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Assessment of Total Factor Productivity among Oil Palm Smallholders in Imo State, Nigeria.

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ABSTRACT

Imo state is one of the leading oil palm producing area in Eastern Nigeria but still experiences seasonal price fluctuation with insufficient palm oil supply. This may be attributed to dominance of oil palm smallholders and low yield. The contributions of oil palm to employment and income in the state justify the research for empirical evidence on its productivity but there is inadequate documentation on the productivity of Oil palm smallholders in the state. In this study, total factor productivity of small scale Oil palm farmers in Imo state is investigated. A three stage sampling procedure was used to select 360 respondents for the study. Three oil palm producing Local Government Areas (LGAs) were sampled from each of the three Agricultural zones. Four villages were selected from each of the chosen LGA using random sampling. This was followed by snowball sampling of ten farmers from each of the selected villages. A total of three hundred and sixty (360) questionnaires were distributed to oil palm smallholders but 288 were retrieved and used for analysis with the help of Fisher index. The result revealed that total factor productivity of these farmers in the state for the period 2015 – 2024 were 0.73, 0.77, 0.8, 0.82, 0.76, 0.59, 0.82, 0.83, 0.9 and 0.91 respectively. The results are all less than one, which indicates inefficiency in the allocation and use of resources for oil palm production in the state. Specifically, it was observed that majority of the farmers did not use fertilizer for oil palm production. Therefore, it is recommended that the Agricultural Development Programme (ADP) be assisted to promote the use of fertilizer among oil palm farming households in Imo state. This will boost fresh fruit bunches (ffb) yield and thus improves the productivity of the farmers.

1.0 Introduction

1.1 Background of the study

Palm oil is presently the vegetable oil produced in largest quantity globally (Alhaji *et. al.*, 2024) having pushed soybean oil into second position because of its low production cost and high yields (AOCS, 2012). The low price of palm oil compared to other vegetable oils makes it an important component of the increasing intake of oils and fats in the developing world (AOCS, 2012). Nigeria is the largest producer of palm oil in Africa and the fifth largest in the world after Indonesia, Malaysia, Thailand and Colombia (USDA, 2022). Palm oil is used for household cooking, food industry, bio-fuel production, oleo-chemicals, personal care and animal feed but its utilization for bio-fuels is still very meager in Nigeria. Transforming the Nigerian oil palm industry to achieve self-sufficiency in palm oil production and join the world leading exporters involves a comprehensive strategy that addresses various aspects of the value chain, from cultivation and processing to marketing and policy support. The oil palm industry in Nigeria has great potential for economic growth and job creation, but faces different challenges, including low productivity, poor modern agronomic farming practices, and limited processing capacity.

The oil palm is grown in Nigeria from latitudes 4^{o} – 11^{o}N; of the Equator from the fresh water swamp forest of the coast to the Northern zone of the Guinea Savannah. Production and supply of palm oil and palm kernel are mainly from 27 states in Nigeria namely; Abia, Akwa-Ibom, Cross River, Rivers, Bayelsa, Imo, Anambra, Ebonyi, Enugu, Delta, Edo, Ondo,

Ogun, Osun, Oyo, Lagos, Ekiti, Benue, Kwara, Kogi, Nasarawa, Plateau, Taraba, Adamawa, Niger, Kaduna and federal Capital Territory (FCT), Abuja (Omoti and Ikuenobe, 2020). Therefore, Nigeria has enormous potential to increase her production of palm oil and palm kernel primarily through expanding the areas under cultivated plantings as well as through the application of improved processing techniques.

1.2 Total factor Productivity

Total Factor Productivity (TFP) is estimated as the ratio of output over a weighted average inputs (Amato *et. al*., 2022), the outcome of this ratio (whether greater or less than one is Total Factor productivity (TFP). It is the portion of output not explained by the amount of input used in production and plays useful role on economic growth and cross-country per capita income differences. Long-run growth in income per capita in any economy is mostly driven by growth in total factor productivity (Bannaga and Lezar, 2024). Factors that enhance TFP growth are innovation/Research and Development (R&D, abundance of skilled labour, (R&D) subsidies, and increases in the size of markets (Latruffe, 2010). It measures technical change, efficiency and effectiveness with which both labour and capital resources are used to produce output. In other words, TFP means making judicious and effective use of the available labour and capital resources.

