# Productivity of participating cassava (*Manihot esculenta*) farmers in Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) sponsored advisory service in Ogun State, Nigeria: 2016-2018

**R.O. Sanusi*, R.M. Adebayo, E.I. Isegbe, A.O. Ibrahim, O.B. Ajayi, O.O. Oke, B.O. Ajibola and A.S. Ajibade**

*Department of Agricultural Extension and Rural Development, College of Agricultural Management and Rural Development Federal University of Agriculture, Abeokuta, Ogun State.*

**Corresponding author email*: unbeatable2013@gmail.com

**The Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) is a service provider in the field of international relations. It is a federal enterprise that acts based on the values and fundamentals of the Federal Republic of Germany. It is involved in good business with good agricultural practices (GAP) in many commodities including cassava. Productivity is the index which allows assessment of efficiency and effective utilization of resources to obtain a certain output. The greater the extent to which variable inputs explain variability in output, the greater their explanatory power. An increase in productivity could be due to technological advances, improvement in managerial advances, and techniques of efficient use of inputs in the production process. An increase in a nation's agricultural productivity implies a more efficient distribution of scarce resources. This study was carried out in Ogun State, Nigeria (latitude 7º 00' N and longitude 3º 35' E) to determine the productivity of participating farmers in a GIZ sponsored advisory service. A total of 336 farmers (168 participants and 168 non-participants) were randomly selected from the 14 local government areas (LGAs) where GIZ operates. Data were analyzed using frequency counts, percentages and least square regression. Results showed that all the participants had formal education and that they all belonged to a farmers´ association. The average farm size for the participants was 1.64 ha. The use of fertilizers/agrochemicals, and planting of improved cassava stem cuttings had positive effect on the output and productivity of the farmers. The study recommends implementation of GIZ's service-friendly policies to enhance cassava farmers´ productivity.**

**Keywords:** Cassava, productivity, GIZ, Nigeria

Productivity is the output per unit of input where input can be land, labour and or capital. According to Roghanian et al. (2012), productivity is the index which allows assessment of efficiency and effective utilization of resources to obtain a certain output. Mathematically the production function is continuous and differentiable, and this property of differentiability enables its use to estimate the rate of return (Nwauwa 2011).

For any production function, the correct functional form can be determined by fitting various feasible functional forms to obtain the best fit which is normally selected based on economic, statistical and econometric soundness (Nwosu 2005). The simplest mathematical form of the production function can be stated as Q= f(X), where Q = output, X= inputs and f is a function indicating a causal relationship between Q and X. Nwosu explained that various functional forms can be used to describe production relationships, but in practice the most used forms include the linear, quadratic and Cobb Douglas functional forms.

According to Ajibefun (2002), increase in productivity could be due to technological advances, improvement in managerial advances, and techniques of efficient use of inputs in the production process. He identified the following ways of productivity increase:

(i) increase in outputs and inputs, with outputs increasing more proportionately than inputs,
(ii) increase in outputs while inputs remain the same,
(iii) decrease in both outputs and inputs

0041–3216/2021/020148–159

with inputs decreasing proportionately more than outputs, and

(iv) decrease in inputs while outputs remain the same. FAO (2013) observed that increase in productivity can contribute to economic growth by providing more food, increasing the prospects for growth and competitiveness in the agricultural market, increasing incomes/savings and decreasing labour migration to other sectors.

An increase in a nation's agricultural productivity implies a more efficient distribution of scarce resources. It is believed that farm productivity is functionally dependent on quantifiable parameters which individually and collectively as regressors exhibit a causal relationship being best represented by a regression model (Nwauwa 2011). Ajibefun (2002) and Asogwa (2005) have observed that raising the production per unit of land is the key to effectively addressing the challenges of achieving food security since most cultivable land has already been brought under cultivation. And even in areas where a wide expanse of land is still available, physical and technological constraints prevent large scale conversion of potentially cultivable land. Proper use of available resources such as land is thus very essential.

Productivity measures are subdivided into partial and total measures. According to Hannula (2002), partial productivity measures are the amount of output per unit of a particular input such as labour, land and capital. Commonly used measures are yield (output per units of land), labour productivity (output per economically active person or per agricultural person-hour. Yield is commonly used to assess the success of new production practices or technology. Labour productivity is often used to compare productivity of sectors within or across economies. It is also used as an indicator of rural welfare or living standards. According to Fakayode et al. (2008), total factor productivity or total productivity is the ratio of the output to the total variable costs of production.

The Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) is a service provider in the field of international cooperation. It is a federal enterprise that acts on the basis of the values and fundamentals of the Federal Republic of Germany. International cooperation between Germany and Nigeria commenced in 1974. In Nigeria GIZ was initially represented by a single office in Lagos until 2003, but since 2004 it has maintained the country office in Lagos and four project offices in Abuja.

GIZ's activities in Nigeria are focused on sustainable economic development, as agreed between the Nigerian and German Governments. It is involved in agriculture (cassava, maize, winter melon and rice) and West African regional integration. Two regional programmes focusing on agriculture are ongoing in Nigeria. The first aims to promote African rice value chains; the second builds the capacities of market-oriented small-scale farming. The purpose of both programmes is to achieve sustainable improvements in the livelihoods and food security of poor farmers in Nigeria and other West African countries.

GIZ is involved in good business with good agricultural practices (GAP) in cassava production. To do good business and make more income with improved management cassava farmers follow the advice given and apply the good agricultural practices to get the most benefit out of inputs and work. The cassava producers (men and women) are formed into groups by GIZ to do things they are not able to do alone. This helps farmers access input supplies more easily and also facilitates smooth management of the project.

The contents (technologies) of the advisory service delivered to the farmers include but are not limited to:

- The use of pesticides and other agrochemicals approved by National Agency for Food and Drugs Administration and Control (NAFDAC) and (Agricultural Development Programme) ADP agents. Labels are to be read to know

the correct dosages and utilization. Spraying is done in the direction of the wind; for cassava it is best done between May and December and should stop 1 month before harvest. This will ensure plant and human health and promote environmental protection.

- To control weeds use approved herbicides in ADP recommended dosages and between January and March.
- The use of improved varieties and recommended inputs.

## *Background*

The Food and Agriculture Organization (FAO) reported that more than one billion people suffer malnutrition (FAO 2009). Local food prices in many developing countries are high. Global food commodity prices are driven by differential rates of growth in the supply and demand for food crops, feed, and livestock products. Growth in demand for agricultural commodities largely stems from growth in demand for food which is driven by growth in population and per capita incomes, coupled with new demands for biofuels. Growth in supply of agricultural commodities is primarily driven by growth in productivity, especially as a result of dwindling land and water resources for agriculture. Therefore, agricultural productivity growth is a pivotal determinant of long-term growth in the supply, availability, and price of food.

Global land productivity, reflecting worldwide output of crop and livestock commodities per harvested and pastured area, was 2.4 times in 2005 what it was in 1961. Labour productivity, the output per agriculture worker, grew by a factor of 1.7 during that same period. Sustaining productivity growth in the long run will mitigate hunger and poverty and, at the same time, reduce pressure on the natural resource base (FAO 2009).

Cassava (*Manihot esculenta*) is a crop with enormous potential. It provides a stable food base for the food need of the populace, components in livestock feeds and raw materials for industries. Cassava also seems to be recording resounding successes in sub-Saharan Africa, out of the numerous stories of crop intervention failures in the region. As a result of this, many African countries have embraced its cultivation with renewed vigour (Aderinto et al. 2017). Engaging good agricultural practices such as prompt weeding, use of improved stem cuttings, recommended plant configuration, good soil management, appropriate timing of cultural operations, optimal use of labour and use of external inputs such as fertilizers, machines and pesticides all enhance farmer productivity (Atagher et al. 2015).

Almost every household in rural Nigeria grows cassava on small farms as one of the staple food crops to feed families and supply the local markets. According to Fakayode et al. (2008) cassava is a very important crop to Nigeria. Hamsa and Bellundagi (2017) stated that although time lag and price forecast influence farmers decisions on production and market supply, they nonetheless noted that its comparative production advantage over other staples serves to encourage its cultivation even by the resource poor farmers. Nigeria is the largest producer of cassava in the world, with about 40 t per annum, ahead of countries like Brazil and Thailand (Awoyinka 2009). This production was obtained from small farms turning out an average of 10 t/ha which falls short of the yield potential of cassava. An average of 15 - 30 t/ha is attainable (Ikuemonisan et al. 2020). The difference between actual and technically feasible yields for the crop implies great potential yet to be harnessed. In view of the growing importance and relevance of cassava in Nigeria, there is an urgent need to increase food production on a sustainable basis and export cassava for much needed foreign exchange. Therefore it is essential to focus on increasing the yield of cassava per unit area of land. Maintaining the current level of production will limit the extent to which the numerous potentials presented by the crop could be harnessed. It is anticipated that improved cassava production will assist

