# Extended Abstract
## Please do not add your name or affiliation

| Paper/Poster Title | Evaluating the Total Factor Productivity and Profitability of Smallholder Cassava-Based Farming: A Case Study of Southwest, Nigeria. |
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**Abstract prepared for presentation at the 98th Annual Conference of The Agricultural Economics Society will be held at The University of Edinburgh, UK, 18th - 20th March 2024.**

| Abstract | 200 words max |
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In this study, Total Factor Productivity (TFP) of productive resources used in cassava-based farms in South-west, Nigeria was measured using a structured questionnaire to collect cross-sectional data from a drawn sample of 360 cassava-based farmers via the multi-stage sampling design. The data were analyzed using descriptive and inferential statistics, total factor productivity index, gross margin and tobit regression model. The summary statistics of the total factor productivity showed that most (66.9%) of the farmers had high level of productivity as their total factor productivity indices were above the optimal scale. Results further showed that age, gender status, marital status, farming experience, farm size, access to credit, access to extension agents, membership of cooperative association and total household income were significant in determining the level of productivity of cassava-based farmers. It was also found that cassava-based production was a profitable enterprise and that the total variable cost, total cost, gross margin, profitability ratio, efficiency ratio, income expenditure ratio and return on investment were significant in determining the level of productivity of farmers. There was a significant difference between farmers who had low productivity and farmers who had high productivity and their socio-economic characteristics and profitability ratios. Therefore, the study recommends that government should provide inputs such as agrochemicals and fertilizer to farmers at subsidized rate and make provision for credit facilities for farmers to increase their scale of production, and increase their productivity.

| Keywords | Cassava-based, Factor-productivity, Profitability, Small-holder farmers, Southwest |
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| JEL Code | B21, B23, E23, Q12 |

| Introduction | 100 – 250 words |
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Cassava (Manihot esculenta) is an important regional food source for around 200 million people (almost one-third of the Sub-Saharan African population) (Abdoulaye *et al.* 2014). Cassava is important to the rural economy in Nigeria because of its ability to yield despite poor soil conditions and tolerance to drought. Nigeria is currently the world's top producer of cassava (FAO, 2019), and it is considered that cassava farming provides a method for farmers to easily get out of poverty because it requires less input and can flourish even in tough environmental circumstances. It has an extraordinary ability to adapt to climate change (HarvestPlus, 2013), with a tolerance for low soil fertility, resistance to drought conditions, pests and diseases, and a high resistance to weeds.

Nigeria is the world's top producer of cassava, with 54.8 million MT produced in 2017, accounting for 20.4% of global production; nonetheless, the average productivity of cassava in the nation is poor (FAO, 2019). The majority of smallholder rural households in Nigeria make their living from cassava farming, which has a significant influence on reducing food insecurity and poverty among these households due to its low production costs and improved varieties (Osun et al., 2014; Sanusi et al., 2022). In addition to serving as a food reserve in times of famine, cassava increases Nigeria's GDP and has changed from a staple to a commercial crop. Despite a steady yearly growth of well over 3% in worldwide cassava production, African smallholder farming systems' productivity of the crop is below ideal levels (Kintché et al., 2017; FAO, 2018). The nation, which is home to an estimated 200 million people, is not able to meet the demands of its expanding population, which implies that it is unable to meet global demand. This has resulted in a shift toward the production of cassava, which has provided millions of Nigerians with a means of subsistence and is currently ranked highly by the government and international development organizations as a target crop for agro-based industrialization and food security. In order to guarantee the least-cost mix of inputs and outputs, increasing the cassava output per unit of input utilization is the right way to go (Osun et al., 2014).

| Methodology | *100 – 250 words* |
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**Sampling Technique and sample size**

A Multi-stage sampling approach was used in the selection of respondents for the study. In the first stage, two States (Ondo and Osun) that are noted for growing cassava were purposively selected. In the second stage, three Local Government Areas (LGAs) were randomly selected from each State. In the third stage, three communities from each LGA were randomly selected and in the final stage, twenty cassava-based farmers were purposively selected from the list that were obtained from the Agricultural Development Program (ADP) in each of the selected States to make a total of three hundred and sixty respondents that were used for the study.

**Method of Data Analysis**

The data collected were analyzed with the use of descriptive statistics such as frequency distribution and percentages to describe the socio-economic characteristics. Total factor productivity index, gross margin and Tobit regression model were used to analyze the total factor productivity, profitability and determinants of factor productivity respectively.

**Total Factor Productivity (TFP)**
This was used to determine the productivity of cassava farmers. TFP can be measured as the inverse of unit variable cost. This is so since TFP is the ratio of the output to the Total Variable Cost (TVC) as shown below;

$$TFP = \frac{Y}{\sum P_i X_i} \tag{1}$$

Where, Y = quantity of cassava in kg, P = unit price of ith variable input, X = quantity of ith variable input.

