*Journal of Forestry Research and Management. Vol. 20 (1).58-65; 2023, ISSN 0189-8418*

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# RATE OF TECHNICAL RETURNS ON CASSAVA FARMERS PRODUCTIVITY IN OYO STATE, NIGERIA

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## ABSTRACT

Many physical factors such as farm management and resource use (land, capital and labour) contribute to agricultural productivity; poor combination of the resource used among famers, together with other socio-economic problems has subjected farmer's productivity to serious exploitation and low level of income. The study, therefore, analyses the rate of technical returns in respect of cassava farmers' production in Oyo State Nigeria. A multistage sampling technique was used to select 330 respondents for this study. Data collected were analysed using descriptive statistics and the Cobb Douglas Production model, Measuring Rate of Technical Return (RTR) using Statistical and Data Analysis (STATA) package. The result revealed that the average age of farmers was 50 years, the farm size used was 3.0 hectares, the household size was 6.0 persons, the cassava output was 37.5 tons and the farmers had 14.4 years of farm management experience. Male farmers constitute 73.0%. About 82% of the respondents were married and 10.9% had no formal education. The majority (83.9%) had farm size of between 0.5-5.0 hectares, 66.1% relied on the local manual methods of land preparation practices. Also 82.1% relied on rain-fed agriculture. The production model revealed that the elasticity of farm size ($\ell = 0.562 > 1$), credit ($\ell = 0.088 > 1$), labour ($\ell = 0.036 > 1$), fertilizer ($\ell = 0.028 > 1$), cassava stem cuttings ($\ell = 0.190 > 1$) had positive relationship to cassava productivity. The return to scale (RTS) was 0.904 showing a positive decreasing return to scale. Elasticity ($\ell$) was in stage II of the production surface with the present level of physical inputs combinations. It was therefore, concluded that production was economical and that cassava farmers are productive in the study area.

**Keywords**: Elasticity, Cobb Douglas, Productivity, Socio economics, Oyo State Nigeria

## Introduction

Many factors contribute to low productivity. These include farm management, resource use, population pressure, fragile ecosystem, poverty, land tenure, inadequate knowledge of appropriate technologies and technical know-how, inadequate price incentives, socio-cultural factors and farmers' perceptions and attitudes, which are inherently unpredictable.

These factors influence and have an effect on the production output (Oyewo, 2011). Production has been defined by several authors concerning their own views and disciplines, because different professionals such as agriculturalists, agronomists, economists and geographers interpret it differently (Addisu and Demeku, 2015). It is defined as the output produced by a given level of input(s) in the agricultural sector of a given economy and clearly shown in mathematical terms as 'the index of the ratio of the value of total farm output to the value of the total inputs used in farm production'

(Aysheshim, 2015). Olayide and Heady (1982) define the production process as one whereby some goods and services called inputs are transformed into other goods and services called output. Oyewo (2011) also defined production as the transformation of goods and services into finished products with a definite technology (that is input-output relationship) which is also applied to every production process.

Productivity is a measure of the ability of the factors of production to generate output. It is generally measured as a partial productivity indicator which is a ratio of output to one input. Rahji (2003) noted that the efficiency with which farmers use available resources and improved technologies is important in agricultural production. In agriculture, the physical inputs which were use are: land, labour, capital and management, the optimal combination of this resource (physical inputs) and their use efficiently will result in better outputs which make it resource use efficiency and thus address poverty and food insecurity. In order for farmers to attain a better level of productivity and be food secure which in turn affect their livelihood. Therefore, there is need to assess the cassava farmers rate of rate of technical returns in cassava farmers productivity in Oyo State.

The Cobb-Douglas Production Function was used because it is required that the production function be self dual. Also this functional form has been used by various scholars such as Olagunju *et al.,* 2010; Olarinde 2011; Fawole and Rahji, 2016 and Akpan *et al*., 2017 on farm productivity for both developing and developed countries that the sets of inputs with positive elasticity were utilized in an efficient manner and such have kept production in various stages of elasticity. The Cobb-Douglass Production Model was also explained by Diewert *et al*., (2011) that the production elasticity of farmers is positively signed and less than unity but not less than zero If $\gamma = 1$, then there are constant returns to scale a proportional change in all inputs results in an equal proportionate change in output, if $\gamma > 1$, there are increasing returns to scale and if $\gamma < 1$ (though not less than 0, given the possibility of free disposal), then there are decreasing returns to scale in farmers productivity. Output elasticity measures the responsiveness of output to a change in levels of physical inputs used in production ceteris paribus. Therefore, this processes need to be looked into in order to examine farmers' socio economic characteristics and the rate of technical returns in cassava farmers production in Oyo State Nigeria.