Nigeria in maximizing the potentials of the crop, especially for poverty alleviation, income generation and foreign exchange earnings. Awoyinka (2009) noted that Nigeria was yet to fully harness the socio-economic potentials of cassava that would translate to higher ranking of cassava next to petroleum as major contributor to the gross domestic product (GDP). In giving a reason for this, Fakayode et al. (2008) submitted that cassava farms, just like the other crop farms, are small scale types which are characterized by very low productivity. Increasing cassava yields from 10 to 15 - 30 t/ha is a significant challenge for the subsector. Push factors such as government support, new varieties, better farming practices and farmer motivation are typically cited as a means to increasing yields. Pull factors such as consumer demand, industrial demand, favourable markets, and positive attitudes are not commonly mentioned. However, it is maintained that both the 'push' and the 'pull' are needed if the industry is to move forward (IFAD and FAO 2004). This position implies that individuals and organizations whose role performances are relevant in the cassava sub-sector need to expand their capacities and be more effective in their activities.

Extension service delivery agency is a critical stakeholder in the agricultural development of Nigeria. Agricultural extension refers to a set of organizations that support people engaged in agricultural production and facilitate their efforts to solve problems; link to markets and other players in the agricultural value chain; and obtain information, skills, and technologies to improve their livelihoods (Kristin, 2009). The Nigerian government, through the Agricultural Development Progamme (ADP), private agencies through agro-input dealers and associations and non-governmental agencies such as GIZ, provide extension related services to Nigerian farmers including cassava farmers.

### *Objectives of the study.*

The broad objective of the study was to determine the productivity of participating cassava farmers in GIZ sponsored advisory service in Ogun State from 2016 to 2018. The specific objectives were to: (i) determine the productivity of participants and non-participants of GIZ sponsored advisory service in the study area; (ii) determine the factors that influence the productivity of participants of GIZ sponsored advisory service in the study area. Hypothesis: there is no significant difference between the productivity of participants and non-participants of GIZ's service.

## Methodology

### *Study area*

This study was conducted in Ogun state (latitude $7^{o}$ 00$^{l}$ N and longitude $3^{o}$ 35$^{l}$ E) which is located in the southwest part of Nigeria with a total land area of 16,409.26 km$^2$. It is bounded on the west by Benin Republic, on the south by Lagos and the Atlantic Ocean, on the east by Ondo state and on the north by Oyo and Osun States. The indigenous population belongs to Yoruba ethnic group comprising mainly the Egba, Yewa, Awori, Egun, Ijebu and Remo. Farming is the dominant economic activity of the people of Ogun state.

The two dominant religions in the state are Christianity and Islam. A small proportion of the people still practice traditional religion. As a means of livelihood the people engage in activities such as trading, farming, tie and dye production, civil service, pottery and other professional and technical occupations. Farming is the dominant economic activity, both crop and livestock production.

The ecological climate of the state falls within the rainforest zone and partly within the southern guinea savannah zone. The mean annual rainfall distribution in the state is about 1300 mm, but this has varied over the years. The average temperature is 28$^{o}$C and relative humidity remains uniform around 78%. The northern part of the state is mainly of derived savannah vegetation while the central part falls in the rain forest belt and the southern part belongs in the mangrove swamp. The geological landscape of the state comprises

extensive fertile soil suitable for animal husbandry, especially cattle rearing. The north-western part of the state tends toward savannah vegetation and so is suitable for cattle rearing. There are also forest reserves, rivers, lagoons, rocks and mineral deposits such as granite, limestone, kaolin, bitumen, phosphate and others. The state's climate supports cultivation of a variety of crops such as yam, cassava, maize, plantain, vegetable and fruits. The main cash crops produced in the state are cocoa, cashew, kola nut, oil palm, rubber and coffee. The state has various agricultural extension programmes implemented in four agricultural zones identified by Ogun State Agricultural Development Project (OGADEP) as Abeokuta, Ilaro, Ijebu and Ikenne. Each zone comprises of blocks, each block is divided into circles or cells and farmers within these areas are anchored by a village extension agent who oversees their activities. The block extension agent oversees the activities of farmers in the coverage area.

### *Population, sampling frame sampling procedure and sample size*

The target population of the study were the cassava growers in the 14 Local Government Areas (LGAs) who made up the participants and non-participants of the GIZ-sponsored advisory services in Ogun state. The sampling frame for the participants was obtained from OGADEP office. There are 43 GIZ extension agents and 8,600 participants spread across the 14 participating LGAs as shown in Table 1.

