# EFFECT OF ADOPTION OF IMPROVED CASSAVA PRODUCTION TECHNOLOGIES ON POVERTY STATUS OF FARMERS IN ABIA STATE, NIGERIA.

**OGBONNA Sylvanus Ibeabuchi (Ph.D)**
Department of Agricultural Economics and Extension
National Open University of Nigeria
Ogbonna101@gmail.com 08034004788

**ABSTRACT**
The study investigated effect of adoption of improved cassava production technologies on poverty status of farmers in Ikwuano Local Government Area(L.G.A), Abia State. Multi stage random sampling technique was used in collecting data from one hundred and ten (110) cassava farmers using semi-structured questionnaire. Data were analyzed using descriptive statistics, adoption scale, per capita poverty indicators, paired t-test analysis and probit regression model. Result showedthat improved cassava(80.91%); supplying (73.63%), planting time (65.45%) and intercropping with maize and melon (65.45%) were the most used cassava technologies by cassava farmers. Result also showed that planting of improved cassava varieties had highest level (x = 4.00) of adoption. The per capita poverty indicators revealed that poverty line, of cassava farmers was₦36,259.80, while poverty incidence of the adopters and non-adopters were 0.3146 and 0.6663, respectively, poverty gap of the adopters and non-adopters were0.2143 and 0.4258 respectively. Paired t-test result showed that mean household monthly expenditure of adopters and non adopters of improved cassava production technologies were ₦37,333.33 and ₦28,066.67 respectively with significant mean difference of ₦9,266.66 at 1.0% alpha level.Probit regression estimates revealed that education level, farm size, farm income, household size and membership of association were significant determinants of adoption at varying risk levels and signs. The major constraint to adoption of improved cassava production technology was inadequate capital (60.91%).The state and local governments should encourage cassava farmers through provision of incentives (such as credits, subsidies, technical assistance) to enable them improve their level of adoption of cassava technologies which will serve as a poverty alleviation outfit.
**Keywords**: Adoption, cassava technologies, farmers, poverty reduction

## INTRODUCTION

Cassava (*Manihotesculenta*) is a dicotyledonous root crop of the family Eurphobiaceae. It is a major root crop grown throughout Nigeria for cash, food, feed and raw material for agro-allied firms for the production of starch, alcohol, pharmaceuticals and confectioneries (Francisco, 2004; Onwumere*et al*., 2006). Nigeria produces more than 45 million metric tonnes of cassava, thus making her the world's largest producer (USAID, 2010).

Cassava plays a dominant role in food security of rural areas because of its capacity to yield under marginal soil condition and its tolerance to drought (Ezedinma *et al*., 2006). According to Ogunniyi*et al.,* (2012), cassava has some inherent characteristics which make it attractive especially to the small holder farmers in Nigeria. First it is rich in carbohydrate which makes it useful in some industries and consequently has a multiplicity of end users. Secondly, it is available all year round compared to other crops as it is more tolerant to low soil fertility and resistant to drought, pest and diseases. Cassava is seen to have a high poverty-reduction potential for Nigeria due to its relatively low production cost and ability to perform well in conditions under which other crops fail (FAO, 2005).

The development and introduction of improved cassava production technologies has long been recognized as one of the key strategies for transforming cassava industries and for enhancing the wellbeing of Nigeria's rural population (Dixon and Ssemakula, 2008). Under the transformation regime, high yield cassava varieties have been developed to increase yield. Also other improved production technologies have been introduced to cassava farmers to enhance yield and reduce cost of production (Nweke*et al.*, 2002; NEPAD, 2006).Some of the production technologies include recommended herbicides application, use of stem multiplication technology, use of stem multiplication technology, use of hybrid cassava stem, use of pesticides, use of inorganic fertilizer, appropriate spacing, and planting date and tillage practices. The International Institute of Tropical Agriculture (IITA) Ibadan and National Root Crop Research Institute (NRCRI) Umudike also collaborated to develop some improved cassava varieties capable of adapting to a wider range of ecological conditions and farming systems. Among these varieties are TME 419, NR 8082, NR 8083, TMS 96/0002, TMS 92/0067 and so on (Imo and Essien, 2005). NRCRI Umudike has developed over 37 hybrid cassava varieties through selective breeding.

