*Original Research Article*

# Does contract farming really matter in cassava farms productivity in Iseyin Local Government Area, Oyo State, Nigeria?

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## Abstract

Improving the productivity of smallholder farmers particularly in developing countries has taken different approaches. Contract farming is one of the approaches employed to increase farmers' productivity. However, agricultural outcomes have not been consistent with contract farming in developing countries. Hence, we examined the effect of contract farming on productivity of cassava farmers in Iseyin Local Government Area of Oyo State, Nigeria. Primary data were collected using a multi-stage procedure to select the farmers. Descriptive and econometric methods were employed for data analysis. The findings revealed that farm size and years of education of the participants in contract farming in the area were significantly different from non-participants by 0.45 ha and 1.76 years, respectively. Years of education, farm size, planting improved cassava variety, price of cassava output and being a female cassava farmer were significant drivers of participation. The mean productivity of the cassava farmers was about 0.89. Non-participants showed a higher productivity than their counterparts in contract farming. Although farm size increased productivity of cassava farmers, household size and contract farming significantly reduced it in the area. Hence, it was concluded that contract farming does not always significantly improve agricultural outcomes. Planting high-yielding varieties coupled with best agronomic practices will better address the issue of declining productivity of the cassava farms in the area, alongside reduction in family size. Further, giving considerable attention to favourable technical supports and contract terms will improve contract farming effect on agricultural outcomes.

**Keywords:** Contract farming; *Manihot esculenta*; descriptive and econometric methods; productivity; participation; smallholders.

## INTRODUCTION

Currently, Africa is the continent faced with the biggest productivity challenge (Arslan et al., 2020). The quest to improve the productivity of smallholder farmers particularly in developing countries has taken different approaches. Empirical studies abound with evidences of improved technologies such as improved planting materials, mechanization, and good farming practices among others having positive impact on agricultural productivity (Awotide et al., 2012; Adofu et al., 2013; Ojo et al., 2016; Mishra et al., 2018; Arslan et al., 2020). In addition, policies and contract farming are other routes to improving farmers' productivity (Sugino and Mayrowani, 2009; Fuglie and Rada, 2011; Tiri et al., 2020). Contract farming is meant to remove or reduce imperfections in agricultural outcomes (Olomola, 2010). Although contract farming is expected to improve agricultural outcomes, it has been reported to