Bannaga and Lezar, (2024) posit that investment in education, health, infrastructure with research and development are the main factors that boost total factor productivity. It can be measured in physical terms e.g. number of cars produced per employee, in monetary terms e.g. thousands of dollars of output per hour worked, or an index e.g. output per unit of labour. However, inputs are defined in terms of; X labour e.g. number of employees or hours of work and X capital e.g. buildings, machinery, equipment, etc. Labour productivity is the ratio of output to the input of labour, it is measured as the amount of output produced per hour worked, while land productivity is the ratio of output to size of land used in production.

Productivity has the capability to enhance economic growth (Gordon, 2015, and Makiela *et. al*. 2022) and differences in growth exist among countries and sectors, which reflect the efficiency of the production process and use of resources (Georges, and Charbel, 2023). Industrialisation plays a pivotal role in the economic expansion of many developing countries. Thus, expanding the manufacturing sector with its capacity to accumulate capital as well as economies of scale, promotes the pace of productivity growth (Haraguchi *et. al.* 2017).

Multifactor productivity (MFP) is the ratio of output to the combined input of labour and capital. Sometimes this measure is referred to as total factor productivity (Perharm and Economics, 2011). Economists sometimes use the term MFP interchangeably with TFP but in terms of measurement, there is a difference between the two terms. The term TFP suggests that all inputs (labour, capital and intermediate inputs such as raw materials, energy, etc.) are taken into account in its computation that is, the denominator of the TFP ratio includes all inputs, while MFP does not include all inputs (Perharm and Economics, 2011), it is considered more accurate because most measures of TFP are computed on the basis of only labour and capital inputs. However, the distinction between MFP and TFP is usually made by those concerned with measurement, and the term TFP continues to be used more widely.

Nigeria has human and land resources to be self-sufficient in palm oil production but lack of adequate investment in the right direction besets the subsector. In addition, there is paucity of information on the productivity of smallholder oil palm farmers in Imo state, Nigeria. This valuable information is quite scanty and not well defined in literature, which affects planning and research for growth and development of the industry. Therefore, it is expedient to carry out this study in order to fill the knowledge gap in this area. The objective of the study is to examine the total factors productivity of Oil Palm production in Imo State for the period 2015 - 2024.

2.0 Methodology

2.1 Study Area

The study was carried out in Imo State. The state is divided into three agricultural zones including; Orlu, Owerri and Okigwe zones.

2.2 Data Collection

Primary and secondary data were used for the study. A three stage sampling procedure was used to select 360 respondents for the study. Three oil palm producing Local Government Areas (LGAs) were sampled from each zone while four villages were selected from each LGA using random sampling. This was followed by purposive sampling of ten farmers from each of the selected villages. A total of three hundred and sixty (360) questionnaires were distributed but 288 were retrieved and used for analysis. The Agricultural Development Programme (ADP) zoning structure was adopted in the state. The selection of oil palm smallholders was based on farmers with less than 10 hectares (ha) oil palm plantation. Data were collected on quantities of inputs, outputs and their prices. Data were analyzed with fisher index.

(iii) **Fisher index**

This was introduced by Fisher (1922) as a geometric mean of Laspyres and Paasche indices. The model includes:

Fisher index = $P_{st}^{F} = \sqrt{P_{st}^{L} \times P_{st}^{P}}$ (1)

The fisher index has statistical and economic theoretic properties. It is versatile, self-dual, accommodates zero quantities in the data and also known as the Fisher Ideal Index. In order to estimate the Total factor productivity (TFP) of oil palm production among small holders in Imo state, the Fisher index model was used. The model was estimated by dividing the value of output (i.e. total value of fresh fruit bunches (ffb) harvested by farmers in naira) by the value of variable inputs used in production. The model expressed in equation 2 was used to obtain the TFP of oil palm smallholders in Imo state

$$TFP, (Q_i^*) = Q_i \Big/ \sum_{i=1}^{5} X_i \quad (2)$$

Where: Q_i^* is Total Factor Productivity (TFP) for the i[th] farmer

Q_i *is* value of ffb output in naira

X_i are the variable inputs, which are listed below and i =1 - 5

X_1 = labour cost in (N)