Fourteen LGAs out of the 20 LGAs in Ogun State which were participating in GIZ service were selected namely; Ewekoro, Ijebu Ode, Ijebu North-East, Shagamu, Obafemi Owode, Ado Odo, Ogun Waterside, Ikenne, Odeda, Ipokia, Yewa North, Ifo and Odogbolu. Watson (2001) sampling technique at a confidence level of 95% with estimated 10% variance in population (degree of variability) was adopted. Random sampling was carried out at the farm level to select 168 participants for the study in a proportionate manner across the participating LGAs. For the control group a similar random sample of 168 non-participants were selected at the farm level from the same participating LGAs. The total sample size for both the participants and non-participants was 336. The survey was conducted with the aid of questionnaires and an interview guide.

Table 1: Sampling frame and size of the study

| | Local government area | Number of extension agents | Sampling frame* | Sample size+ |
|---|---|---|---|---|
| 1 | Odeda | 9 | 1800 | 14 |
| 2 | Ifo | 2 | 400 | 11 |
| 3 | Ewekoro | 3 | 600 | 12 |
| 4 | Ado Odo | 3 | 600 | 13 |
| 5 | Shagamu | 1 | 200 | 11 |
| 6 | Obafemi Owode | 4 | 800 | 13 |
| 7 | Ikenne | 3 | 600 | 13 |
| 8 | Odogbolu | 1 | 200 | 11 |
| 9 | Ijebu North East | 2 | 400 | 11 |
| 10 | Ijebu Ode | 5 | 1000 | 13 |
| 11 | Ogun Waterside | 2 | 400 | 11 |
| 12 | Yewa North | 4 | 800 | 13 |
| 13 | Yewa South | 2 | 400 | 11 |
| 14 | Ipokia | 2 | 400 | 11 |
| | Total | 43 | 8600 | 168 |

Source: OGADEP, 2016. *Calculated using formula of Watson (2001). +Sample size for both GIZ participants and non-participants.

## Data analysis

Data obtained were subjected to descriptive and inferential analysis using the Statistical Package for Social Sciences (SPSS 20.0) and STATA 14 version. Results were presented as percentages, means, and standard deviations. Regression analysis was carried out between respondents' productivity and the factors that influenced it, while Z-test was used to test the null hypotheses.

## Results

The mean age, household size and farm size of the respondents were 44 years, five persons, 1.6 ha and 43years, four persons, 1.1ha for GIZ participants and non-participants respectively (Table 2). Among the participants almost half (48.2%) of the respondents had tertiary education and most (64.9%) of the respondents were male. The majority (95.8%) were married, and all (100%) of the respondents belonged to a farmer association as shown in Table 2. The results showed that 60.1% of the respondents had been involved in GIZ's advisory for 3 years and 39.3% for 2 years. It should be noted that the non-participants had lower levels of educational attainment and less participation in farmers´ groups.

Table 3 shows that the majority of the cassava growers harvested 11 - 20 t/ha of cassava in 2016. The mean output of the participants for the year was 19.33 t/ha, for the non-participants the mean output in 2016 was 12.73 t/ha. In 2017, many (58.3%) of the participants (but none of the non-participants) harvested an output greater than or equal to 21 t/ha. The mean productivity of the participants for 2017 was 21.53 t/ha, while 13.70 t/ha was recorded among the non-participants. However in 2018 just over half (54.8%) of the participants recorded an output of less than 10 t/ha and 28% recorded 11 - 20 t/ha. The mean output in 2018 was 10.92 t/ha among the participants and 10.25 t/ha among the non-participants.

Table 2: Participants' distribution by socioeconomic characteristics

| **Characteristics** | **Freq (%)** | **Mean** | **Freq (%)** | **Mean** |
|---|---|---|---|---|
| | **Participants** (n = 168) | | **Non-participants** (n = 168) | |
| **Age** | | | | |
| ≤ 40 | 45.2 | | 38.1 | |
| 41 - 56 | 41.7 | | 58.3 | |
| ≥ 57 | 13.1 | 43.7 ± 0.69 | 3.6 | 42.61± 0.55 |
| **Sex** | | | | |
| Male | 109 (64.9) | | 120 (71.4) | |
| Female | 59 (35.1) | | 48 (28.6) | |
| **Marital status** | | | | |
| Married | 161 (95.8) | | 152 (90.5) | |
| Single | 7 (4.2) | | 16 (9.5) | |
| **Household size** | | | | |
| ≤5 | 133 (79.2) | | 156 (92.9) | |
| 6 - 10 | 33 (19.2) | | 12 (7.1) | |
| ≥ 11 | 2 (1.2) | 5 ± 0.44 | 0 | 4 ± 0.26 |
| **Education** | | | | |
| No-formal | 00 | | 15 (8.9) | |
| Primary school | 19 (11.3) | | 34 (20.2) | |
| Secondary school | 68 (40.5) | | 107 (63.7) | |
| Tertiary | 81 (48.2) | | 12 (7.1) | |