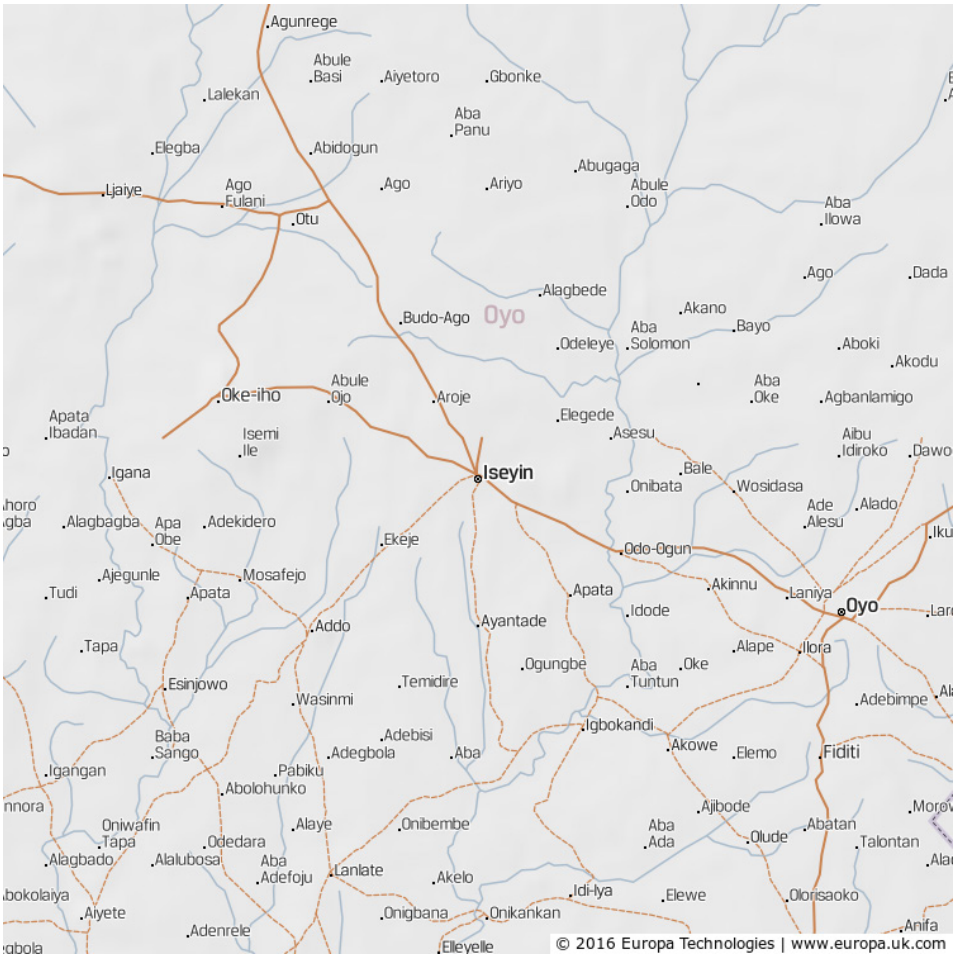


**Figure 1.** Map of Iseyin Local Government Area of Oyo State
Source: Google map

have had inconsistent effect on agricultural outcomes in developing countries (Olomola, 2010; Obasi, 2014; Mishra et al., 2018).

Contract farming is the agreement between a farmer and a contracting firm for a specified supply of output at a certain price (Obasi, 2014). It is done for various crops and livestock in Nigeria. Cassava is one of the most important crops in Nigeria due to its level of production and consumption. Nigeria is the largest producer of cassava globally with 59,193,708 metric tons contributing about 21% of its global production (Onwumere and Ichie, 2013; FAOSTAT, 2019; PwC, 2020;) followed by Congo DR and Thailand with global contributions of 10.8% and 10.6%, respectively (Otekunrin and Sawicka, 2019). Cassava production is concentrated in the Southern zones and North-Central zone of Nigeria (HarvestPlus, 2010).

Low yield remains in cassava production despite Nigeria being the largest producer. Thus, the country is yet to meet the domestic demand for food and industrial use with little being exported (Ikuemonisan et al., 2020). The low yield has been linked to ineffective agronomic practices and inefficient management of production resources (Ikuemonisan et al., 2020). In order to improve the productivity, income, market access and reduce price volatility, some cassava farmers have entered into contract with manufacturing firms or other large scale processors who act as off-takers for the cassava produced in some areas of Oyo State, Nigeria. The State is one of the largest cassava producers in South West, Nigeria[1].

There are few empirical studies related to contract farming oncassava in Nigeria (Obasi 2014; Ogunleye and Ojedokun, 2014). Although the study of Ogunleye and Ojedokun (2014) was conducted in same region as this study, it focused on the preference for contract farming by cassava farmers and the method of analysis was centered mainly on the tests of statistics such as

1 https://www.researchgate.net/figure/Cassava-Production-area-and-yield-by-State-in-Nigeria_tbl1_266021203

chi-square. Although Obasi (2014) related contract farming of cassava farmers with productivity and welfare in another region in Nigeria, this study focused on the drivers of participation of cassava farmers in contract farming and its effect on productivity. Hence, we provide a contribution to knowledge on the effect of contract farming in developing countries which is not conclusive in the literature. Our working hypothesis was as follows: Contract farming improves cassava farm productivity in Iseyin Local Government Area, Oyo State, Nigeria.