## Methodology

### The Study Area

This study was carried out in Oyo State, Nigeria. The State is located in the southwestern part of the country. Oyo State consists of thirty three (33) local government areas grouped under four (4) agricultural zones: Ibadan-Ibarapa, Oyo, Saki and Ogbomoso Zones. Oyo State covers a total land area of about 27,249,000 $Km^2$ with a total population of about 5.6million (National Population Commission, 2006). Presently, the population of Oyo State has hit 7,840, 864 million as of 2016, latest demographic estimates released by the National Bureau of Statistics in 2017, in Oyewo *et al*., (2020). It is situated between Latitude $7^o$ N and $19^o$N and Longitude $2.5^o$E and $5^o$E of the meridian and it is bounded in the south by Ogun State, in the north by Kwara State, in the west by Ogun State and partly by the Republic of Benin and in the East by Osun State.

The state is well drained with rivers flowing from the upland in the north-south direction. Oyo State has an equatorial climate with dry

and wet seasons and a relatively high humidity. The dry season lasts from November to March while the wet season starts in April and ends in October. Average daily temperatures range between 25 °C (77.0 °F) and 35 °C (95.0 °F) almost throughout the year. The vegetation pattern of Oyo State is that of the rainforest in the south and the guinea savannah in the north. The climate favours the cultivation of crops like Maize, yam, cassava, millet, rice, plantain, cocoa tree, oil Palm and cashew. The majority of the dwellers are civil servants (www.oyostate.gov.ng; Official Website of the Government of Oyo State).

**Sampling Technique and Sample Size**

The population sample for the study comprises registered Cassava farmers across the four agricultural zones from the cassava growers association in Oyo State. Multi-stage sampling technique was used to select a total of 330 respondents for this study.

This involved the purposive selection of the existing four Agricultural zones, namely, Ibadan-Ibarapa, Oyo, Saki and Ogbomoso zones because of the proximity and availability of the cassava farmers for the study. The agricultural zones were Ibadan-Ibarapa (14 blocks), Oyo (5 blocks), Ogbomoso (5 blocks) and Saki (9 blocks).

The first stage involved the purposive selection of two Local Government Areas namely: Ibarapa East and Egbeda from Ibadan-Ibarapa zone, Atiba and Itesiwaju from Oyo zone; Ogbomoso North and Ogo-oluwa from Ogbomoso zone; Atisbo and Iwajowa from Saki agricultural zone making a total of eight (8) Local Governments' Areas because they have the highest number of cassava farmers. Each Local Government Council area represents an agricultural block of the ADP.

The second stage involved the random selection of 60% of the population which was 348 cassava farmers out of 580 farmers from the population of the registered cassava farmers with the Nigeria Cassava Growers Association (NCGA) across the four agricultural zones in Oyo State. The list of the farmers in these areas was sought from the Federal Department of Agriculture (FDA) Moor Plantation Ibadan, Oyo State. Selection of the respondents from each of the LGAs represents the zones which comprises of 83, 94, 71 and 99 from Ibadan-Ibarapa, Oyo, Saki and Ogbomoso agricultural zones respectively, making a total of 348 respondents. However, only a total number of 80, 90, 70 and 90 questionnaires were retrieved from Ibadan-Ibarapa, Oyo, Saki and Ogbomoso zones making a total sum of three hundred and thirty (330) respondents to make the sample size of the population under study (Table 1) which gave a response rate of 95% of the questionnaires that were found useful for the analysis.

**Table 1: Sampling Frame for the Study**

| Agricultural zones | LGA | Population of respondents | Sample selected | Sample size used | Total |
|---|---|---|---|---|---|
| Ibadan-Ibarapa | Ibarapa East | 80 | 48 | 45 | |
| | Egbeda | 58 | 35 | 35 | 80 |
| Oyo | Atiba | 90 | 54 | 50 | |
| | Itesiwaju | 66 | 40 | 40 | 90 |

Journal of Forestry Research and Management. Vol. 20 (1).58-65; 2023, ISSN 0189-8418

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| | | | | | |
|---|---|---|---|---|---|
| Saki | Atisbo | 60 | 36 | 35 | |
| | Iwajowa | 59 | 35 | 35 | 70 |
| Ogbomoso | Ogbomoso North | 98 | 58 | 50 | |
| | Ogo-oluwa | 69 | 41 | 40 | 90 |
| 4 | 8 | 580 | 348 | 330 | 330 |

The study used data mainly from primary source. Data were collected with the use of structured questionnaire and an interview schedule. The data collected were analysed using descriptive statistics and the Cobb Douglas Production Model.