Eventhough, development of improved cassava production technologies is important, the primary aim is adoption of these technologies by farmers. The World Bank (2008) noted that the adoption of improved agricultural technologies, such as high yielding varieties and planting methods that led to a green revolution in Asia could also lead to significant increase in agricultural productivity in Africa and stimulate the transition from low productivity subsistence agriculture to a high productivity agroindustrial economy. The adoption of improved cassava production technologies is an important route out of poverty for many poor cassava farmers by enhancing cassava farming productivity, income and poverty reduction.

Poverty which is a situation where an individual lives on less than US $1.25 a day or incapable of meeting basic requirements of life is a phenomenon that is multidimensional, widespread and severe in Nigeria (Chimaobi, 2010; IFAD, 2012). World Bank (2001) summarized the various dimensions of poverty as conditions of lack of opportunity, lack of empowerment and a lack of security. Windows of opportunities remain closed to the poor making them practically unheard and inactive in the society. Absence of empowerment to the poor limits their choices in many social and economic endeavours and the lack of security makes them vulnerable to diseases, violence and deprivation.

The poverty situation in Nigeria is quite severe, both the qualitative and quantitative measures attest to the growing incidence and depth of poverty in the country (NBS, 2004; Okwumadewa, 2002). Recent evidence from the National Bureau of statistics supports the fact that poverty in Nigeria is on the increase. According to NBS (2010), the national poverty rate of Nigeria increased from 28.1% in 1980 to 54.4% in 2004 and 69.0% in 2010.The identification of constraints to farmers' adoption of improved cassava production technologies would provide a direction of action for government in trying to boost farmers adoption of innovations in cassava production. The results of this study is also expected to help policy makers in formulating policies that promote the welfare of cassava farmers.The specific objectives were to:i) identify improved cassava production technologies used by cassava farmers in the study area; ii) assess level of adoption of improved cassava production technologies in the study; iii) analyze current poverty profile of cassava farmers in the study area;iv) determine effect of adoption of improved cassava production technologies on poverty status of cassava farmers in the study area; v) determine factors that influence adoption of improved cassava production technologies by cassava farmers in the study area; and vi) identify constraints to adoption of improved cassava production technologies by cassava farmers in the study area.

## RESEARCH METHODOLOGY

### Study Area

The study was conducted inIkwuano Local Government Area of Abia State. Ikwuano Local Government Area is located between latitudes 5° 24'N and 5° 30' N of the Equator and longitudes 7° 32' E and 3° 37' E of the Greenwich Meridian. According to the National Population Census (2006), Ikwuano has a population of 137,993 people which comprise of 71,020 females and 66,973 male, with an area of 281 km². The LGA is bounded on the West by Umuahia North L.G.A, on the East by Ikono and Oforo L.G.A's of Akwa-Ibom state, on the South by Isiala-Ngwa north L.G.A and North by Bende L.G.A.

### Sampling Technique

The population for this study comprised of all cassava farmers in the LGA. A multi stage random sampling technique was used to select sample from the population of cassava farmers in the LGA. The first stage was the random selection of five autonomous communities from the forty two autonomous communities in the Local Government Area. The second stage was the random selection of four villages from each autonomous community making it a total of twenty (20) villages. The third stage was the random selection of six cassava farmers from each of the twenty (20) villages to give a total of one hundred and twenty (120) respondents. A total of one hundred and twenty questionnaire were distributed, butone hundred and ten questionnaire were correctly filled and returned. Thereforeone hundred and ten cassava farmers served as respondents for the study.

### Data Collection

Primary data were used for this study. Primary data were generated through semi structured questionnaire administered on respondents following self-administration method. Data were collected on socio-economic characteristics of respondents, types of improved cassava production technologies, level of adoption of improved cassava production technologies, expenditure level of farmers and constraints to adoption of improved cassava technologies.

### Data Analysis

Simple descriptive statistical tools such as frequencies mean and percentages were used to achieve objectives (i) and (v). Adoption score index was used to realize objective (ii). Objective (iii) was analyzed using per capita poverty indicators. Objective (iv) achieved with the aid of paired t-test analysis, while,objective (vi) was analyzed using probit regression model.

