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Competitiveness of Oil Palm Production Systems in Nigeria: A Policy Analysis Matrix Approach

Abdul-Qadir, M. I[1*], Okoruwa, V. O.[2] and Salman, K. K.[3]

[1]*Nigerian Institute for Oil Palm Research (NIFOR), Benin City, Edo state, Nigeria.*
[2, 3] *Department of Agricultural Economics, Faculty of Agriculture and Forestry, University of Ibadan, Ibadan, Nigeria*
abdurauf2007@gmail.com

Abstract

There is demand-supply gap in palm oil production in the country, coupled with non-attainment of self-sufficiency in palm oil production in the country. Therefore, this study evaluates the competitiveness of oil palm production systems in Nigeria using policy analysis matrix. Data were collected with multistage sampling procedures through the administration of well-structured questionnaires. The results showed that oil palm production in Nigeria is classified into small, medium and large scale systems and the three systems are competitive in the production of palm oil and palm kernel under existing market prices. The private profits for the three production systems, the large, medium and small scale were ₦1, 131,350, ₦ 607,443 and ₦ 99,640 respectively, which indicates that the large scale system is more competitive at private levels followed by medium scale system. The social profits for small, medium and large scale systems were ₦ 773, 649, ₦ 1,023,067 and ₦ 1,417,059 respectively, which implies comparative advantage of all the systems confirmed by DRC of 0.3806, 0.3639 and 0.2668 for small, medium and large scale systems respectively. Thus, Nigeria has comparative advantage in palm oil production for export. The net transfer and subsidy ratios were negative, which display poor protectionist policies and overall transfer of resources away from the production systems. In this study, it is concluded that palm oil production in Nigeria is competitive at private and social levels.

Keywords*: Competitiveness, Oil palm, production systems, Policy analysis matrix, Nigeria.*

1. Introduction

The oil palm originated in West Africa and was taken to Malaysia (then Malaya) by the colonial rulers in the 1870s [1]. The oil palm belt of Africa runs through Sierra Leone, Liberia, Ivory Coast, Ghana, Togo, Benin, Nigeria, Cameroons the People's Republic of Congo and the Democratic Republic of Congo. In West Africa, the belt is narrow because of the rapid decline in rainfall northwards. Thus, in Nigeria there are no semi-wild palms north of about 7^{o} N, except where there are shallow water table such as near the Jos Plateau [2]. It produces palm oil and palm kernel oil with multiplicity of uses. It is used for food and non-food products. Examples of food use are cooking oil for households and food industry, shortening, margarines, cocoa butter substitutes and key ingredient in instant noodle production as well as animal feed. Examples of non-food use include Oleo-chemicals, biodiesel and personal care products. Besides food and non-food uses of palm oil, it also has health benefits. Health importance of palm oil is derived from its balanced composition of saturated and unsaturated fatty acids *e.g.* ., saturated palmitic acid (44%), monounsaturated oleic acid (40%) and polyunsaturated fatty acids (10%). Others are high

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carotene content (15 times higher than carrots and 50 times higher than tomatoes), low cholesterol content and no risk of trans-fatty acids; hence it is a good substitute of trans-fat, which has high level of cholesterol. It contains vitamin E, tocopherols and highest content of tocotrienols among edible oils. It meets Food and Agriculture Organisations (FAO) of the United Nations and World Health Organization (WHO) food standard [3]. Palm kernel also produces oil that is useful for most of the aforementioned benefits specifically manufacture of soap and the residue left after oil extraction, Palm Kernel Cake (PKC) is used for animal feed.

Palm oil industry in Malaysia has been an important subsector in the development of that country and in the world supply of dietary oils and facts in the last 30 years. Without the large volume of exported palm oil from Malaysia and Indonesia, there would be a major problem in meeting world demand for vegetable oil [1]. The palm oil industry in Malaysia is the fourth largest contributor to the country's Gross National Income (GNI), accounting for about 8% or equivalent to US$ 13.2 billion [4] while that of Indonesia contributed the sum of US$ 438.8 billion to her economy in 2007 [5]. In Nigeria, the oil palm contributed ₦104 billion and ₦ 115 billion to Gross Domestic Products (GDP) in 2010 and 2011 respectively [6].

Annual national demand of palm oil is 1.6 million MT while domestic supply is 1.3 million MT. The deficit of 0.3 million MT is met through import where the nation annually expends an average of ₦ 77.5 billion – US$500 million [7]. Consequently, there is depletion of foreign exchange through palm oil import, loss of premier position of being the world largest producer of palm oil and non-attainment of self-sufficiency in palm oil production in the country. Indonesia, has about 9 million hectares under oil palm with palm oil output of 33.5 million MT, Malaysia has a planted area of 5 million hectares with palm oil output of 21 million MT, Thailand has 700,000 hectares with palm oil output of 2.25 million MT while Nigeria has a planted area of 500,000 hectares with palm oil output of 1.3 million MT as at 2010 [8]. This calls for question; what are the causes of poor growth and development of the Nigerian oil palm industry? Therefore, this study examines the competitiveness of the oil palm production systems in Nigeria.

2. Theoretical Framework and Literature Review

2.1. Theoretical Framework

The underlying theoretical framework for this study is Asset-Processes-Performance (APP) theory. The APP framework states “Competitiveness involves a combination of assets and processes for optimum performance” [9]. It integrates resources to performance through production processes. [10] Underpinned the competitiveness of India’s agrifood chain using APP framework. The APP framework reflects in this study by its ability to explain the major determinants (asset and process) of competitiveness of oil palm production systems in Nigeria.

Competitiveness is a multidimensional concept use for performance measurement at firm, sectoral and national levels. Researchers are interested in which sector can contribute the most to a nation’s economic growth and they often turn to the concept of competitiveness as a basis for analysis [11]. Competitive forces drive productivity growth and the way to more competitive market is to put consumers’ interests first [12]. Competitiveness is the ability of companies, industries, regions and nations to generate, while being exposed to international competition, relatively high factor income and employment levels on a sustainable basis [13]. It is a sustained rise in the standards of living of a nation or region and as low a level of involuntary unemployment as possible [14]. It is the ability to sell products that meet demand requirements (price, quality and quantity) and at the same time, ensure profits overtime that enable the firm to thrive. The competitiveness of the agricultural sector is protected in developed worlds [11], while

protection of the agricultural sector is poor among developing countries thus affecting the competitiveness of the sector in such nations.