**Gross Margin**
Gross Margin analysis was used to estimate the costs and returns of cassava-based production in the study area (objective II).

$$GM = TR - TVC \tag{2}$$

Where, GM = Gross Margin, TR = Total value of cassava output in/ ha, TVC = Total Variable Cost of cassava production/ ha

**Tobit Regression Model**
Tobit regression model was used to analyze the factors that determine the level of productivity of cassava-based farmers. Therefore, the Tobit regression model is specified as follows:

$$Y_i = \beta_0 + \beta_i X_i + U_i \tag{3}$$

Where:
$Y_i$ = Total factor productivity index, $\beta_0$ = Intercept parameters, $\beta_i$ = Slope of estimated parameters, $U_i$ = error term, $X_i$ = explanatory variables.
The explanatory variables are expressed as;
$X_1$ = Gender (male =1, female = 0), $X_2$ = Age (in years), $X_3$ = Marital status (married = 1, otherwise = 0), $X_4$ = Household size (number), $X_5$ = Level of education (years of formal education), $X_6$ = Farming experience (in years), $X_7$ = Farm size (Ha), $X_8$ = Access to credits (Yes = 1; No = 0), $X_9$ = Access to extension agents (Yes = 1; No = 0), $X_{10}$ = Access to healthcare (Yes = 1; No = 0), $X_{11}$ = Membership of cooperative association (Yes = 1; No = 0), $X_{12}$ = Total household income (amount in naira).

| Results | 100 – 250 words |
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The summary statistics of the total factor productivity showed that most (66.9%) of the farmers had high level of productivity as their total factor productivity indices were above the optimal scale, which indicated good input mix allocation in the production process while 33.1% had low level of productivity as their total factor productivity indices were below the optimal scale. This can be inferred that more than half of the sampled population were productive in the utilization of their input resources. The socio-economic variables such as age, gender status, marital status, farming experience, farm size, access to credit, access to extension agents,

membership of cooperative association and total household income were significant in determining the level of productivity of farmers at either 1% or 5% level. These variables have produced positive outcomes which suggests that a rise in any of these factors could increase total factor productivity in the study area. However, there is a significant difference between the farmers with low productivity and high productivity in relation to the socio-economic characteristics.

Results showed that variable inputs such as labour, cassava stem and agrochemicals were significant at 1%, 1% and 5% level respectively in determining the level of productivity of farmers. Farmers with high level of productivity incurred higher cost on labour and agrochemicals while farmers with low productivity incurred higher cost on cassava stem, fixed assets, and rent. However, farmers with high productivity incurred higher cost on the input utilized and realized higher revenue than farmers with low productivity.

Results further showed that the total variable cost, total cost, gross margin, profitability ratio, efficiency ratio, income expenditure ratio and return on investment are significant in determining the level of productivity of farmers at either 1% or 5% level. Farmers with high level of productivity had a higher value in all these ratios than farmers with low productivity.

| Discussion and Conclusion | *100 – 250 words* |
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The summary statistics of the total factor productivity revealed that more than half of the sampled population were productive in the utilization of their input resources. However, a reasonable number of them operated below the optimal scale. Farmers who had higher years of farming experience, farm size, access to credit, access to extension agents, and total household income had high level of productivity than their counterparts. The socio-economic variables such as age, gender status, marital status, farming experience, farm size, access to credit, access to extension agents, membership of cooperative association and total household income were significant in determining the level of productivity of smallholder cassava-based farmers. Most of the farmers with high level of productivity were male, mostly married and advanced in age. Results further showed that variable inputs such as labour, cassava stem and agrochemicals were significant in determining the level of productivity of farmers. Farmers with high level of productivity incurred higher cost on labour and agrochemicals while farmers with low productivity incurred higher cost on cassava stem, fixed assets, and rent. However, farmers with high productivity incurred higher cost on the input utilized and realized higher revenue than farmers with low productivity. Results also showed that the total variable cost, total cost, gross margin, profitability ratio, efficiency ratio, income expenditure ratio and return on investment are significant in determining the level of productivity of farmers. Based on the return on investment, it is an indication that farmers with high productivity experienced higher profitability than farmers with low productivity.

**Recommendations**

1. The government should provide inputs such as agrochemicals and fertilizer to farmers at subsidized rate as most of the farmers spend a lot to purchase these inputs, which has a significant effect on the level of profitability, and hence reduce their productivity.

2. The government should make provision for credit facilities for farmers to increase their scale of production, thereby increasing their productivity.

3. The government should do better in empowering and equipping the extension agents to perform better in farmers' education, dissemination of relevant information and mobilization of farmers for training when the need arises.

4. The farmers should be encouraged and educated to join cooperative associations as this contributes to establishing more networks and building good relationships that can have positive impact on their enterprise that ordinarily cannot be achieved on their own.

5. Farmers should be encouraged to engage rigorously in non-farm activities that can give them income. This income could be used to purchase all necessary farm inputs and increase their scale of production.