The level of adoption of improved cassava production was determined using adoption score index In accordance with Okoye*et al*.(2009).Adoption score index wascalculated with aid of a 7 point Likert scale graded thus; unaware = 0, Aware = 1, interest = 2, evaluation= 3 trial = 4, accept = 5 and reject = 6. In accordance with Okoye*et al*., (2009) the mean adoption level was determined as follows:

$$\overline{X_s} = \frac{\Sigma x}{n} \qquad \ldots(1)$$

Mean score was computed by multiplying the frequency of each response pattern with its appropriate nominal value and dividing the same with the number of respondents to the terms. This is summarized with the equation below.

$\overline{X} = \Sigma fn/nr$

Where; $\bar{X}$ = Mean score;Σ = Summation; f= Frequency; n = Likert nominal; $n_r$= number of respondents.

$\overline{X} = \frac{0+1+2+3+4+5+6}{7} = \frac{21}{7} = 3.0$

**Decision Rule**

Less than 1.0=Unaware stage of the technology; 1.0 – 1.49= Awareness stage of the technology; 1.5 – 1.99 =Interest stage of the technology; 2.0 – 2.49 =Evaluation stage of the technology; 2.50 – 2.99= Trial stage of the technology; 3.0 and above = Adoption of the technology.

The following specification was used to determine poverty level among the cassava farmers (objective iv) in accordance to Ezeh (2007) and Osondu*et al.*, (2015b):

$H=q/n$ .....(2)

Where:H= head count ratio;q= number of cassava farmers that are poor;n= total number of cassava farmers;

The poverty gap will be calculated as:

$I=\frac{1}{N}\Sigma(\frac{Z-Y}{Z})$ ......(3)

Where: I= Poverty gap

Z= Poverty line – estimated using the mean household expenditure (relative scale)

Y= average per capital household expenditure of poor cassava farmers.

The poverty line used in determining poverty among the cassava farmers is expressed following Osondu*et al.*, (2015a):

Z=2/3 (Y)

Where,

Z= Poverty line measured in Naira (₦)

Y= mean per capita household expenditure measured in Naira (₦)

Given:

$$\text{per capita household expenditure} = \frac{\text{Total monthly household expenditure}}{\text{Household size}}$$

$$\text{Mean capita household expenditure} = \frac{\text{Total per capita household expenditure}}{\text{Total number of households}}$$

The paired treatment test used is stated implicitly following Emerole*et al.*, (2009):

$$t = \frac{\bar{X} - \bar{X}}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}} \quad .......(4)$$

$n_1 + n_2 - 2$ degree of freedom

Where;

t = Student "t" statistic

$\bar{X}$= Sample mean of household monthly expenditure of cassava farmers adopters of improved cassava production technologies.

$\bar{X}$ = Sample mean of household monthlyexpenditure of cassava farmers non-adopters of improved cassava production technologies.

$S_1^2$ = Sample variance of household monthly expenditure of cassava farmers adopters of improved cassava production technologies.

$S_2^2$ = Sample variance of household monthlyexpenditure of cassava farmers non-adopters of improved cassava production technologies

$n_1$ = Sample size of cassava farmers adopters of improved cassava production technologies.

$n_2$ = Sample size of cassava farmers non-adopters of improved cassava production technologies.

Probit regression model is appropriate when the dependent variable takes one of only two possible values representing presence or absence. The model was adopted as used by Gujarati (2003) and Ajani and Tijani (2009).

Pi [y=1] = [Fzi]

Where,

Zi = β0 + β1X1 ……(5)

y1 = β1 + β2 X2i + …… + βk Xki ……….(6)

yi* is unobserved but yi = 0 if yi* < 0, 1 if yi* ≥ 0

P (y1 = 1) = P ( yi*≥ 0 )

= P (u1≥ - β1 + β2 X2i + …… + βk Xki) ……(7)

i = 1,2,…..110

$Y_i$ = Adoption (Dichotomous variable 1= If a farmer's level of adoption of improved cassava technologies > 3; 0= otherwise)