## MATERIALS AND METHOD

### Study area

The study was carried out in Iseyin Local Government Area (LGA) of Oyo State, South-West, Nigeria. The LGA has a latitude of 8.1°N and longitude 3.29°E. It has an area of 1,338.2 km² and a population of 334,799 in 2015; comprising about 51% and 49% of male and female, respectively.[2] It has a moderate to heavy seasonal rainfall and high relative humidity with a mean annual temperature of 24.4 °C. The major occupation of the people is farming and crops like maize, sorghum, yam, cassava and vegetable are grown in the area. The Yoruba tribe dominates the area.

### Data type and sampling technique

Primary data were collected with the aid of semi-structured questionnaire administered to the cassava farmers in the study area in order to obtain information such as their socio-economic characteristics, farm characteristics and contract scheme, among others. A multistage sampling technique was used to select cassava farmers for this study. First, two wards were randomly selected from the eleven wards in the LGA. A list of the villages was not available but a list of polling units in each selected ward showed similar number of polling units (17 polling units each in Akinwumi/Osogun and Ekunle II). Hence, five villages were randomly selected proportionate to size from each ward giving a total of ten villages. The villages selected in Akinwumi/Osogun were: Aba Paanu, Baale Sagbo, Akinwumi, Osoogun and Araromi, whereas the villages selected in Ekunle II were: Onilu, Basorun Isale, Ita Obele, Aaba and Ipowu. Since contract farming was common in the area, 15 cassava farmers were randomly selected from each village to give a total of one hundred and fifty (150) cassava farmers, which comprised 98 contract farmers and 52 non-contract farmers. All questionnaires were properly filled, hence, all 150 were found useful for the analysis.

### Analytical techniques

Descriptive statistics, probit regression, total factor productivity, and ordinary least squares (OLS) regression were employed to analyse the data collected. Descriptive statistics was used to describe the rate of participation in contract scheme. Probit was used to determine the drivers of contract farming participation among the cassava farmers. Total factor productivity was used to estimate the productivity level of the farmers. The Cobb-Douglass model, a functional form of the OLS model, was used to assess the effect of contract farming participation on cassava productivity.

### Descriptive statistics

This included frequency, mean and standard deviation to profile and describe the socioeconomic characteristics of the respondents.

### Probit model

The probit model was used to examine the factors influencing cassava farmers' participation in contract farming. This model uses cumulative standard normal distribution (Torres-Reyna, 2016). The marginal effect (how much change of the outcome as a result of change in value of a predictor) of the covariates on the response variable was reported because the coefficient of the probit regression cannot be interpreted. Following Torres-Reyna (2016), the model is specified as follows:

$$\Pr(Y_i = 1 \mid X_1, X_2, \ldots X_n) = \frac{1}{e^{(\infty_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_n X_n + \varepsilon_i)}} \quad (1)$$

$Y_i$ ..... Participation status (participated in contract farming = 1, Otherwise = 0)
$X_1$ ..... Age of cassava farmers (years)
$X_2$ ..... Marital status (Married = 1, others = 0)
$X_3$ ..... Years of education (years)
$X_4$ ..... Gender (Male = 1, Female = 0)
$X_5$ ..... Quantity of cassava cuttings (kg)
$X_6$ ..... Cassava variety (Improved cassava variety = 1, otherwise = 0)
$X_7$ ..... Cassava output (kg)
$X_8$ ..... Farm size (ha)
$X_9$ ..... Price of output (₦)
$\infty_0$ ..... Constant
$\beta$ ..... Parameters to be estimated
$\varepsilon_i$ ..... Error term