X_2 = Cost of seedlings in (N)

X_3 = Cost of pesticides used in (N)

X_4 = Cost of fertilizer used in (N)

X_5 = Cost of herbicides used in (N)

All outputs and inputs were valued with farm gate prices and normalized by conversion to per hectare per year.

3. Result and discussion

Estimation of total factor productivity of smallholder oil palm farmers in Imo state

The total factor productivity model presented in equation two was used to estimate the TFP for oil palm production among smallholder oil palm farmers in Imo state. This was obtained by dividing the monetary value of ffb output by the cost of variable inputs used in production, which include seeds, labour, fertilizer, herbicides, and pesticides. The inputs and output

quantities and their prices were normalized to per hectare per year. The farm gate price of ffb output and market prices of inputs were used to calculate the input cost and output revenue.

$Q_{i,}$ = value of ffb output in (N)

X_1 = labour cost in (N)

X_2 = Cost of seedlings in (N)

X_3 = Cost of pesticides used in (N)

X_4 = Cost of fertilizer used in (N)

X_5 = Cost of herbicides used in (N)

The TFP is calculated as output/inputs mostly labour and capital. Therefore, TFP less than one indicates inefficiency while TFP greater than one implies progress and improvement in efficiency with the difference from one indicating percentage deterioration and progress respectively (Latruffe, 2010). Table 1 presents the TFP of oil palm smallholders in Imo state.

Table 1: **Estimation of total factor productivity (** N'000)

Var	**Details**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
Q_1	ffb Revenue	600	630	680	700	650	500	720	740	800	970
X_1	Labour cost	550	550	580	580	580	580	600	600	600	600
X_2	Seedling cost	200	200	200	200	200	200	200	200	200	375
X_3	Pesticides cost	20	20	25	25	25	25	25	30	30	30
X_4	Fertilizer cost	0	0	0	0	0	0	0	0	0	0
X_5	Herbicide cost	48	48	48	48	48	48	48	60	60	60
TFP	$Qi/\sum^{5}_{i=1}$	**0.73**	**0.77**	**0.8**	**0.82**	**0.76**	**0.59**	**0.82**	**0.83**	**0.9**	**0.91**

Source: Computed from field survey data 2025.

This study indicates that the TFP of oil palm smallholders in Imo state for the period 2015 to 2024 is less than one which implies inefficiency and decreasing returns to scale. Following the definition of TFP by Comin (2006) as Solow residual i.e. the excess that remain after accounting for inputs used in production. These results are in line with that of Sadiq *et al*, (2019), IIETA (2023) and MPRA (2024), who found that agricultural TFP growth was a little less than one and it indicates inefficient use of resources in the study areas. The TFP appreciates minimally in the period 2015 – 2024 from 0.73 in 2015 to 0.91 in year 2024 with depression in 2019 and 2020, which is expected to be the consequences of Covid 19 pandemic. Finding from the field disclosed that majority of the farmers were not using fertilizer, which affected bunch yield.

4. Conclusion

The study examined the Total Factor Productivity (TFP) of oil palm smallholders in Imo state for the period 2015 – 2024. Inadequate literature and documentation in this research area in the state informed this study. The performance result showed that TFP of the aforementioned farmers in the state was less than one (1.0000) for the period 2015 – 2024. This

indicates inefficiency in the allocation and use of resources for oil palm production in the state. Particularly, it was observed that majority of farmers in the state did not apply fertilizer to their palms. Therefore, it is recommended that the Agricultural Development Programme (ADP) be assisted to promote the use of fertilizer in oil palm farming among smallholder oil palm farmers in the state. This will boost fresh fruit bunches (ffb) yield and thus improves the productivity of the farmers.

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