$X_1$= Gender (1=Male; 0=Female); $X_2$ = Age of household head (Years); $X_3$= Household size (number); $X_4$= Years of formal education (Years); $X_5$ = Marital status (1 if Married, 0=Otherwise); $X_6$= Extension contact (number of extension contact per year); $X_7$= Farming experience (years); $X_8$= Farm size (hectares); $X_9$= Farm income (Naira); $X_{10}$ = Membership of farmers association (Yes=1, No=0); $X_{11}$= Access to credit (Yes =1, No=0); $\beta_1$=Coefficient of exogenous variables and

μ =error term

## RESULTS AND DISCUSSION

### Types of improved cassava production technologies used by cassava farmers

Table 1showed that various types of cassava production technologies were used by farmers in the study area. Twelve (12) types of improved cassava production technologies were used and identified by the farmers which include; improved cassava varieties, Ploughing and ridging before planting, planting on flat after ploughing, planting time, plant spacing, intercropping cassava with maize and melon, organic manures (poultry, cropping and rice mill waste), basal NPK fertilizer application to improve soil nutrient, pesticides to control pest, herbicides to control weed, weeding at least two times per planting season, and supplying (replacement of ungerminated cuttings).

The table further showed that technologies which most respondents use include: improved varieties (80.91%); supplying (73.63%), planting time (65.45), intercropping cassava with maize and melon (65.45%), organic manures (63.63%), planting space (50.0%). This implies that the farmers were using various improved cassava production technologies. This result is in conformity with Ajieh (2014); and Ajani and Onwubuya (2013) whose findings show that cassava farmers in South-eastern region were using various improved cassava production technologies. This will help to boost production of cassava as well as ensure household food security since cassava is a major staple food consumed by most households in rural areas.The least cassava production technologies used by farmers in the study area are; use of pesticides to control pest (20.0%), use of herbicides to control weed (28.18%), planting on flat after ploughing (25.45%), and ploughing and ridging before planting (29.09%).

**Table 1: Cassava production technologies used by farmers in Ikwuano Local Government Area of Abia State, Nigeria**

| Technology | Frequency* | Percentage |
|---|---|---|
| Improved cassava varieties | 89 | 80.91 |
| Ploughing and ridging before planting | 32 | 29.09 |
| Planting time | 72 | 65.45 |
| Planting on flat after ploughing | 28 | 25.45 |
| Plant spacing | 55 | 50.00 |
| Intercropping cassava with maize and melon | 72 | 65.45 |
| Organic manures (poultry, cropping and rice mill waste) | 70 | 63.63 |
| Basal NPK fertilizer application to improve soil nutrient | 52 | 47.27 |
| Pesticides to control pest | 22 | 20.00 |
| Herbicides to control weed | 31 | 28.18 |
| Weeding at least two times per planting season | 50 | 45.45 |
| Supplying (replacement of ungerminated cuttings) | 81 | 73.63 |

*Source: field survey data, 2017*
**multiple responses recorded; N=110 farmers*

**Level of Adoption of Improved Cassava Production Technologies**

The level of adoption of improved cassava production technologies is shown in Table 2. The table shows that the adoption scores for the different production technologies ranged between 2.42 and 4.0. This is an indication of high level of adoption of cassava production technologies among farmers in the study area. The findings could be associated with farmers awareness that the use of improved technologies increase crop yields, income and better the living standard of the farmers while non adoption of improved technologies by the farmers is one of the major reasons for low productivity of small-scale farmers (Nsoanya and Nenna, 2011).

The table further shows that among the selected cassava production technologies, planting of improved cassava varieties had the highest level (4.0) of adoption. This was followed (in descending order) by weeding at least two times per planting season ($\bar{x}$ =3.81), March-April planting time ($\bar{x}$ =3.71), Supplying (replacement of ungerminated cuttings) ($\bar{x}$=3.49), organic manures such as poultry dropping ($\bar{x}$=3.48), Crop mixture (Intercropping cassava with maize and melon) ($\bar{x}$ =3.13), 1m X 1m planting spacing ($\bar{x}$ =3.10). The high level of adoption of improved cassava varieties is because of its advantage such as resistance to Cassava Mosaic Disease, early maturing and outstanding yield potentials (Ajani and Onwubuya, 2013). Meanwhile, the adoption of crop mixture with cassava is not surprising because intercropping cassava with maize and melon has been identified to be compatible to fit into the farming systems of farmers especially in South Eastern Nigeria, thereby giving the farmer the choice of growing more crops in the field and maximizing the use of land and its resources (Seesahai, 2008). In the same vein, the adoption of organic manure in cassava production has the advantage of better crop establishment, high yield, and improvement in the maintenance of soil resource base as well as reduction in storage loss according to NRCRI (2014).