2 https://www.city-facts.com/iseyin

**Table 1.** Demographic characteristics of the respondents

| Variables | Frequency | Pooled (%) |
|---|---|---|
| **Gender** | | |
| Male | 97 | 64.67 |
| Female | 53 | 35.33 |
| **Age (years)** | | |
| ≤30 | 1 | 0.67 |
| 31–40 | 18 | 12.00 |
| 41–50 | 47 | 31.33 |
| 51–60 | 61 | 40.67 |
| >60 | 23 | 15.33 |
| Mean = 52.25; std 8.43 | | |
| **Household size** | | |
| ≤4 | 26 | 17.34 |
| 5–8 | 119 | 79.33 |
| >8 | 5 | 3.33 |
| Mean = 6.0; std = 1.54 | | |
| **Years of education** | | |
| Primary | 96 | 64.00 |
| Secondary | 37 | 24.67 |
| Tertiary | 17 | 11.33 |
| Mean = 8.61; std = 3.67 | | |
| **Cassava Farming experience (years)** | | |
| ≤10 | 19 | 12.67 |
| 11–20 | 75 | 49.99 |
| >20 | 56 | 37.34 |
| Mean = 20.88; std = 8.75 | | |
| **Farm size (ha)** | | |
| ≤2.0 | 90 | 60.00 |
| 2.1–4.0 | 54 | 36.00 |
| >4.0 | 6 | 4.00 |
| Mean = 2.32; std = 1.15 | | |
| **Agricultural Training** | | |
| Training | 103 | 68.67 |
| No training | 47 | 31.33 |

Source: Field Survey, 2018.

### Total Factor Productivity

Total Factor Productivity (TFP) analysis was used to estimate the productivity of cassava farmers in the study area. According to Fakayode et al. (2008) total factor productivity (TFP) or total productivity is the ratio of output to the total variable costs of production it can also be measured as the inverse of unit variable cost. Hence, TFP is the ratio of the output to the Total Variable Cost (TVC) as shown below:

$$TFP_i = \frac{Q_i}{\sum P_i R_i} \quad (2)$$

where:
$Q_i$..... Output = quantity of cassava produced (kg)
$P_i$ ..... unit cost of ith variable input used (N)
$R_i$..... input = quantity of ith variable input used in producing cassava (labour, cassava cuttings planted, fertiliser used, transportation cost).

Total Factor Productivity index was eventually generated to know the proportion of farmers who were productive or not. Following Adenegan et al. (2018), the TFP index less than 1 indicates farmers that are not productive (resources not efficiently utilised) whereas values 1 and above indicate farmers that are productive.

### Multiple regression model

The multiple regression model was used to analyse the effect of participation in contract farming on productivity by cassava farmers. The variations in productivity were explained by the included independent variables. The results were subjected to different functional forms, however, the Cobb Douglass function gave the best output using statistics, economics theory and econometrics. Hence, its result is presented in this study. The model was specified as follows:

$$lnY_i = \beta_0 + \beta_1 lnX_1 + \beta_2 lnX_2 + \ldots + \beta_n lnX_n + \varepsilon_i \quad (3)$$

$lnY_i$..... Total Factor Productivity of ith farmer
$lnX_1$..... Age of farmers (years)
$lnX_2$..... Sex of the household head (Male = 1; female = 0)
$lnX_3$..... Farming experience of the farmers (years)
$lnX_4$..... Household size
$lnX_5$..... Years of education of the farmers (years)
$lnX_6$..... Farm size (ha)
$lnX_7$..... Agricultural training (received training = 1, otherwise = 0)
$lnX_8$..... Distance to target market (km)
$lnX_9$..... Contract farming (participant = 1, non-participant = 0)
$\beta_0$ ..... Constant
$\beta$ ..... Parameters to be estimated
$\varepsilon_i$ ..... Error term

## RESULTS

### Demographic characteristics of the respondents

Table 1 reveals the social and farm characteristics of cassava farmers interviewed. It is revealed that about 65% of the cassava farmers are male. This indicates a male dominance in cassava production. This is in line with the study on cassava farming that was conducted by Obasi (2014) in South East Nigeria which found that cassava farming was a male dominated activity. The average age of the cassava farmers is 52 years indicating youths are hardly involved in cassava farming. Majority (79%) having 5–8 family size could leverage on this for family labour in farming operations. The average cassava farming experience is about 21 years indicating