[15] explained competitiveness as follows; for company, it is the ability to supply products and services more effectively and efficiently than the relevant competitors. In trade sector, it means sustained success in international markets without protection or subsidies. It involves more of benefits obtained through superior productivity. Measures of competitiveness in the trade sector include firm profitability, the firms export quotient (export divided by output), regional or global market share and performance in the international markets. Competitiveness at the industry level is the ability of the nation's firms to achieve sustained success against foreign competitors without protection or subsidy and this is a better indicator of the economic health of a nation than competitiveness of a single firm which may be due to monopoly. Competitiveness at the national level means the ability of the nation's citizens to achieve a high and rising standard of living and is measured by the growth of aggregate productivity, standard of living, firms' penetration of export market and foreign direct investment.

[16] Posited that "national prosperity is created and not inherited, it does not grow out of a nation's natural endowments, its labour pool, its interest rates, or its currency value, as classical economics insists. The author emphasize that a nation's competitiveness depends on the capacity of its industry to innovate and upgrade." This study defines competitiveness as the ability of investors to operate at profitable and sustainable levels at domestic and international scene. Competitiveness can also be determined by the comparative advantage a nation has in the production of certain commodities and the higher the comparative advantage the higher the competitiveness.

The theory of comparative advantage emphasizes trade between parties or nations which have comparative advantage in the production of different goods [17]. This leads to specialization and welfare improvement among the participants. A nation has comparative advantage in the production of a particular good if the relative price of that good is low compare to other countries. Comparative advantage, whether driven by technology or factor endowment leads to differences in supply and demand [17]. The technological difference is explained by the Ricardo's theory while the resource/factor endowment difference is explained by Hechscher-Ohiln (H-O) theory. Thus, The Ricardian and H-O theories are chosen as underlying theoretical frameworks for this study.

The Ricardian theory states "A country exports that commodity in which it has a comparative labour-productivity advantage". The Hechscher-Ohiln theory states "countries differ in comparative advantage with respect to their factor intensities namely, land, labour and capital that are used in the production of goods and services". Though there are different reasons for comparative advantage, the H-O theory isolates factor endowments as the basic determinant of comparative advantage [18]. This theory explains causes of differences in comparative advantage between countries. Thus, the H-O theory clarify that the basic resource differences between countries determine the location of production, which most trade theories could not elucidate [18]. These frameworks reflect in this study in explaining the importance of (resource availability) in respect of oil palm production in Nigeria. The frameworks served as guide on the investigation of availability of basic resources (land, labour, capital and suitable climatic conditions) for oil palm production in Nigeria. From the above, the roles of competitiveness for performance measurement are invaluable; hence it is used in this study to measure the performance of the Nigerian oil palm production systems. Firms' effectiveness determines industrial competitiveness while industries' effectiveness determines national competitiveness.

2.2. Literature Review on Policy Analysis Matrix Studies

[19] Examined yam production in Nigeria using PAM and found that yam enterprise was profitable in the country, government intervention was positive on output and Nigeria

has comparative advantage in yam production. [20] Used PAM and established that Nigeria cassava and maize growers do not have comparative advantage in the production of these commodities for export but local and regional demand creates a viable market for maize and cassava tubers while Nigerian farmers have comparative advantage in rice production in the country. [21] Determined the comparative advantage, government protection and competitiveness of rice processing in Nigeria using PAM. The result showed that government protection was positive and there is comparative advantage in processing paddy rice into basic milled rice. [22] Evaluated the competitiveness of different geographic areas and farming systems in producing a variety of agricultural commodities using DRC ratio. Findings indicate that the most competitive crop is groundnuts, while sunflower and Virginia tobacco become relatively more competitive in drier ecological zones. Maize, despite taking the lion's share of cultivated land, is only competitive in two ecological zones where it ranks last in its efficiency in using domestic resources. The study reports that emphasis on maize production may not be warranted and that removal of maize subsidies would boost the production of other crops.

[23] Assessed the competitiveness and Comparative Advantage of Tree Crop Smallholdings in Papua New Guinea using Domestic Resource Cost (DRC) ratio. The study found that DRC ratios for competitiveness of cocoa, copra, coffee, and palm oil were 0.52, 0.99, 0.44 and 0.43 respectively while their comparative advantage were 0.30, 0.55, 0.28, and 0.23 respectively at the farm gate level. At point of export, DRC ratios for competitiveness of cocoa, copra, coffee and palm oil were 0.43, 0.91, 0.26 and 0.27 respectively while comparative advantage were 0.26, 0.51, 0.17 and 0.16 respectively. [23] Concluded that coffee, cocoa and palm oil are internationally competitive and have a comparative advantage at all levels while the copra industry has comparative advantage throughout the study period but only gained competitiveness after devaluation. Devaluation improved competitiveness and comparative advantage at all levels for commodities but coffee and palm oil are more efficient in earning foreign exchange than the other two commodities.

[24] While assessing the competitiveness of pineapple production in Osun state, Nigeria used PAM approach. The results revealed that the crown and sucker production techniques were privately profitable at N550, 438/ha and N679, 138/ha respectively and socially profitable at N730, 228/ha and N841, 828/ha respectively with Sucker production technique having higher competitiveness. Nominal protection on input and output and the effective protection coefficients for the two production systems indicated presence of tax and that the producers were not protected by policy. The study recommends provision of incentive structures that will protect the pineapple producers.

Most of the aforementioned studies differ from this present study in terms of enterprise type except study by [23], which evaluated the competitiveness of tree crop enterprises. However, while [23] compared the competitiveness of four different tree crops, this present study examined the competitiveness of different production systems of the same crop (oil palm) with PAM framework. The weakness of DRC ratios would have affected the precision of the results obtained by [23]. In other words, their results would have been more robust if PAM framework with alternative methodologies for profitability measurement was used for the study rather than DRC ratio alone. [23] also noted that the devaluation increase the competitiveness of the agricultural commodities but did not consider the effect of devaluation on other sectors of the economy. The effect of government intervention, comparative advantage and competitiveness of production systems measured by most of the previous studies reviewed above are the focus of this study.