However, farmers in the study area did not adopt Basal NPK fertilizer application to improve soil nutrient ($\bar{x}$=2.78), pesticides to control pest ($\bar{x}$=2.42), herbicides to control weed (2.42), Ploughing and ridging before planting ($\bar{x}$=2.77,) and planting on flat after ploughing ( x̄ =2.56) because their mean adoption score were less than 3.0 which was regarded as the critical adoption point. According to the farmers, the primary constraint to fertilizer use in the State is the physical absence of the product at the time that it is needed rather than problems of affordability or farmers' lack of knowledge about its importance.

The position of fertilizer application, insecticides and herbicides use in the adoption level observed in the area, raises some doubts as to what extent the extension service delivery have gone in the area. A possible explanation of this could be high cost of inputs, unavailability of agro - chemicals and technical know-how associated with the use of improved technologies. Gadzama*et al*. (1995) reported that the major factors that hinder the adoption of recommended practices are the expensive nature of farm inputs and ignorance on the part of the farmers.

**Table 2: Level of adoption of cassava production technologies among farmers in Ikwuano Local Government Area of Abia State, Nigeria**

| Technology Packages | Reject | Accept | Trial | Evaluation | Interest | Aware | Unaware | TARS | Mean |
|---|---|---|---|---|---|---|---|---|---|
| Ploughing and ridging before planting | 2<br>(12) | 21<br>(105) | 20<br>(80) | 14<br>(42) | 17<br>(44) | 22<br>(22) | 14<br>(0) | 305 | 2.77 |
| Planting on flat after ploughing | 6<br>(36) | 13<br>(65) | 16<br>(64) | 22<br>(66) | 14<br>(28) | 23<br>(23) | 16<br>(0) | 282 | 2.56 |
| Planting time (March-April) | 3<br>(18) | 45<br>(225) | 17<br>(68) | 21<br>(63) | 13<br>(26) | 8<br>(8) | 3<br>(0) | 408 | 3.71 |
| Plant spacing (1X1m) | 12<br>(72) | 22<br>(110) | 22<br>(88) | 9<br>(27) | 15<br>(30) | 14<br>(14) | 16<br>(0) | 341 | 3.10 |
| Improved cassava varieties | 4<br>(24) | 47<br>(235) | 29<br>(116) | 16<br>(48) | 5<br>(10) | 7<br>(7) | 2<br>(0) | 440 | 4.00 |
| Intercropping | 8<br>(48) | 21<br>(105) | 18<br>(72) | 21<br>(63) | 14<br>(28) | 28<br>(28) | 0<br>(0) | 344 | 3.13 |
| organic manure | 2<br>(12) | 41<br>(205) | 22<br>(88) | 16<br>(48) | 9<br>(18) | 12<br>(12) | 8<br>(0) | 383 | 3.48 |
| Basal NPK fertilizer application | 3<br>(18) | 18<br>(90) | 23<br>(92) | 12<br>(36) | 18<br>(36) | 34<br>(34) | 2<br>(0) | 306 | 2.78 |
| Use of pesticides | 5<br>(30) | 10<br>(50) | 16<br>(64) | 22<br>(66) | 9<br>(18) | 38<br>(38) | 10<br>(0) | 266 | 2.42 |
| Use of herbicides | 7<br>(42) | 10<br>(50) | 18<br>(72) | 10<br>(30) | 13<br>(26) | 46<br>(46) | 6<br>(0) | 266 | 2.42 |
| Weeding at least two times per planting season | -<br>(0) | 88<br>(290) | 12<br>(48) | 18<br>(54) | 9<br>(18) | 9<br>(9) | 4<br>(0) | 419 | 3.81 |
| Supplying | -<br>(0) | 54<br>(270) | 10<br>(40) | 10<br>(30) | 16<br>(32) | 12<br>(12) | 8<br>(0) | 384 | 3.49 |

***Source:*** *Field Survey Data, 2017*
*Cut-off score = > 3.0 = adoption; < 3.0 = did not adopt.*
*Reject 6; Using 5; Evaluation 4; Trial 3, Interest 2; Awareness 1; Unaware 0*
*TARS= Total Adoption Raw Score; Figures in parenthesis are theLikert scale value: N=110*

**Poverty Profile of the cassava farmers**

The poverty profile of cassava farmers in Ikwuano Local Government Area of Abia State is shown in Table 3. The table shows that the poverty line (mean monthly household expenditure) of the cassava farmers was ₦36,259.80 per month or ₦435117.6 per annum. This compares favourably with Oguobi (2012) that obtained a poverty line of ₦30,445.83 among farmers in Abia State.