**Table 2.** Cassava farmer participation rate in contract farming.

| Participation | Frequency | Percentage |
|---|---|---|
| **Contract farmers** | 98 | 65.33 |
| **Non-contract farmers** | 52 | 34.66 |
| **Total** | 150 | 100.0 |

Source: Field survey, 2018.

long years of experience. The proportion of the farmers who cultivated cassava farms on 2 hectares or less was 60%, conforming to the findings of Jerumeh and Omonona (2020) that most cassava farmers in Nigeria are smallholder farmers. Majority (64%) of the farmers attained only primary level of education. This suggests that cassava farmers are not highly educated. About 69% of these farmers received agricultural training in the last production season.

### Participation in contract farming

The participation in contract farming by the cassava farmers is shown in Table 2. It is revealed that about 65% of the cassava farmers participated in contract farming while about 35% did not. This implies that more than half of the cassava farmers in this area are participants of contract farming. The study of Poku et al. (2018) showed an inconsistent result in the level of participation in contract farming by cassava farmers due to the divided sectors of firms involved (public and private). In public firm, 66.7% of the cassava farmers participated in the grower scheme while in private firm, non-participants occupied 34.4% in the cassava grower scheme in Ghana. This shows that structure of the scheme could influence level of participation in contract farming scheme.

### Comparison between contract farming participants and non-participants

In Table 3, using some selected socio-economic and farm characteristics, *t*-test statistics was used to test for the statistical difference between participants and non-participants of contract farming. It is revealed that there is statistical difference in farm size and level of education of participants and non-participants at 5% and 1%, respectively. This indicates that participants in contract farming cultivated more cassava farmland and are more educated than their counterparts who did not participate in this scheme. This is in line with the findings of Poku et al. (2018) which showed that cassava farmers who participated in cassava outgrower scheme in Ghana cultivated more farmland and are more educated.

### Determinants of participation in contract farming

Table 4 reveals the drivers of participation in contract farming among cassava farmers in the area. The overall model is significant at 1% as revealed by the value of prob > $\chi^2$, indicating that the coefficients of the included covariates are different from zero and well fit for the model. Five of the nine explanatory variables included in the model are statistically significant at various levels.

As expected, being educated increases the chances of cassava farmers participating in contract farming by 2%. This implies that cassava farmers who are educated are more likely to participate in contract farming than their counterparts who are not. This is because education helps them to easily understand the terms of agreement and to utilise any technical support or advice given by the contractors (Siros and Hoang, 2013). However, this opposes the findings Kozhaya (2020) which revealed that education reduces participation in contract farming because more educated farmers are more likely to utilise other sources of information for their farming improvement than being held down by contracts which may not likely meet their desires.

Being a female cassava farmer promotes the probability of participation in contract farming in the area. In other words, male cassava farmers are less likely to participate in contract farming by about 17%. This is because men have better access to productive resources than women (Adejoh et al., 2017). Hence, women are more likely to participate in contract farming due to the productive resources that would be provided through the contract. Planting improved cassava variety increases the probability of participation in contract farming by 49%. This is because cassava farmers who planted improved cassava variety are more likely to be engaged by contractors due to the possibility of getting higher yield.

**Table 3.** Mean Difference between contract farming participants and non-participants

| Characteristics | Participants | Non-participants | Difference | T-stat |
|---|---|---|---|---|
| **Age of farmers (years)** | 51.88 | 52.94 | 1.06 | 0.735 |
| **Household size** | 5.85 | 6.29 | 0.44 | –1.461 |
| **Farming experience (years)** | 21.00 | 20.63 | 0.37 | 0.249 |
| **Farm size (ha)** | 2.50 | 2.05 | 0.45 | 2.199** |
| **Years of education (years)** | 9.22 | 7.46 | 1.76 | 2.866*** |

Source: Authors' computation, 2018.