2.3. Literature Review on Oil Palm Studies

The oil palm provides direct employment to about 4 million Nigeria people in 20 oil palm growing states and indirectly to other numerous Nigerians involved in palm oil processing and marketing [25]. Improved processing techniques can be used to increase palm oil and palm kernel production in Nigeria [26]. [27] Reported that stagnation in the oil palm sector in Nigeria was prodded by poor producer price by the marketing board and the 30 months civil war of 1967 to 1970, which affected the eastern states that was the prime production area at that time. In addition, the author found that improved processing technology enhance net returns from processing. [28] Reported high demands of palm oil for export and increased return from palm oil processing in Ghana by medium and large scale farmers. In addition, the study discloses that the business of the small scale processors in Ghana is at the risk of collapsing because the large scale mills, which benefits from economies of scale and higher efficiency, are able to offer lucrative prices to farmers for their fruits. [29] Reported that the small scale processors are inefficient and not profitable.

In a study on palm oil value chain analysis in the Niger Delta, [30] found some major challenges affecting the competitiveness of Nigeria palm oil sector. These are the dominant presence of the wild groves and smallholder farms in the production system characterised by low yield, inefficient processing technologies that are extracting 25-50% of the oil content, serious management challenges of most of the government owned farms, fragmented relations and poor coordination between the actors in the value chain. [31] Examined the constraints of oil palm production in Ife Central local Government Area (LGA) of Osun state, Nigeria. The result of the study found that lack of land, funds, reliance on production from the groves and inadequate information and cultivation knowledge were the major problems limiting oil palm production in the area.

2.4. Policy Analysis Matrix Framework

Policy Analysis Matrix (PAM) is an analytical tool developed by [32] and augmented by [33]. It measures the impact of policy on competitiveness and farm-level profits, the influence of investment policy on economic efficiency and comparative advantage and the effects of agricultural research policy on changing technologies [32]. In other words, the PAM approach helps to estimate private profitability, social profitability and policy transfer effects of different agricultural production systems, technologies, agro-ecological zones *etc*. It uses farm budget data of inputs costs and sales revenues valued at market and social prices. The determination of private profits, which is valued at market prices shows the farmers that are currently competitive and how their profits could change with adjustment in price policies. This is useful information to ministry of agriculture who administers the policy of price control.

The social profits, calculated at efficiency prices, measure the economic efficiency or comparative advantage of the production systems. Thus, it provides information on how additional public investment might change the current efficiency. This is relevant to development planners who allocate capital budget to increase efficiency and national income. Policy transfer effects provide information on how best to allocate funds for agricultural research to raise crop yield or reduce social costs, thereby increasing social profits. Absence of market failure or distortion policy *e.g.* ., tax converges the private and social profits while their presence cause the two profits to diverge and their divergence calls for policy intervention. The inputs are subdivided into tradable *e.g.* ., fertilizer, herbicides, pesticides, seeds, *etc*. and non-tradable factors also called domestic factors *e.g.* .,. land, public services, capital items such as finance and real estate, *etc*.

2.5. Data and Modelling Assumptions

The oil palm is a permanent crop, so time series data for the period 1984 – 2013 was used for the study. Primary data used include the quantities and market prices of inputs and outputs *e.g.* .,. labour used, capital items, fertilizer, agro-chemical, farm size, seeds, yields, storage costs and production subsidy. Others are data for estimating the efficiency prices of non-tradable items like labour, repair of capital items and transportation, which were sourced from farmers, processors and marketers. Secondary data such as efficiency prices of input and output, port charges, tariffs on cif were obtained from Customs and Excise Divisions, importers, wholesalers, National Bureau of Statistics (NBS), Central Bank of Nigeria (CBN) and ministry of agriculture,

Farm budget information comprising sales revenues and input cost collected from the field in respect of the oil palm production systems was used for construction of the PAM framework. The ruling market prices obtained from the field for the survey period were used as private prices. Social prices for input and output were calculated based on export parity prices with information such as world reference prices, subsidized prices, free on board (fob), cost insurance and freight (cif), exchange rates obtained from CBN website. Lagos port was used as the farm-gate location for comparing the market and reference prices of palm oil. Transportation costs from the farm locations in Edo and Kogi (the study areas) to the port in Lagos were collected and used for analysis. The shadow exchange rate used in this study accounted for the opportunity cost of foreign currency. The exchange rate for the period covered by this study was obtained from CBN website and the mean exchange rate for the period was 155, which was used for the calculation of parity prices. The data collected during the field survey were inputted into the PAM software for computation of the parity price. Equation 1 displays the model for import parity calculation.

$$IPP = (CIF\times SER)+IMT+HCB+(TCBM+MCBM)+(TCMF+MCMF) \quad (1)$$

Where, CIF is cost of insurance and freight, which is equivalent to import price of goods at point of entry, SER is shadow exchange rate, IMT is import tariff (port), HCB is handling cost at border, TCBM is transport cost from border to market, MCBM is marketing cost from border to market, TCMF is transport cost from market to farm gate, MCMF is marketing cost from market to farm gate.

2.6. Social Valuation of Non-Tradable

Social prices of land, labour, capital, building, water, maintenance and repair cost were determine at the domestic economy of the country. Shadow price was used for factor whose market price was not available. The private land rental rate was used as proxy for the private price of land. For labour, the work of [34] was adapted in this study. Social valuation of labour was obtained by dividing labour into peak-season and off-season components. The wage rate in the peak-season is the opportunity cost of labour for the period considered and the opportunity cost of labour during the off peak season period is half the prevailing wage rate [24]. Thus, equation 2 presents the social price of labour.

$$P_L = \frac{W_p+0.5W_0}{2} \quad (2)$$

Where; P_L is social price of labour, W_P is prevailing wage rate in peak season, W_O is prevailing wage rate in off peak season. The social price of land was the opportunity cost (net return/profits) of land assuming the land was used for next best alternative *e.g.* .,. cocoa production. This is difficult to measure, so the social price of land in this study was calculated as the ratio of net return to land.