The incidence of poverty otherwise called the head count ratio Ayobatele and Amudipe(1999); and Ezeh*et al*.(2012) shows that the poverty incidence for cassava farmer adopters and non-adopterswere 0.3146 and 0.6263 respectively. This implies that 31.46% and 66.63% of the adopters and non-adopters of improved cassava technologies in the study area were poor because their income fell short of the mean household expenditure used as poverty line. This result with respect to the non-adopters compared favourably with Ezeh (2009) and Oguobi (2012) that obtained 65.5% and 62.5% respectively for rural farm households in Abia State Nigeria.

The poverty gap (poverty depth) also known as the income short fall allows for the assessment of the depth of poverty among the rural farm households in local institutions in the study area. Table 3 also shows that the poverty gap of cassava farmer adopters and non-adopters were 0.2143 and 0.4258 respectively. This implies that the poor adopters and non-adopters of improved cassava production technologies required 21.43% and 52.58% of the poverty line (₦36,259.80) to get out of poverty. This amounts to ₦7770.47 and ₦19,065.40 required on average by each pooradopter and non-adopter respectively per month. This result corroborates with Ezeh*et al* (2012) that obtained a poverty gap index of 0.46 and 0.48 for male and female Fadama 1 farmers respectively in Abia state.

**Table 3: Poverty indicators of cassava farmers in Ikwuano Local Government Area of AbiaState, Nigeria**

| Poverty indicators | Values |
|---|---|
| Mean monthly income (₦) | 49479.41 |
| Mean monthly expenditure (₦) | 36259.80 |
| Poverty line (₦) | 36259.80 |
| **Adopters** | |
| Poverty incidence | 0.3146 |
| Poverty gap (Poverty Depth) | 0.2143 |
| **Non-Adopters** | |
| Poverty incidence | 0.6663 |
| Poverty gap (Poverty Depth) | 0.5258 |

*Source: Field Survey Data, 2017*

**Effect of Adoption of Improved Cassava Production Technologies on Poverty Status of Cassava Farmers**

The result of the paired t-test for difference in household monthly expenditure of adopters and non adopters of improved cassava production technologies in the study area is shown in Table 4. The result shows that the mean household monthly expenditure of adopters and non adopters of improved cassava production technologies was ₦37,333.33 and ₦28,066.67 respectively. The mean difference between the two farm income levels was ₦9,266.66 with a standard error of 912.04. The paired 't' result showed that this is statistically significant at 1.0% risk level because the calculated 't' = 2.66 > the tabulated "t"$_{0.025}$ = 2.58. Therefore the null hypothesis is rejected. This implies that the household monthly expenditure of adopters of improved cassava production technologies was greater than the household monthly expenditure of non-adopters of improved cassava production technologies. This corroborates the findings of Ayedun, (2016) whose result shows that the mean household monthly expenditure of adopters was greater than non adopters of improved cassava production technologies in Southern Nigeria.

**Table 4. Paired samples variable for household monthly expenditure of adopters and non adopters of improved cassava production technologies in Ikwuano Local Government Area of Abia State**

| Variable | | Individual mean | Mean difference | Standard error | Value |
|---|---|---|---|---|---|
| Monthly expenditure (₦) | Adopters | 37,333.33 | | | |
| | Non adopters | 28,066.67 | 9,266.66 | 912.04 | 2.66 |

***Source:*** *Calculations from field survey data, 2017*
**** = Variables significant at 1.0% alpha level*

**Factors influencing adoption of improved cassava production technologies**

The Probit estimate of factors that influenced adoption of cassava production technology in Ikwuano Local Government Area of State, Nigeria is presented in Table 5. Overall, the model predicted 82.73 per cent of the sample correctly and posted a log likelihood value of -16.412785, a pseudo $R^2$value of 0.6591 and a goodness of fit chi-square value of 77.84 which is statistically significant at 1.0% level.