Table 2 continued: Participants' distribution by socioeconomic characteristics

| **Characteristics** | **Freq (%) Participants** (n = 168) | **Mean** | **Freq (%) Non-participants** (n = 168) | **Mean** |
|---|---|---|---|---|
| **Farm size (ha)** | | | | |
| ≤1 | 78 (45.08) | | 138 (82.1) | |
| 1.1 - 2 | 66 (38.16) | | 26 (15.5) | |
| 2.1 - 10 | 29 (16.76) | 1.64 ± 0.78 | 4 (2.4) | 1.14 ± 0.49 |
| **Years of participation in GIZ** | | | | |
| 1 | 2 (1.2) | | 0.00 | |
| 2 | 65 (38.7) | | 0.00 | |
| 3 | 101 (60.1) | 3.35 ± 0.76 | 0.00 | |
| **Association membership** | | | | |
| Membership | 168 (100) | | 64 (38.1) | |
| No membership | 0 | | 104 (61.9) | |

Table 3: Respondents distribution by productivity of participants and non-participants in GIZ's service

| | Participants (n = 168) | | Non-participants (n = 168) | |
|---|---|---|---|---|
| Productivity (t/ha) | Percentage | Mean | Percentage | Mean |
| **2016** | | | | |
| ≤10 | 1.8 | | 6.5 | |
| 11-20 | 78.0 | | 93.5 | |
| ≥21 | 20.2 | 19.33 ± 2.57 | 0.00 | 12.73 ± 0.29 |
| **2017** | | | | |
| ≤10 | 0.6 | | 3.6 | |
| 11-20 | 41.1 | | 96.4 | |
| ≥21 | 58.3 | 21.53 ± 2.11 | 0.00 | 13.70 ± 0.39 |
| **2018** | | | | |
| ≤10 | 54.8 | | 23.2 | |
| 11-20 | 28.0 | | 76.8 | |
| ≥21 | 17.3 | 10.92 ± 9.01 | 0.00 | 10.45 ± 0.29 |

Table 4 shows the results of the estimation explaining farmers´ productivity. The value of $R^2$ was 0.6634 indicating that 66.34% of the variation in output was due to the variables included in the model. Household size (ß = 3.53, P ≤ 0.001), farming experience (ß = 4.161, P ≤ 0.001) and belonging in a farmers' group significantly and positively influenced the farmers productivity in the study area.

The results of the univariate analyses of variance presented in Table 5 shows that there are significant relationships between education (F = 2.408, P ≤ 0.001), technology cost (F = 1.575, P = 0.038), group membership (F = 7.640, P ≤ 0.001), government policy (F = 3.037, P ≤ 0.001) and the farmers' productivity. Some of these dependent variables that were significantly related to

productivity did not show significant coefficients in Table 4 because there were correlations between them.

Table 6 reveals a significant difference between the productivity of the participants and non-participants in GIZ's service (Z = 14.66, P ≤ 0.001). The sum of the productivities for participants from 2016 - 2018 was 51.78 t/ha, while that of the non-participants for the same period was 38.23 t/ha. The total costs of production for participants and non-participants were ₦452,700.00 (US$ 1,131.75) and ₦320,700 (US$ 801.75) respectively. The computed productivities (total revenue/total cost) for participants and non-participants were 2.01 and 1.54, respectively.

Table 4: Participants' distribution by factors influencing productivity (n=168)