2.7. Sensitivity Analysis

Sensitivity analysis was performed in this study, to investigate the effects of changing variables on the competitiveness and policy indicators of the Nigerian oil palm production systems. [35] Observed that PAM is a static model, which cannot capture the possible changes in policy parameters and productivity. Therefore, sensitivity analysis was carried out to overcome the static weakness of policy analysis matrix. It was used to measure the response of some profitability ratios on changes in productivity, exchange rate and free on board (fob). [32] Described the rationale for sensitivity analysis as expounded below. Estimation of social prices of factors are approximations of their true values, so sensitivity analysis in PAM is imperative to examine the robustness of PAM results. Input substitution has positive impact when factor price changes are very large but adequate data to measure the effects of input substitution do not exist in most empirical situations, so sensitivity analysis is necessary to test the effects of assumed parameters on PAM results. It provides a way of assessing the impact of changed assumptions and errors in estimating profitability with private and social prices.

3. Methodology

3.1. Study Area

The study was carried out in South-south and North-central geo-political zones of Nigeria. The choice of these two zones was based on the intensity of oil palm production in these areas and the variation in the ecologies of the two zones. South-south is a zone of high production while North-central represents a zone of low production. Edo and Kogi states were selected from South-south and North-central zones respectively. Agriculture provides employment and income for about 75% of the population of Edo and Kogi states, though traders, artisans, professionals in various fields are also found in the area. The area is characterized by wet and dry seasons of 7 - 8 months and 4 - 5 months respectively. Annual rainfall ranges from 2,500 mm in the forest zone to 700 mm in the Guinea savanna [36]. The climatic conditions prevailing in this area is favourable for oil palm production.

3.2. Sources and Method of Data Collection

Primary and secondary data were used for this study. Secondary data were collected from Journals, bulletins and catalogues of institutions such as Nigerian Institute for Oil palm Research (NIFOR), Central Bank of Nigeria (CBN), National Bureau of Statistics (NBS), Food and Agriculture Organization (FAO) of the United Nations, and other relevant materials. The primary data were collected using cross-section survey, which entails the administration of well-structured questionnaire to the various actors along the oil palm value chain (producers, processors, marketers, *etc*.). The questionnaires were used to elicit information such as socioeconomic characteristics, prices, quantities of inputs and outputs including labour, capital, farm size, ffb yield, seeds, herbicides, pesticides and fertilizer. Data such as exchange rate, tariffs, fob and cif of palm oil were obtained through secondary sources. Data were collected from farmers, processors and marketers using respondent identified as having full knowledge of socioeconomic or demographic characteristics, oil palm production, processing and marketing data. The study employed the services of Agricultural Development Project (ADP) extension agents in each state for questionnaire administration. The ADPs in Edo and Kogi states were visited for logistic and survey plan during questionnaires administration. The ADP provided personnel that led the survey team and interpreted the local language of the people.

3.3. Policy Analysis Matrix

Investigating the level of competitiveness among oil palm production systems in Nigeria was analysed using Policy Analysis Matrix. The PAM methodology of [32] was adapted in this study as displayed in Table 1 below.

Table 1. Illustrative Policy Analysis Matrix

	Revenues	Cost of tradable inputs	Cost of domestic factors	Profit
Private prices	A = $p_i^p q_i^p$	B = $\sum a_j p_j^p q_j^p$	C = $\sum b_k p_k^p q_k^p$	D = π^p
Social Prices	E = $p_i^s p_i^s$	F = $\sum a_j p_j^s q_j^s$	G = $\sum b_k p_k^s q_k^s$	H = π^s
Divergences	I = (A – E)	J = (B – F)	K = (C – G)	L = (D – H)

Source: Monke and Pearson (1989)

Where, A = private revenue, B = tradable input cost (*e.g.*, fertilizer, herbicides, pesticides, seeds, and so on), C = domestic factor cost such as land, labour, capital, *etc*., D = private profit, E, F, G and H are social values of A, B, C and D respectively. The divergences denoted by letters I, J, K and L were obtained as shown in Table 2 below. Quantities of inputs and outputs with their respective unit prices, exchange rate, fob, tariff, transport costs *etc*. were inputted into PAM software, which produced the PAM results. Others are p_i^p = price of output in private prices, q_i^p = quantity of output in private prices, a_j = tradable input coefficients, p_j^p = price of tradable input in private prices, q_j^p = quantity of tradable input in private prices, b_k = domestic input coefficients, p_k^p = price of domestic input in private prices, q_k^p = quantity of domestic input in private prices, π^p = private profit, p_i^s = output price in social prices, q_i^s = quantity of output in social prices, p_j^s = tradable input price in social prices, q_j^s = quantity of tradable input in social prices, p_k^s = domestic input price in social prices, q_k^s = quantity of domestic input in social prices, π^s = social profit.

Table 2. Relationships among the Parameters in Table 1.

Letters	Relationships
1**,** Private profits (D)	D = A – (B + C)
2. Social profits (H)	H = E – F – G
3. Output Transfer (I)	I = A – E
4. Input transfer (J)	J = B – F
5, Factor transfer (K)	K = C - G
6. Net transfer (L)	L = D – H or L = I – J – K

Source: Adapted from Akande and Ogundele, 2007.

3.4. Measurement of Private Profitability

Measures of private profitability in PAM include private profits, Private Benefit-Cost Ratio (PBCR) and Private Cost-benefit Ratio (PCR).

3.4.1. Private Profits D:

This is the difference between the private revenue (A) and private cost (B+C) as expressed in equation 3 below.

Private Profits D = A - (B + C) (3)

D > 0 = competitiveness, D = 0 = break even, D < 0 = non- competitiveness

3.4.2. Private Benefit-Cost Ratio (PBCR):

This is the ratio of private revenues to private costs. It is expressed in equation 4 below.

Private Benefit-Cost Ratio (PBCR) = A/ (B+C) (4)

PBCR > 1 = competitiveness, PBCR = 1 = break even, PBCR < 1 = non-competitiveness

3.4.3. Private Cost-Benefit Ratio (PCR):

This is the ratio of domestic factor costs (C) to value added in private prices (A - B). It is defined as shown in equation 5 below.