In the model, five out of nine explanatory variables were statistically significant at given levels and these variables were education, income, farm size, access to credit and number of contact with extension agents. In the table, a positive sign on the variable's coefficient indicates a higher probability to adopt improved cassava production technology and vice versa when a negative sign was obtained.

Specifically, the coefficient (0.1785113) of household size was positive and statistically significant at 1.0% alpha level. The positive sign of the variable implies that the larger the household size, the higher the adoption of improved cassava production technologies. This result is in line with Joseph (2004) and Okoye*et al.,* (2009) whose result showed a positive relation between household size and adoption of improved cassava varieties and cocoyam technology respectively in Abia State. The availability of substantial family labour may reduce the number of hired farm labours and cost associated use of improved production technologies, thereby increasing the chances of adoption of improved innovations (Anyaegbunam*et al.,* 2009).

The coefficient of education (0.7551557) was positive and statistically significant at 10.0% probability level. This indicates that an increase in educational level of the respondents enhanced their adoption of improved cassava production technology. This result conforms to *a priori* expectation and also in line with Agor (2004) who obtained a positive relationship between education and adoption of cocoyam rebirth technology in Abia State according to Okoye*et al*, 2004, education has the capacities to influence people to accept new innovation and change their attitude to the desired technology.

The coefficient of farm size (0.9909502) was positively signed and highly significant at 99.0% confidence level. The implication is that as farm size increases, the higher the probability of adopting improved cassava production technology. This result conforms to *a priori* expectation. Possession of larger farm land may stir up the motive to adopt new technologies learnt. This result is in tandem with *a priori* expectation and Abdoulaye*et al*, (2014) that obtained a positive relationship between farm size and adoption of improved cassava varieties in Nigeria. This is because a farmer may have positive behavior to a new technology but might have limitation due to insufficient or non – availability of farmland (Bankole, 2012).

The coefficient of farm income was positive (0.794312) and statistically significant at 1.0% probability level. It can be adduced that an increase in farm income increases the probability of adoption of improved cassava production technology by farmers in the study area. This is in line with *a priori* expectation. Increase in farm income is expected to boost adoption of agricultural technology because a poor farmer may not readily adopt an innovation that is too expensive. This result also conforms to Joseph (2004) who obtained a positive relationship between farm income and adoption of improved cassava varieties in Abia State.

The coefficient of membership of farmers association (0.5045751) was positive and statistically significant at 5.0% alpha level. This implies that an increase in the membership of farmers association increases the adoption of improved cassava production technologies among the farmers. This result is linewith*a priori* expectation and the result obtained by Abdoulaye*et al*, (2014) in Nigeria with regards to adoption of cassava varieties. Murphy (1993) stated that farmers communicate most frequently and effectively with those who are members of their associations. These farmers are more likely to obtain information from and be influenced in their farming practices and decisions by other farmers. Also, membership to association improves a farmers social capital and enhances access to extension service and credit.

**Table 5.Probit regression estimates of factors that influenced adoption of improved cassava production technologies in Ikwuano L.G.A of Abia State, Nigeria**

| Variable | Estimated coefficients | Standard errors | Z-ratios | P>\|z\| |
|---|---|---|---|---|
| Constant | -10.20118 | 7.187821 | -1.42 | 0.156 |
| Age | -0.4400757 | .6267739 | -0.70 | 0.483 |
| Gender | -0.0649026 | 1.497444 | -0.04 | 0.965 |
| Agric extension contact | 0.4699613 | 0.6446412 | 0.73 | 0.466 |
| Household size | 0.1785113*** | 0.0551789 | 3.23 | 0.001 |
| Educational level | 0.7551557* | 0.4446364 | 1.70 | 0.089 |
| Farming Experience | 0.1973097 | 0.1656863 | 1.19 | 0.234 |
| Farm size | 0.9909502*** | 0.1346554 | 7.36 | 0.000 |
| Farm income | 0.794312*** | 0.2814616 | 2.82 | 0.005 |
| Membership of farmers association | 0.5045751** | 0.1357198 | 2.00 | 0.045 |
| Access to credit | 0.1171933 | 0.2023078 | 0.58 | 0.562 |
| Pseudo $R^2$ | 0.6591 | | | |
| Log likelihood: | -16.412785 | | | |
| $Chi^2(9)$ | 77.84*** | | | |

