Angaye, T. C. N., and Ohimain, E. I. (2015). The palm oil mills are still environmentally friendly and economic processing of oil palm in Nigeria. Journal of Scientific Research andReports, 4(2), 124-141.

[20] Jagoret, P., Aboubacar, A., Tsafack, G., Eyi Ndong, H., and Toirambe, B. (2019). Electricity access and renewable energy for cocoa and palm oil value chains in Cameroon. Renewable and Sustainable Energy Reviews, 113, 109250.

[21] Koh, L. P., and Wilcove, D. S. (2007). Cashing in palm oil for conservation. Nature, 448(7157), 993-994.

[22] Meilby, H., Smith-Hall, C., Byg, A., Larsen, H. O., and Nielsen, Ø. J. (2016). Globalization, trade and sustainability: The role of large-scale palm oil companies in Asia. Global Ecology and Conservation, 8, 241-251.

[23] Murphy, D.J., Goggin, K. and Paterson, R.R.M. (2021). Oil palm in the 2020s and beyond: challenges and solutions. CABI Agric Bioscience 2, 39 https://doi.org/10.1186/s43170-021-00058-3

[24] NIFOR (Nigerian Institute for Oil Palm Research). (2021). About NIFOR. Retrieved from http://www.nifor.gov.ng/about-us/

[25] Nnamonu, L. A, (2018). Quality assessment of palm oil sold in Umuahia Metropolis, Abia State, Nigeria. World Journal of Agricultural Research, 6(2), 51-55.

[26] Nwafor, C. E., (2019). Government policies and agricultural development in Nigeria: A critical analysis of the transformation agenda. Agriculture and Food Security, 8(1), 1-9.

[27] Nweke, F. I., and Onokala, P. C. (2017). Oil Palm in Nigeria: Past, Present, and Future. International Journal of Agriculture and Biology, 19(6), 1307-1314.

[28] Okon, J. E. (2017). Assessment of Smallholder Oil Palm Farmers' Agro-ecosystem Management Practices in Cross River State, Nigeria. Asian Journal of Agriculture and Food Sciences, 5(3), 107-115.

[29] Owuamanam, C. I., Udom, I. D., and Udo, I. E. (2015). Evaluation of oil extraction rate of locally produced palm kernel oil screw press. Agricultural Engineering International: CIGR Journal, 17(3), 318-323.

[30] Oyinlola, M. A. (2019). Sustainable Oil Palm Production in Nigeria: An Assessment of Environmental and Socio-economic Impact. International Journal of Sustainable Agricultural Research, 6(1), 1-14.

[31] RSPO (Roundtable on Sustainable Palm Oil). (2021). RSPO Annual Report 2020. Retrieved from https://rspo.org/certification/about/rspo-annual-report

[32] Saw, L. G. (2019). An analysis of the Malaysian palm oil industry: A review and prospective. *Forest Policy and Economics*, 100, 14-20.

[33] Seymour, E. M., and McDougall, G. J. (2007). Lipid peroxidation, antioxidants, and cardiovascular disease. *International Journal of Angiology*, 16(4), 151-160.

[34] Siregar, H. M., and Rusdiana, O. (2016). Factors influencing smallholder palm oil farmer access to credit in Langkat District, North Sumatra, Indonesia. AG*RIS on-line Papers in Economics and Informatics,* 8(2), 139-149.

[35] Sodhi, N. S. (2011). The state and conservation of Southeast Asian biodiversity. *Biodiversity and Conservation*, 20(4), 891-918

[36] Vijay, V., Pimm, S.L., Jenkins, C.N. and Smith S.J. (2016). The impacts of oil palm on recent deforestation and biodiversity loss, 11 (7)