Private Cost-benefit Ratio (PCR) = C/ (A - B) (5)

PCR > 1 = non-competitiveness, PCR = 1= break even and PCBR < 1 = competitiveness

3.5. Measurement of Comparative Advantage

Indicators of comparative advantage in PAM are Social Profits (H), Domestic Resource Cost (DRC), Social Cost-Benefit Ratio (SCBR) and Social Benefit-Cost Ratio (SBCR).

3.5.1. Social Profits (H):

This is the difference between revenue in social prices and costs in social prices. It is defined in equation 6 below.

Social Profits (H) = E – (F + G) (6)

Positive social profits (H) indicates positive social valuation and thus comparative advantage or efficiency.

3.5.2. Domestic resource cost (DRC):

This is the ratio of domestic resource (G) in social prices to value added (E-F) in social prices as displayed in equation 7 below.

$$\boldsymbol{DRC} = \frac{Domestic\ Factors_{social\ prices}}{(Output - Tradable\ inputs)_{social\ prices}} \quad \text{i.e. } G/(E - F) \qquad (7)$$

DRC < 1 means it costs less in domestic resources to generate an additional unit of foreign exchange. Thus, it is cheaper for the country to produce such commodity locally than to import it. This is an indicator that the country has comparative advantage in the production of that commodity.

3.5.3. Social Benefit-Cost Ratio (SBCR):

This measures how much is generated by each unit of investment. It is the ratio of social revenues to social costs and it is relevant for comparison of unlike systems. It is expressed in equation 8 below.

$$SBCR = \frac{(Revenues)_{social\ prices}}{Tradables + Domestic\ factor}$$ i.e. E/ (F + G) (8)

SBCR > 1 means an activity is profitable, SBCR = 1 implies break even and SBCR < 1 infers that an activity is not profitable.

3.6. Measurement of Government Protection

Government interventions are measured by Nominal Protection Coefficient (NPC), Effective Protection Coefficient (EPC), Profitability Coefficient (PC), Net transfer and Subsidy Ratio to Producers (SRP).

3.6.1. Nominal Protection Coefficient (NPC):

It has input and output approach; The NPC on tradable outputs (NPCO) The NPCO and NPCI are defined in equations 9 and 10 respectively.

$$NPCO = \frac{Output_{market\ prices}}{Output_{social\ prices}}$$ i.e. A ÷ E (9)

$$NPCI = B/F$$ (10)

NPCO < 1 indicates the presence of tax (tariff) on output, NPCO > 1 shows the presence of subsidy and NPCO = 1 (in the absence of market failures) reveals the absence of intervention but NPCI < 1 implies subsidy, NPCI > 1 implies tax.

3.6.2. Effective Protection Coefficient (EPC):

This is defined as ratio of value added in private prices to value added in social prices as shown in equation 11 below.

$$EPC = \frac{(Output - Tradable\ inputs)_{mkt\ prices}}{Output - Tradable\ inputs_{social\ prices}}$$ **i.e.** (A – B) ÷ (E – F) (11)

EPC < 1 indicates negative effect of policy (tax), EPC > 1 indicates subsidy

3.6.3. Profitability Coefficient (PC):

This is the ratio of private profit (D) to social profit (H). It is defined as shown in equation 12 below.

Profitability Coefficient (PC) = D/H (12)

PC < 1 means distorting policy or market failure affecting the system, PC > 1 indicates subsidy to the system.

3.6.4. Net Transfer (L):

This is calculated as private profit D less social profit H.

Net Transfer (L) = D/H or I - (J+K) (13)

L < 0 shows distorting policy or market failure, L > 0 indicates Subsidy and L = 0 in the absence of market failure signifies no intervention.

3.6.5. Subsidy Ratio to Producer (SRP):

This is the ratio of net policy transfer (L) to social revenues (E). It is expressed as shown in equation 14 below.

$$\text{Subsidy Ratio to Producer (SRP)} = L/E \quad (14)$$

SRP > 0 means subsidy and SRP < 0 implies tax.

3.7. Sensitivity Analysis

Sensitivity analysis was performed in this study, to investigate the effects of changing variables (productivity, exchange rate and free on board (fob). on the competitiveness and policy indicators of the Nigerian oil palm production systems.

4. Results and Discussion

4.1. Measurement of Competitiveness

Oil palm production in Nigeria is subdivided into small, medium and large scale systems. The small scale farmers operate ≤ 10 hectares (ha) oil palm plantations, medium (11 – 50 ha) while the large scale farmers have ≥ 51 hectares. The competitiveness of the Nigerian oil palm production systems analysed with Policy Analysis Matrix (PAM) methodology are shown in Table 3, The results indicate that the large scale system is more competitive followed by medium scale system based on the magnitude of their private profits. The comparison of the three production systems in respect of private profitability, comparative advantage and government protection is presented in Table 4. The PAM results were consistent with the findings of [36] and [23].

4.2. Private Profitability

The PAM results as shown in Table 4 revealed that the private profits of the three production systems, the small, medium and large were ₦ 99,640, ₦ 607,443 and ₦ 1,131,350 respectively. Private profits measure competitiveness of investment at market prices. Though the large scale production system was more profitable followed by medium scale system, the private profits were positive across the three production systems, which indicates that the major actors (oil palm farmers, processors and marketers) are competitive at the ruling market prices. The Private Cost-benefit Ratio (PCR) were 0.8241, 0.4855 and 0.3094 for small, medium and large scale production systems respectively. The lower PCR of the large scale and medium scale production systems indicates higher competitiveness among the three production systems. Private Benefit-Cost Ratio (PBCR) shows the amount generated by each naira invested in both tradable and non-tradable inputs measured in private prices. It is higher in large scale system, followed by medium and small scale systems in order of magnitude of their profitability as shown in Table 4.

4.3. Comparative advantage

Table 4 presents the summary statistics of the indicators of comparative advantage in PAM. The first indicator of efficiency, Social Profits (SP) for the three production systems, the small, medium and large were ₦ 773,649, ₦ 1,023,067 and ₦1, 417,059 respectively. The social profit for large scale system was the highest followed by medium scale system and that of the small scale system was the least. However, the social profits were positive across the three production systems, implying that all the systems have comparative advantage in the production of palm oil for export. Countries achieve rapid economic growth by promoting activities that generate high positive social profits [37].