*Source: Field Survey data, 2017.*

*** Significant at 1.0% alpha level; * significant at 5.0% alpha level;* significant at 10.0% alpha level

**Challenges associated with adoption of improved cassava production technologies**

The problems encountered in the adoption of improved cassava production technologies by farmers in Ikwuano L.G.A of Abia State, Nigeria is displayed in Table 6. The result revealed that constraints such as inadequate capital (60.91%), infrequent/poor extension service (55.45%), inadequate information/ knowledge of the technology (50.91%), and reluctance towards adoption (52.73%) were the major challenges associated with adoption of cassava production technologies. This finding is supported by Ajakaiye (1998) and Onazi (1973) who observed that the Nigerian farmer needs credit especially for their farm product due to the vicious circle of poverty, low productivity resulting to low farm income levels with virtually no savings for investment in the transformation of their production technology and farmers reluctance to let go their old ways. Young (1994) reported that rural farmers are mostly poor resource farmers. Hence, to enable them adopt any innovation, funds should be provided.

Meanwhile, other constraints associated with adoption of improved cassava production technologies include inadequate farm input/equipment (48.18%), no-retraining facilities (45.45%), inadequate farm size (41.81%), and inadequate farm labour (36.36%)

**Table 6: Challenges associated with adoption of improved cassava production technology in Ikwuano L.G.A of Abia State, Nigeria**

| Constraints | Frequency* | Percentages |
|---|---|---|
| Infrequent/Poor extension services | 61 | 55.45 |
| No-retraining facilities | 50 | 45.45 |
| Reluctance to adoption | 58 | 52.73 |
| Inadequate capital | 67 | 60.91 |
| Inadequate information/ knowledge of the technology | 56 | 50.91 |
| Poor credit access | 55 | 50.00 |
| Inadequate farm input/equipment | 53 | 48.18 |
| Inadequate Labour | 40 | 36.36 |
| Inadequate farm size | 46 | 41.81 |

*Source: Field survey data, 2017*
**multiple responses recorded: N =110*

## CONCLUSION AND RECOMMENDATIONS

Cassava farmer adopters of improved production technologies generally had lower poverty than the non-adopters. There was significant effect of adoption of improved cassava production technologies on farmer's expenditure level. Also, age, gender, educational level, farmer's income, credit access, farming experience, and farm size of the farmers were significant and positive determinants of adoption of improved cassava production technologies.

One major constraint to adoption of cassava production technologies was inadequate capital/credit. The study therefore suggests that government should increase funding of research on simple low-cost input technologies that can be affordable by farmers.

Also, a special micro- credit scheme should be established by the government for cassava farmers to enhance their capacity to adopt and utilize technologies.

Furthermore, cassava farmers should utilize their memberships in co-operative societies to assist themselves financially as people come together so as to meet collective needs that could not be resolved by an individual.

Given that infrequent/poor extension service and poor retraining facilities were among the constraints to adoption of the technology, the introduction of new technologies should be backed up by training and provision of complementary services by all the stakeholders (ADP, research institutes, universities, among others) involved in the dissemination of agricultural technologies. Efforts of the extension workers are highly needed to organize training programmes, workshop, agricultural show and seminars with regards to dissemination of improve cassava technology. These would undoubtedly erase doubt among the farmers, increase farmers skills, knowledge and techniques in cassava production and hence improve and better their living standard.

The level of adoption of NPK fertilizer and agrochemicals (pesticides, herbicides) were low due to high cost of these agrochemicals. These suggests the need for alternative use of organic fertilizers and bio-pesticides as well as development of markets by the local government or state provision of subsidy on agro-chemicals and markets by the local government or state.

Finally, since the adoption of improved cassava technology had significant impact on poverty, therefore, government should encourage the cassava farmers through the provision of incentives (such as credits, subsidies, technical assistance) to enable them improve their level of adoption of improved cassava technology which will serve as a poverty alleviation outfit.

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