**Elasticity Model: Measuring Rate of Technical Return**

$$Y = f(X1, X2 \ldots\ldots\ldots\ldots\ldots\ldots X5) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

**Cobb-Douglas Production Function**

$$LnYi = LnA + \beta i \sum_{i=1}^{5} Lni + \mu \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Y = Cassava yield (kg/ha)
$X_1$ = Farm size (hectares)
$X_2$ = Credit (naira)
$X_3$ = Labour (man day)
$X_4$ = Fertilizer (kg)
$X_5$ = Stem cuttings (bundles)

$$LnY = (bo + b1lnX1 + b2lnX2 + b3lnX3 + b4lnX4 + b5lnX5 + \mu) \quad \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

When Y = dependent Variable, X = independent Variables
$\mu$ = error term, $b_1$ = parametric estimates and $b_0$ = the intercept term
A and $B_i$ = parameters estimated (i = 1, 2... 5)
$X_i$ = the vector of transformations of the ith input used by jth farm
$\beta$ = a vector of unknown parameters and U = random variables

**Results and Discussion**

**Respondents Socio-economic Characteristics**

The result in Table 2 shows that 9.7% of the farmers were between the ages of 21 and 30 years while 28.8% were between 51and 60 years with the mean age of 50 years which is in consonounce with the results of Akinnagbe and Umukoro (2011) and also supported by the results of Amao *et al.,* (2013) and Babalola *et al.,* (2013). This shows that the farming population is already ageing in the study area in conformity with the findings of Ogunniyi *et al*., (2013) to the effect that cassava-based farming in Oyo State was in the hands of elderly people who may not have the required labour by themselves. Most of the farmers (73.0%) were males while 27.0% were females. This implies that male farmers dominated cassava production in the study area which may be due to the rigorous activities involved in cassava production. Females are generally involved in farm processing and other farming activities. There is also a cultural belief that men have more access to land than women in the study area as asserted by Ogundele and Yusuf (2004) who observed that female farmers are highly discriminated against in the use of critical input such as land. More than three quarters (81.8%) of the farmers were married while 6.1% were single. This implies that the majority of the farmers are married with the availability of family labour which may be used for cassava farming activities all other things being equal. In respect to education, 10.9% of the farmers had no formal education 26.4% had primary education, 28.8% had tertiary education while the majority (33.9%) attained secondary school education meaning that average cassava farmers in the area had one form of formal education or the other (Oluwemimo, 2010).

The table also shows that 33.3% of the farmers had household sizes between 1 and 5, 7.3% had household size between 11 and 15 while 59.4% had household sizes between 6 and 10 with mean a value of 6.0 persons. This implies that the respondents have a fairly large household size which may, however, useful for family labour. This finding is at variance with finding from the work of Raufu and Adetunji., (2012) and Oladeebo *et al.,* (2013) who asserted that the availability of adequate family workforce for cassava production is one of the characteristics of a developing country, respondents engaged in livestock farming constitute 10% while 6.1% engaged in hunting. The majority (83.9%) of the farmers engaged in crop farming. These results might be an indication of abundant land resource in the study area. The finding is in consonance with that of Raufu and Adetunji (2012). In respect of farm management experience, 4.6% had 31-40 years experience, 11.8% had between 21and 30 years experience while 41.2% and 42.4% had between 1 and 10 years and 11 and 20 years experience respectively. The mean number of years of farm management experience was 14.4years, which implies that most of the farmer had substantial farm management experience, which may influence land management and increase crop productivity. It was also indicated that 18.2% of the farmers used family labour while 81.8% used hired labour. This is in agreement with the result from the work of Akinola *et al.,* (2015). This implies that majority of the farmers do not use family labour in large quantity especially for labour intensive farming.