The Domestic Resource Cost (DRC) for the three production systems, the small, medium and large were 0.3806, 0.3639 and 0.2668 respectively. Thus, it cost less than one in domestic resources to generate an additional unit of foreign exchange in the three production systems, which implies that Nigeria oil palm producers have comparative advantage in the production of palm oil for export. These results are in line with the finding of [23].

The Social Cost Benefit Ratios (SCBR) were 0.4323, 0.4449 and 0.3471 for small, medium and large scale production systems respectively. The results confirmed that the three production systems are competitive at the international scene but large and medium scale systems are more competitive. Social Benefit-Cost Ratio (SBCR) is useful for comparing unlike systems, it showed that the large and medium scale systems are more efficient as shown in Table 4.

Table 3. Policy Analysis Matrix for Oil Palm Production Systems (in Naira (₦))

Large Scale:	Revenues	Tradable inputs	Domestic Factor	Profits
Private prices	1,834,560	196,451	506,759	1,131,350
Social prices	2,170,297	232,851	520,387	1,417,059
Divergences	(335,737)	(36,400)	(13,628)	(285,709)
Medium Scale:				
Private prices	1,347,840	167,307	573,090	607,443
Social prices	1,842,974	234,507	585,401	1,023,067
Divergences	(495,134)	(67,200)	(12,311)	(415,624)
Small Scale:				
Private prices	690,120	124,484	465,996	99,640
Social prices	1,362,791	113,684	475,458	773,649
Divergences	(672,671)	10,800	(9,462)	(674,009)

Source: Computed from field survey data, 2013

4.4. Government Protection

Measures of government protections that can be abstracted from PAM are Nominal Protection Coefficient (NPC), Effective Protection Coefficient (EPC), Profitability Coefficient (PC), Net Transfer (NT) and Subsidy Ratio to Producer (SRP). Nominal Protection Coefficient on Output (NPCO) as shown in Table 4 were 0.5064, 0.7313 and 0.8437 for small, medium and large scale production systems respectively. The results indicate disincentive policy such as tax affecting the producers. Nominal Protection Coefficient on Input (NPCI) for the three production systems, the small, medium and large were 1.0950, 0.7134 and 0.8437 respectively. These results indicate that the medium and large scale systems obtained inputs at prices less than world market price, implying input subsidy to the systems *e.g* ., the fertilizer subsidy. Effective Protection Coefficient (EPC) for small, medium and large scale oil palm production systems were 0.4528, 0.7339 and 0.8437 respectively, which indicates disincentive policies to the three systems in Nigeria. The Profitability Coefficients (PC), which show the ratio of private profits to social profits were; 0.1288, 0.5937 and 0.7984 for small, medium and large scale production systems respectively. The PC was higher with large scale production system followed by medium scale system but it was very low with small scale production system, which indicates poor competitiveness at private level. Net Transfer (NT) for large scale system was higher followed by medium and small scale systems in order of magnitude but they were all negative, which infer tax to the three production systems. Subsidy Ratio to Producer (SRP) were (0.4946), (0.2255) and (0.1330) for small, medium and large scale systems respectively. Thus, the three production systems experienced distorting policy, which is a transfer of resources away from the production system to the society.

4.5. **Sensitivity Analysis of Changes in Major PAM Variables**

Policy Analysis Matrix (PAM) framework is a static model, which cannot capture changes in prices and productivity as well as policy parameters [35]. Therefore, sensitivity analysis was carried out to overcome the static weakness of policy analysis matrix. It measures changes in productivity, exchange rate and free on board.

Table 4. Competitiveness of Oil Palm Production Systems in Nigeria

Measurement criteria	Small scale	Medium scale	Large scale	Base values
Private Profit	₦ 99,640	₦ 607,443	₦ 1,131,350	₦612,811
Private Cost-benefit Ratio (PCR)	0.8241	0.4855	0.3094	0.5397
Private Benefit-Cost Ratio (PBCR)	1.1687	1.8204	2.6088	1.8660
Social Profit	₦ 773,649	₦ 1,023,067	₦ 1,417,059	₦1,071,259
Domestic Resource Cost (DRC)	0.3806	0.3639	0.2668	0.3377
Social Cost-Benefit Ratio (SCBR)	0.4323	0.4449	0.3471	0.4081
Social Benefit-Cost Ratio (SBCR)	2.3132	2.2478	2.8813	2.4808
N. Protection Coeff. On output (NPCO)	0.5064	0.7313	0.8437	0.6938
N. Protection Coeff. On input (NPCI)	1.0950	0.7134	0.8437	0.8840
Effective Protection Coefficient (EPC)	0.4528	0.7339	0.8437	0.6768
Profitability Coefficient (PC)	0.1288	0.5937	0.7984	0.5070
Net Transfer	₦ (672,671)	₦ (415,624)	₦ (285,709)	₦(458,447)
Subsidy Ratio to Producers (SRP)	(0.4946)	(0.2255)	(0.1330)	(0.2844)

Source. Computed from field survey data, 2013

4.5.1. Changes in Yield

Table 5 presents the effects of decrease and increase in yield by 30% on the competitiveness of oil palm production systems in Nigeria. With decrease in yield, the average private profits of the production systems declined from a base value of ₦ 612,811 to ₦ 138,529 while the individual values are ₦ 383,446; ₦122, 095 and (₦ 89, 955) for large, medium and small scale oil palm production systems respectively. In all, large scale system remain more competitive at the domestic market. Though the average value was positive, which indicates competitiveness of the industry at the ruling market price, the private profits of the small scale system was negative, thus showing non competitiveness at domestic market with decrease in yield by 30%. Similarly, the social profits declined from a base value of N1, 071,259 to N 939,120, N674, 335 and N514, 555 for large, medium and small scale systems respectively. The average value was N709, 337, which implies efficiency/comparative advantage of the Nigerian oil palm industry at the international scene. The DRC was less than one, which infers that it cost less in domestic resource to generate additional unit of foreign exchange. However, the net transfers of the three production systems were negative, which indicates distorting policy.