| Variables | Coefficient | Standard error | t-value | P>/t/ |
|---|---|---|---|---|
| Age | 79.55152 | 59.20096 | 1.34 | 0.181 |
| Household size | 3.532 | 0.287 | 12.29 | 0.001*** |
| Farm size | 1.06393 | 21.86838 | 0.05 | 0.961 |
| Education | -1.34501 | 3.95045 | -0.34 | 0.734 |
| Farming experience | 4.161 | 0.762 | 5.46 | 0.001*** |
| Cultural operations | -67.36502 | 55.08625 | -1.22 | 0.223 |
| Fertilizer/agrochemical usage | 11.10978 | 5.18651 | 2.14 | 0.014** |
| Government policy | 16.91801 | 14.83371 | 1.14 | 0.256 |
| Infrastructure | 11.99184 | 5.87458 | 2.04 | 0.043* |
| Group membership | 2.471 | 0.559 | 4.42 | 0.001*** |
| Labour availability | 19.22537 | 21.43212 | 0.90 | 0.371 |
| Cassava cultivar | 80.61539 | 33.87104 | 2.38 | 0.019** |
| Access to credit | 14.22415 | 8.16145 | 1.74 | 0.083 |
| Technology cost | 64.15345 | 39.0251 | 1.64 | 0.102 |
| Constant | 6.33890 | 22.77434 | 0.28 | 0.781 |
| Number of observations | = 168 | | | |
| F(6, 161) | = 52.89 | | | |
| Prob>F | = 0.0000 | | | |
| R-squared | = 0.6634 | | | |
| Adj R-squared | = 0.6509 | | | |

Note: *, ** and *** shows significance at 10 %, 5 % and 1 % levels respectively

Table 5: One-way ANOVA results of the factors influencing respondents' productivity (n=168)

| Variables | Sum of squares | P-value | F |
|---|---|---|---|
| Education | 3.77 | 0.026 | 2.408 |
| Technology cost | 2.16 | 0.038 | 1.575 |
| Credit accessibility | 7.73 | 0.067 | 1.468 |
| Group membership | 304.04 | 0.001 | 7.640 |
| Government policy | 2.86 | 0.001 | 3.037 |
| Infrastructure | 0.86 | 0.926 | 0.649 |
| Fertilizer/agrochemicals | 1754.85 | 0.148 | 1.304 |
| Cassava cultivar | 4.80 | 0.572 | 0.936 |

Table 6: Test of difference between the productivity of participants and non-participants of GIZ's service (n=168 for both groups).

| Variables | Mean | Z-value | Decision |
|---|---|---|---|
| Productivity of participants | 51.79 ± 0.81 | 14.66*** | Significant |
| Productivity of non-participants | 38.23 ± 0.40 | | |

***= significant @ 1% probability level

## Discussion

The mean age (43.7) implies that the majority (86.9%) of the GIZ participant cassava growers were in their middle and economically active age and as such could withstand the stress associated with cassava farming and sustain their productivity. Most (64.9%) of the participants were men, who are believed to be the actors in agricultural enterprises. Nonetheless, according to Lastarria and Wheeler (2006) women also contribute a good quota to increased production of valuable crops. Most (95.8%) of the participants were married which suggests that the respondents were responsible individuals who need to maintain their productivity to continue contributing to both family and national welfare. A good number of the GIZ participants had secondary or tertiary education, while only 11.3% had just primary school education; lower levels of education were recorded for the non-GIZ participants. This implies that education shaped the minds of the participants and made them wish to be involved in the GIZ project when they heard of it. The educational background of the farmers plays a vital role in their production and technology adoption. Generally, education is thought to create a favourable mental attitude for the acceptance of new practices especially information-intensive and management-intensive practices (Caswell et al. 2001). Education reduces the amount of complexity perceived in a technology thereby increasing the adoption of the technology. All the participants (100%) of GIZ's service belonged to a registered cooperative society. This is so because one of the modules of the advisory service taught by GIZ emphasized the benefits of membership in farmer organizations. According to GIZ (2016), belonging in a farmer organization can help members to get better prices for their farm's produce through group sales where larger quantities of produce are sold, the buyers' need less effort to get large quantities of produce and higher prices can be negotiated. GIZ also emphasized that membership in farmer organizations can help members to get inputs at lower prices by purchasing larger quantities, while agro-dealers on the other hand need less effort to find input buyers and enjoy economy of scale.

### *Cassava farmers´ productivity*

The participating farmers mean output in 2016 was 19.33 t/ha. The implication is that farmers were responding to the advisory service, and hence realizing the potential yield of cassava under good agricultural practices as opposed to the non-participants with 12.73 t/ha. As one of the leading cassava producers in the world, Nigeria's cassava cultivation process management is extensive but there is a gap between outputs per unit area compared with more advanced countries. The participants' productivity in 2017 was better than that of 2016. The increased productivity recorded in 2017 could be as a result of a number of factors such as favourable market prices, farmer needs and better management practices. This result is in consonance with Aye (2012) who estimated conservatively that with improved crop and soil management, and the use of higher yielding varieties more resistant to drought,

pests and diseases, cassava could produce an average of 23.2 t/ha. It also corroborates Derpsch (2002) who suggested that a major driver of production increases is high prices of produce in world markets. According to the law of demand and supply, the higher the price the higher the quantity supply and vice versa. What stimulated the farmers most could have been the attractive market price for cassava in 2017. Also, it could be that cassava growers were responding to rising demand by intensifying production.