**Table 2: Respondents Socio-economic Characteristics**

| Variables | (n= 330) | Frequency | Percentage | Mean |
|---|---|---|---|---|
| **Age (years)** | | | | |
| 21-30 | | 32 | 9.7 | |
| 31-40 | | 59 | 17.9 | |
| 41-50 | | 88 | 26.7 | |
| 51-60 | | 95 | 28.8 | |
| 61 and above | | 56 | 16.9 | 50.0 |
| **Gender** | | | | |
| Male | | 241 | 73.0 | |
| Female | | 89 | 27.0 | |
| **Marital Status** | | | | |
| Single | | 20 | 6.1 | |
| Married | | 270 | 81.8 | |
| Divorced | | 15 | 4.6 | |
| Widow | | 11 | 3.3 | |
| Widower | | 14 | 4.2 | |
| **Educational Level** | | | | |
| No formal Education | | 36 | 10.9 | |
| Primary education | | 87 | 26.4 | |
| Secondary education | | 112 | 33.9 | |
| Tertiary education | | 95 | 28.8 | |
| **Household Size (People)** | | | | |

| | | | |
|---|---|---|---|
| 1-5 | 110 | 33.3 | |
| 6-10 | 196 | 59.4 | |
| 11-15 | 24 | 7.3 | 6.0 |
| **Primary occupation** | | | |
| Livestock | 33 | 10.0 | |
| Crop | 277 | 83.9 | |
| Hunting | 20 | 6.1 | |
| **Farm management experience** | **(years)** | | |
| 1-10 | 136 | 41.2 | |
| 11-20 | 140 | 42.4 | |
| 21-30 | 39 | 11.8 | |
| 31-40 | 15 | 4.6 | 14.4 |
| **Source of Labour** | | | |
| Family | 60 | 18.2 | |
| Hired | 270 | 81.8 | |

**Rate of Technical Returns on cassava Farmers' Production in the Study Area**

Table 3 shows that the use of using the Cob-Douglass Production Model in linear form explains the production elasticity of the farmer. Farm size, credit, labour and fertilizer were positive and less than unity but not less than zero If $\ell = 1$, then there are constant returns to scale: any proportional change in all inputs results in an equal-proportionate change in output. If $\ell > 1$, there are increasing returns to scale and if $\ell < 1$ (though not less than 0, given the possibility of free disposal) and as also explained by Diewert *et al*., (2011), then there are decreasing returns to scale therefore, showed that cassava production was productive in the study area considering the return to scale value of 0.904 which indicates a positive decreasing return to scale and shows that production was in stage II of the production surface which is the only economical and rational stage of production.

This implies that for a unit increase in farm size, credit, labour and fertilizer there will be a positive and significant percentage increase in the cassava output, ( i.e. $\ell = 0.562$, a 1% increase in farm size usage would lead to approximately 56% increase in cassava output). This is in consonance with the work of Olarinde (2011) and Oyewo *et al*., (2021) also supported by Fawole and Rahji (2016) that the sets of inputs with positive elasticity were utilized in efficient manner and such have kept production in rational stage of production and also conform to the findings of Akpan *et al*., (2017). The Return to Scale (RTS) of 0.904 (Table 3) indicated that for every 100% increase in the combination of inputs used there was a corresponding 90.4% in the corresponding output of cassava production in the study. However, there is room for improvement with the present scope of production by the adoption of these combinations of the physical inputs (farm size, credit, labour, fertilizer and cassava stem cuttings) and better sustainable land management's practices which may enhance productivity among the farmers by 9.6% through the combination of the factors of production in the study area.

**Table 3: Rate of Technical Return in Farmers' Productivity**

| Variables | Elasticity |
|---|---|
| Farm size | 0.562 |
| Credit | 0.088 |
| Labour | 0.036 |
| Fertilizer | 0.028 |
| Stem cuttings | 0.190 |
| **RTS** | **0.904** |

## Conclusion

The study examined the farmers socio economic characteristics and rate of technical returns on their productivity using descriptive statistics and the Cobb Douglas Production Model: Measuring Rate of Technical Return (RTR): it was concluded that cassava famers were within their working age, with substantive years of farming experience, fairly enough household sizes which can be useful for family labour, although farming activities in the study is becoming ageing. The return to scale (RTS) value of 0.904 showing a positive decreasing return to scale and that production was in the stage II of production surface which is known as the only economical and rational stage of production. These implies that for a unit increment in the combination of physical inputs used there was 0.904 corresponding increment in the level of cassava production. This suggested that cassava farmers are productive and can operate at this level of production phase. However, there is room for improvement in the level of production since the potential of the physical inputs has not been fully utilized in the study area.

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