Increase in yield by 30% as shown in Table 5 improves the competitiveness of the oil palm production systems in the country. The private profits increased from the base value of 612, 811 to 627,005, 1,335,402 and 2,216,902 for small, medium and large scale production systems respectively with an average value of ₦ 1,393,103. The PCR improved from 0.5397 (base value) to 0.4872, 0.3539 and 0.2250 for small, medium and large scale systems respectively, which displays enormous improvement in competitiveness at the domestic market. The social profits also experienced much improvement followed by DRC, which improved from 0.3377 (base value) to 0.3682, 0.3069 and 0.2558 for small, medium and large scale systems respectively. This implies

that increase in yield increases the efficiency/comparative advantage of the three oil palm production systems.

Table 5. Effects of Changes in Yield on the Competitiveness of Oil Palm Production Systems in Nigeria

Measur-ement Criteria	Base values	Decrease in Yield by 30%			Increase in yield by 30%		
		Small scale	Medium scale	Large scale	Small scale	Medium scale	Large scale
PP	₦ 612,811	(₦ 89,955)	₦ 122,095	₦ 383,446	₦ 627,005	₦ 1,335,402	₦ 2,216,902
PCR	0.5397	1.3651	0.7725	0.4910	0.4872	0.3539	0.2250
SP	₦ 1,071,259	₦ 514,555	₦ 674,335	₦ 939,120	₦ 1,043,241	₦ 1,390,460	₦ 1,924,333
DRC	0.3377	0.3999	0.3434	0.2878	0.3682	0.3069	0.2558
SBCR	2.4808	2.2046	2.1353	2.7061	2.3889	2.3295	3.0129
NPCO	0.6938	0.3591	0.5207	0.6035	0.7690	0.9350	1.0790
NPCI	0.8840	1.0898	0.7245	0.8510	1.098	0.7071	0.8394
EPC	0.6768	0.2873	0.4890	0.5714	0.7405	0.9667	1.1063
PC	0.5070	(0.1748)	0.1811	0.4083	0.6010	0.9604	1.1520
NT	(-₦ 458,447)	(-₦ 604,510)	(-₦ 552240)	(-₦ 555,674)	(-₦ 416,235)	(-₦ 55,059)	₦ 292,570
SRP	0.2844	(0.6419)	(0.4354)	(0.3730)	-0.2320	(0.0226)	0.1016

Source: Computed by the Author

The NPCO for small, medium and large scale systems improved from its base value of 0.6938 to 0.7690, 0.9350 and 1.0790 respectively with an average value of 0.929 indicating that the small and medium scale systems will sell their palm oil at market prices less than international prices while the large scale system will sell at prices a little higher than international prices. With increase in yield, NPCI shows that the large and medium scale systems obtained input at prices less than international prices while the small scale system obtained input at prices a little higher than international prices. The EPC displays the competitiveness of large scale system over others with a value of 1.1063, which is greater than international price with increase in yield. Similar were the profitability coefficient, net transfer and subsidy ratio to producer that were greater than zero for large scale system. The net transfers were negative for small and medium scale systems but positive for large scale system.

4.5.2. Changes in Exchange Rate

Table 6 displays the effects of decrease and increase in exchange rates by 30% on the competitiveness of oil palm production systems in Nigeria. With decrease in exchange rate, there was no substantial change in the private profits of all the systems while social profits declined from an average value of 1,071,259 to 604,442, which signifies decrease in profitability at social levels. The DRC declined from 0.3377 (base value) to 0.5328, 0.5168 and 0.3756 respectively. The NPCO was less than one in small and medium scale systems indicating distorting policy but greater than one in large scale system, which infers that large scale farmers will be able to sell their palm oil at prices greater than international prices when exchange rate is decreased by 30%. The NPCI was less than one

for medium and large scale systems indicating that the farmers will obtain inputs at prices less than international prices while the small scale system will obtain inputs at prices approximately equal to international price with decrease in exchange rate. The EPC was greater than one in medium and large scale systems, implying favourable policy with decrease in exchange rate. The net transfers were positive in the case of medium and large scale systems while that of small scale system was negative. Thus, decrease in exchange rate increases the profitability of oil palm farmers, processors and marketers.

Increase in exchange rate by 30%, as shown in Table 6 left the private profits unchanged while the social profits increased substantially, which is an indicator of increased competitiveness at social levels at the detriment of private profitability. The DRC improved from 0.3377 (base value) to 0.2947, 0.2795 and 0.2058 for small, medium and large scale systems respectively, indicating competitiveness at the international scene. Increase in exchange rates decreased the NPCO ratio from its base value of 0.6938 to 0.3995, 0.5787 and 0.6675 for small, medium and large scale systems respectively. There was no significant change in NPCI due to increase in exchange rate. The net transfers were all negative as well as the subsidy ratio to producer, thus signifying distorting policies affecting the producers. Therefore, high exchange rate is an indirect tax paid by farming and non-farming households in the country.

Table 6. Effects of Changes in Exchange Rate on the Competitiveness of Oil Palm Production Systems in Nigeria

Measu-rement Criteria	Base values	Decrease in exchange rate by 30%			Increase in exchange rate by 30%		
		Small scale	Medium scale	Large scale	Small scale	Medium scale	Large scale
PP	₦612,811	₦ 99,640	₦ 607,443	₦1,118,471	₦ 99,425	₦ 607,443	₦ 1,118,471
PCR	0.5397	0.8238	0.4855	0.3078	0.8242	0.4933	0.3078
SP	₦ 1,071,259	₦ 416,846	₦ 547,329	₦ 849,153	₦ 1,137,991	₦ 1,509,143	1,971,269
DRC	0.3377	0.5328	0.5168	0.3756	0.2947	0.2795	0.2058
SBCR	2.4808	1.7075	1.6675	2.1418	2.9309	2.8406	3.6506
NPCO	0.6938	0.6860	0.9858	1.1377	0.3995	0.5787	0.6675
NPCI	0.8840	1.0950	0.7134	0.8437	1.0948	0.7134	0.8438
EPC	0.6768	0.6339	1.0422	1.1880	0.3504	0.5636	0.6509
PC	0.5070	0.2390	1.1098	1.3172	0.0874	0.4025	0.5674
NT	(-₦ 458,447)	(-₦ 317,206)	₦ 60,114	₦ 269,318	(-₦ 1038566)	(-₦ 901,701)	(852,799)
SRP	0.2844	(0.3153)	0.0440	0.1691	(0.6012)	(0.3872)	(0.3141)