The mean output for the GIZ participants in 2018 was 10.92 t/ha. The decrease in average output per hectare from 21.53 t/ha in 2017 to 10.92 t/ha in 2018 could be due to price instability. It could be that the 10.92 t/ha was not the cassava growers real output for the year. It represented the quantity the farmers were willing to supply to the market at that particular time due mostly to cassava price disadvantage compared to the previous year; Hamsa and Bellundagi (2017) reported that time lag and price forecast influence farmers decisions in crop production and market supply per time. In 2018 the farmers experienced losses and may not have been able to meet their responsibilities. Also, the nation at large lost the foreign exchange accruable from cassava production.

## *Factors influencing the productivity of participants of GIZ's service*

Household size positively and significantly influenced the productivity of the farmers. This implies that the more the number of persons that make up a particular household the better the productivity of such a farmer. The number of persons in a household correspond with the cheap labour available to such a farmer. Also, the number of years particular farmers has acquired in the business of farming influenced their productivity. Moreover, belonging to a farmer' group has positive influence on the farmers' productivity. Farmers in association pool resources together and achieve what they could not and might find difficult to achieve individually.

Furthermore, fertilizer/ agrochemical application has a positive effect on the output and productivity of the farmers, and the more they are applied the better the productivity. To do good business and make more income with improved agricultural practices, the cassava farmers follow the advice given by GIZ's agents as against their traditional believe that fertilizers/agrochemical causes or hastens root rot. They apply the good agricultural practices to get the most benefit out of inputs and work. This is in line with the finding of Atagher et al. (2015) who posited that one of the most important ways of increasing agricultural productivity is through improved crop husbandry practices such as prompt weeding, use of improved planting materials, recommended plant configuration, good soil management, appropriate timing of cultural operations, optimal use of labour, and use of external inputs such as fertilizers, machines and pesticides.

The use of improved cassava stem cuttings has a positive significant effect on the farmers' productivity. It implies the more cassava growers cultivates improved cassava varieties the better their productivity. This is according to a priori expectation since improved varieties are developed and distributed to farmers to raise their farm yields. It corroborates Afolami et al. (2015) who posited that technological improvement (such as improved cassava varieties) is the most important factor in increasing agricultural productivity and reduction of poverty in the long-term.

Also, Nigerian government policies such as inclusion of 10% cassava flour in confectionaries, inclusion of 10% ethanol in gasoline and placing higher tariff on cassava products helps to boost local production and provide better market for farmers. And this encourages more participation in cassava production, and boosts farmers' productivity.

*Test of difference between the productivity of participants and non-participants of GIZ's advisory service*

Table 6 reveals a significant difference between the productivity of the GIZ participants and non-participants. The computed productivity (2.01) for participants was greater than that (1.54) of the non-participants. It implies that the advisory service was effective. This result is in line with that of Atagher et al. (2015) who reported 2.96 and 1.68 respectively as the cassava productivities among women ADP participants and non-participants in Benue state, Nigeria.

## Conclusion and recommendations

The study concludes that cassava, given the right treatment, is a viable crop with potential to mitigate poverty in Nigeria, provide food security and earn foreign exchange. Given an enabling environment, cassava possesses the potential to take more Nigerians out of joblessness and attracts foreign investors. Cassava production is a good venture that could provide livelihood diversification for individuals and reduce the country over dependence on petroleum. Cassava produces useful by-products such as ethanol used in brewery industries and starch used in various pharmaceutical and many other industries. The study recommends the provision of production resources and the implementation of GIZ's service-friendly government policies to enhance cassava farmers' productivity in the study area. Furthermore, fertilizer/ agrochemical application and the use of improved cassava varieties were the factors that positively and significantly influenced the productivity of the participants in the study area. Therefore, fertilizer/agrochemical application and the use of improved cassava variety such as those recommended by GIZ's extension agents should be intensified for better productivity. Also, farmers´ friendly policies should be put in place to encourage more able-bodied youths to participate in cassava production.