**Table 4.** Probit regression for the determinants of cassava contract farming participation

| Participation | Coefficient | Std. Error | Marginal effect |
|---|---|---|---|
| **Age of farmers (years)** | 0.015 | 0.019 | 0.004 |
| **Marital status** | 0.063 | 0.269 | 0.015 |
| **Educational level (years)** | 0.086** | 0.042 | 0.020 |
| **Gender** | –0.713*** | 0.269 | –0.165 |
| **Quantity of cassava cuttings (kg)** | 0.000 | 0.003 | 0.000 |
| **Cassava variety** | 2.112*** | 0.425 | 0.490 |
| **Cassava output (kg)** | –0.005 | 0.009 | –0.001 |
| **Farm size (ha)** | 0.471** | 0.203 | 0.109 |
| **Price of output (₦)** | 0.000** | 0.000 | 0.000 |
| **Constant** | –5.028*** | 1.496 | |
| **Number of observations** | 150 | | |
| **LR $\chi^2$ (9)** | 68.48 | | |
| **Prob > $\chi^2$** | 0.0000 | | |
| **Pseudo R2** | 0.3537 | | |

Source: Authors' computation, 2018.
NB: *, **, and *** represent 10%, 5%, and 1% statistical significance, respectively.

**Table 5.** Total factor productivity index of cassava farmers

| Productivity index | Participant | Non-participant | Pooled | T-test |
|---|---|---|---|---|
| | Frequency (%) | Frequency (%) | Frequency (%) | |
| **<1** | 71 (72.45) | 24 (46.15) | 95 (63.33) | 4.1219*** |
| **≥1** | 27 (27.55) | 28 (53.85) | 55 (36.67) | |
| **Total** | 98 (100.0) | 52 (100.0) | 150(100.0) | |
| **Mean** | 0.7694 | 1.1157 | 0.8895 | |
| **SD** | 0.4259 | 0.5925 | 0.5153 | |

Source: Authors' computation, 2018.

The coefficient of farm size is positively related to participation in contract farming and significant at 5%. This implies that an additional increase in hectare of cassava farmland will likely raise participation in contract farming by 10%. Land is an important determinant in recruiting farmers to participate in the scheme and very key to cassava output. This is in agreement with the results of Abebe et al. (2013). Price of cassava output increases the probability of participation in contract farming scheme. This implies that increase in price of cassava output by the contracting firm increases the chances of cassava farmers to participate in the scheme. This is a key factor in terms of agreement and once it is favourable, cassava farmers are more likely to participate in the scheme.

## Productivity level of contract farming of participants and non-participants

Results presented in Table 5 show that the proportion of farmers who are not productive are twice (66.7%) that of those who are productive (33.3%). Using cross tabulation, the number of farmers who participated in contract farming and are productive is 28 whereas those who did not participate and are productive is 22. There are more participants (72.5%) who are less productive compared to their non-participant counterparts (46.2). This is equally reflected in their mean with non-participants having better productivity (1.1). This is statistically significant at 1%. This suggests that contract farming participants are more productive and utilise their productive resources better.

## Effect of contract farming on cassava productivity

Results in Table 6 show the effect of contract farming on cassava productivity. The statistical significance of the model (Cobb Douglas regression) at 1% indicates that the included explanatory variables were well fit. Out of the nine explanatory variables included, five of them were statistically significant at 1%t and 5%.