Source: Constructed by the author

4.5.3. Changes in Free on Board

Table 7 presents the effects of increase and decrease in free on board (fob) by 30% on the competitiveness of oil palm production systems in Nigeria. Decrease in fob has no significant impact on private profitability but it decreased social profits from an average

value of 1, 071,259 to 850,184, inferring reduction in social profitability. The DRC reduced from 0.3377 (base value) to 0.3902, which confirms the reduction in social profitability. The NPCO were less than one in all the production systems, which infers that the farmers will sell their palm oil at prices less than international prices. However, there was no substantial change in NPCI when fob is decreased by 30% in all the production systems. The net transfers had negative values with decrease in fob. The impact of the reduction in fob on net transfers is analogous to that of decrease in exchange rate but decrease in exchange rate impacted more positive effects on the actors.

Increase in fob by 30% as shown in Table 7, reduced the efficiency/comparative advantage of all the production systems with no substantial effects on the private profits. The net transfers were negative, which indicates distortionary policy affecting the major actors in the production systems.

Table 7. Effects of Changes in Free on Board (Fob) on the Competitiveness of Oil Palm Production Systems

Measurement Criteria	Base values	Decrease in fob by 30%			Increase in fob by 30%		
		Small scale	Medium scale	Large scale	Small scale	Medium scale	Large scale
PP	₦612,811	₦ 99,640	₦ 607,443	₦ 1,118,471	₦ 99,640	₦ 607,443	₦ 1,118,471
PCR	0.5397	0.8238	0.4855	0.3078	0.8238	0,4855	0.3078
SP	₦ 1,071,259	₦ 606,418	₦ 800,092	₦ 1,144,043	₦ 940,883	₦ 1,246,046	₦ 1,664,322
DRC	0.3377	0.4395	0.4225	0.3087	0.3357	0.3196	0.2349
SBCR	2.4808	2.0293	1.9758	2.5383	2.5970	2.5197	3.2378
NPCO	0.6938	0.5772	0.8320	0.9600	0.4511	0.6524	0.7525
NPCI	0.8840	1.095	0.7134	0.8440	1.0950	0.7134	0.8437
EPC	0.6768	0.5228	0.8521	0.9763	0.3994	0.6446	0.7428
PC	0.5070	0.1643	0.7592	0.9776	0.1059	0.4875	0.6720
NT	(₦ 458,447)	(₦ 506,778)	(₦ 192,649)	(₦ 25,572)	(₦ 841,243)	(₦ 638,603)	(₦ 545,851)
SRP	0.2844	(0.4239)	(0.1189)	().0135)	(0.5498)	(0.3091)	(0.2267)

Source: Constructed by the author

5. Conclusion, Recommendations and Suggestions for Further Reading

5.1. Conclusion

Self-sufficiency in domestic palm oil supply remain unattainable in Nigeria, despite the various efforts of government to revive the subsector, a country that played a leading role in production and export of this commodity in the world prior 1965. The poor growth and development of the Nigerian oil palm industry requires crucial need to gain a better understanding of the competitiveness of oil palm production systems in the country. Against this background, competitiveness of oil palm production systems was studied using primary and secondary data.

The Policy Analysis Matrix (PAM) results showed that the three production systems are competitive in the production of palm oil and palm kernel in Nigeria under existing

market prices. In other words, farmers, processors and marketers are making profits from their investments in the industry. The private profits for the three production systems, the large, medium and small were N 1,131,350, N 607,443 and N99, 640 respectively, indicating that the large scale system is most competitive followed by medium scale system. The competitiveness of the three oil palm production systems is confirmed by PCR of 0.8241, 0.4855 and 0.3094 for small, medium and large scale systems and PBCR of 1.1687, 1.8204 and 2.6088 for small, medium and large scale systems respectively.

The social profits were N773, 649, N 1,023,067 and N 1,417,059 for small, medium and large scale systems respectively, which implies comparative advantage/efficiency of all the systems. This was confirmed by DRC of 0.3806, 0.3639 and 0.2668 for small, medium and large scale systems respectively, which implies Nigeria has comparative advantage in palm oil production for export. However, the large scale system has greater efficiency in the production of palm oil for export. The net transfer was negative which indicates poor protectionist policies and overall transfer of resources away from the production systems. In this study, it is concluded that Nigeria has comparative advantage/efficiency in the production of palm oil for export.

5.2. Recommendations

The PAM results showed that palm oil production in Nigeria is competitive at private and social levels. Therefore, efforts should be made to grow the crop in the country and export oil palm products to other countries rather than import palm oil.

Sensitivity analysis revealed that increase in yield improved the competitiveness of oil palm production systems at private and social levels. The net transfer for large scale system was positive with increase in yield. Therefore promotion of modern agronomic practices that will enhance productivity is expedient for acceleration of growth and development of the Nigerian oil palm industry.

Increase in exchange rate made the net transfer for the three production systems negative, which indicates tax. Therefore, the unfavorable exchange rate need to be addressed by government to make the input and output available at favourable prices.

5.3. Suggestions for Further Studies

This study examine competitiveness of oil palm production systems in Nigeria using policy analysis matrix. The profile of the study could be broadened to expand the findings and policy recommendations. Therefore, the following suggestions are offered for further studies:

i. Evaluation of the Strength, Weakness, Opportunity and Threat (SWOT) need to be carried out to identify the prospects and problems of the industry.

ii. Assessment of value addition at various node of the oil palm chain is necessary to reveal the values generated at different stages of the chain.

iii. Assessment of the employment opportunities at different nodes of the oil palm chain is imperative at this time when unemployment is ravaging our economy. This will unveil the role of the Nigerian oil palm industry in solving the problem of unemployment in the country

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