## References

Aderinto, A., A. Agbelemoge, and O.M. Dada. 2017. "Effectiveness of Extension Service Delivery and Productivity of Cassava Farmers in Southwestern Nigeria." *The Journal of Agricultural Science* **12 (1)**: 14–23

Afolami, C.A., A.E. Obayelu, and I.I. Vaughan. 2015. "Welfare Impact of Adoption of Improved Cassava Varieties by Rural Households in South Western Nigeria." Agricultural and Food Economics 3 (18): 2–17. https://doi.org/10.1186/s40100-015-0037-2

Ajibefun, I.A. 2002. "Analysis of Policy Issues in Technical Efficiency of Small scale Farmers using Stochastic Frontier Production Function; with Application to Nigeria Farmers." Paper Prepared for Presentation at the 13th International Farm Management Congress, Wageningen, the Netherlands.

Asogwa, B.C. 2005. "An Evaluation of the Agricultural Policies and Effects on Resource-Use in Cassava Production in Benue State, Nigeria." MSc Thesis submitted to Department of Agricultural Economics, University of Agriculture Makurdi.

Atagher, M.M., E.C. Okorji, and C.C. Eze. 2015. "Comparative Productivity Analysis of Cassava Enterprises by Project and Non-project Women Farmers in Benue State, Nigeria." *British Journal of Economics, Management and Trade* **6 (3):** 230–240.

Awoyinka, Y.A. 2009. "Cassava Marketing: Option for Sustainable Agricultural Development in Nigeria." *Ozean Journal of Applied Science* **2 (2):** 175–183.

Aye, T.M. 2012. "Cassava Agronomy: Land Preparation, Time and Method of Planting and Harvest, Plant Spacing and Weed Control." In *The Cassava Handbook – A Reference Manual Based on the Asian Regional Cassava Training Course,* edited by R.H. Howeler.

Caswell, M., K.C. Fuglie, S. Ingram, and C.

Kascak. 2001. "Adoption of Agricultural Production Practices: Lessons Learned from the U.S. Department of Agriculture Area Studies Project." Resource Economics Division, Economic Research Service. U.S. Department of Agricultural Economics Report No. 792. Washington DC.

Derpsch, R. 2002. "Experiences of Small Farmers in Paraguay with Zero Tillage and Cover Crops." Abstract Presented at the ASA-CSSA-SSSA International Annual Meeting, Indianapolis, USA.

Fakayode, S.B., R.O. Babatunde, and R. Ajao. 2008. "Productivity Analysis of Cassava-Based Production Systems in Guinea Savanna." *American-Eurasian Journal of Scientific Research* **3 (1):** 33–39.

FAO. 2009. "More People Than Ever are Victims of Hunger." (Press release, FAO, Rome, 2009). www.fao.org/ fileadmin/user.

FAO. 2013. *Save and Grow: Cassava. A Guide to Sustainable Production Intensification*. ISBN 978-92-5-107641-5.

GIZ. 2016. "Doing Good Business with Quality Cassava. One world- No hunger Initiative." Green Innovation Centres for the Agriculture and Food Sector-Nigeria.

Hamsa, K.R., and V. Bellundagi. 2017. "Review on Decision-making Under Risk and Uncertainty in Agriculture." *Economic Affairs* **62 (3):** 447–453

Hannula, M. 2002. "Total Productivity Measurement Based on Partial Productivity Ratio." *International Journal of Production Economics* **78 (1):** 57–67.

IFAD and FAO. 2004. The Global Cassava Development Strategy. Rome. P.5-37

Ikuemonisan, E.S. and Adenegan, K. 2020. Cassava Production in Nigeria: Trends, Instability and Decomposition Analysis (1970—2018). Heliyon 6 (10). https//doi.org/10.1016/j.heliyon2020.e5089.

Kristin, E.D. 2009. "The Important Role of Extension System: Agriculture and Climate Change; An Agenda for Negotiation in Copenhagen." International Food Policy Research Institute, Washington, DC.

Lastarria-Cornhiel, S., and R. Wheeler. 2006. *Gender in Agriculture Sourcebook. A Handbook of Agriculture.*

Nwauwa, L.O.E. 2011. "Market Participation of Small-scale Maize Farmers in Osun State: An Application of Household Commercialisation Index (HCI)." *Proceedings of the 25th Farm Management Association of Nigeria (FAMAN): Policy and Agricultural Development in Nigeria; Challenges and Prospects in Akure, Nigeria*.

Roghanian, P., A. Ragli, and H. Gheysari. 2012. "Productivity through Effectiveness and Efficiency in the Banking Industry." *Journal of Social and Behavioral Sciences* **40:**550–556.

Watson, J. 2001. "How to Determine a Sample Size: Tipsheet #60." University Park, PA: Penn State Cooperative Extension. Retrieved on 8 January, 2019 from http://www.extension.psu.edu/evaluation/pdf/TS60.pdf.