Advancing age of the cassava farmers by 1% increases their productivity by about 1.32%. Being a male farmer increases the productivity by about 43%. This implies that male cassava farmers are more productive than their female counterparts. This could be attributed to men having better access to productive

**Table 6.** Cobb-Douglas function for effect of contract farming on productivity

| Productivity | Coefficient | Std. Error |
|---|---|---|
| **Age of famers (years)** | 1.317** | 0.513 |
| **Household head gender** | 0.431** | 0.041 |
| **Farming experience** | –0.232 | 0.165 |
| **Household size** | –0.428** | 0.206 |
| **Educational level (years)** | 0.134 | 0.185 |
| **Agricultural training** | 0.046 | 0.245 |
| **Farm size (ha)** | 0.502*** | 0.164 |
| **Distance to market (km)** | –0.043 | 0.207 |
| **Contract farming** | –0.816*** | 0.234 |
| **Constant** | –4.329** | 1.877 |
| **Number of observations** | 146 | |
| **F (9,136)** | 4.69 | |
| **Prob > F** | 0.0000 | |
| **R-squared** | 0.2370 | |
| **Adj. R-squared** | 0.1865 | |

Source: Authors' computation, 2018.
NB: **and *** represent 5 %, and 1% statistical significance, respectively.

resources such as land than women. As reported by Gebre et al. (2021), inequality in gender access to productive resources has created a gap between a male-headed and female-headed households. Increase in the number of household members by 1% reduces the farm productivity by about 43%. The volume of farm produce put for sale reduces as household size increases (Adenegan et al., 2012). This is because large household size promotes household poverty and by extension, poverty reduces farmers' productivity (low productivity) as revealed in the vicious cycle of poverty.

A percentage increase in hectare of cassava farmland will increase farm productivity by about 50%. This implies that increase in farm size increases productivity of farmers. This confirms that a reasonable or an appropriate increase in farm size could enhance crop productivity (Khataza et al., 2018). Most findings in literature have established a significant positive impact of contract farming on various farming outcomes such as profit, productivity, income, and efficiency among others (Saigenji and Zeller, 2009; Henningsen et al., 2015; Mishra et al., 2018). Contrary to these findings, contract farming in this study significantly reduced cassava productivity by about 82%. This could be associated with unfavourable contract terms for instance, price offered and lack of technical support such as extension service to cassava farmers. Although contract farming is designed to be a win-win situation, its success or effectiveness still depends on the capabilities of farmers, and enforcement of the terms and conditions of the contract.[3] This is because the contract itself may not automatically guarantee success in crop production if terms and other conditions are not well observed. Henningsen et al. (2015) also pointed out that contract farming scheme lowered sunflower farmers' technical efficiency in Tanzania.

## CONCLUSION

The aim of this study was to examine the effect of contract farming participation on the productivity of cassava farmers. Based on the findings, more than half of the cassava farmers in this area were under contract farming. Farm size and level of education of the participants are significantly different from non-participants of contract farming. Hence, factors such as level of education, farm size, planting improved cassava varieties, price of cassava output and being a female cassava farmer positively drive participating in contract farming in this area. Similarly, age of the farmers, gender of the household head and farm size are important factors increasing their productivities. However, household size and participation in contract farming drive down productivity of cassava farms in the area. Thus, poor technical assistance or input support from the contractor, unfavourable terms of agreement, and cattle crop destruction (particularly in Nigeria) could have been responsible for this decline in productivity in contract farming.

It is therefore recommended that planting high-yielding varieties coupled with best agronomic practices and reduction in family size should be adopted to improve productivity. Also, since contract farming is not positively consistent with agricultural productivity in the area, favourable technical support and terms of agreement should be given considerable attention to address the issue of declining productivity of the cassava farms in this area. Female cassava farmers should equally be supported in accessing productive resources in order to enhance their productivity.

## CONFLICT OF INTEREST

The authors declared no conflicts of interest with respect to research, authorship and publication of this article.

3 https://www.agrilinks.org/post/reducing-price-risk-contract-farming-conditions-success-edition

## ETHICAL COMPLIANCE

The authors have followed the ethical standards in conducting the research and preparing the manuscript.

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