Available online at www.jpsscientificpublications.com
Volume – 2; Issue - 5; Year – 2016; Page: 775 – 786
DOI: 10.21276.iajmr.2016.2.5.9

Indo – Asian Journal of Multidisciplinary Research (IAJMR)
ISSN: 2454-1370

SOCIO-ECONOMIC DETERMINANT FACTORS TO THE ADOPTION OF COCOYAM PRODUCTION TECHNOLOGIES BY SMALL HOLDER FARMERS IN SOUTH EAST NIGERIA

S. I. Ume[1], C. I. Ezeano[2], B. N. Onunka[1] and T. C. Nwaneri[1],
[1]*Department of Agricultural Extension and Management. Federal College of Agriculture Ishiagu, Ivo Local Government Area of Ebonyi State, Nigeria.*
[2]*Department of Agricultural Economics and Extension, Nnamdi Azikiwe University, Awka, Nigeria.*

Abstract

The present study was aimed at addressing the problems of adoption of improved production technologies of cocoyam from socioeconomic point of view. This research was indispensable especially now that this crop is facing possible extinction in South East and other zones of the country where it serves as staple food and as well a cash crop. Purposive and multi stage random sampling techniques were used to select 120 farmers for the detailed study. Data, comprising information on the farmers' socio – economic characteristics and other quantitative variables relevant to the study were collected using well structured questionnaire and personal interview. Descriptive statistics such as percentage response was used to address the farmers' socio – economic characteristics and constraints to cocoyam production respectively, while the extent of adoption was captured using Tobit model analysis. The result shows that extension visit, cooperative membership; off farm income and educational level were the major determinants of extent of technology adoption of cocoyam in the study area. More so, the results revealed that the major constrains to the production of cocoyam were poor access to credit, high cost of labour, high cost of fertilizer and high cost of planting materials. Policies options aimed at increasing farmers' access to fertilizer, educational programmes such as adult education, cooperative membership and extension contacts were proffered.

Key words: Socio - economics, Determinants, Adoption, Cocoyam, Production, Technology, Small holder and Farmers.

1. Introduction

The importance of agriculture lies on supplying food items, industrial inputs, generating foreign exchange, creating employment opportunities, contributing to gross domestic product (GDP) and expanding markets for industrial outputs (Tanko and Opara, 2010). In spite of the potentials of the sector, its production is however subsistence - based and dominated by smallholder farm households that operate on farms of less than one hectare in many developing countries (Okoye *et al*., 2007). However, small holder farming production is generally distinguished by low access to improved technologies, financial services, modern inputs, agricultural markets and irrigations services which result in variability of earnings from the farming sector. Therefore, there is a dire need to boost the productivity and sustainability of agriculture in order to meet the Millennium Development Goals, of which amongst is to halve the number of people suffering from extreme poverty and hunger by

*Corresponding author: **S.I. Ume**
E.mail: Umesmilesi@gmail.com
Received: 28.07.2016; *Revised*: 04.09.2016;
Accepted: 30.09.2016.

2020 through among others the use of modern agricultural technologies (Ume and Okoye, 2009).

The importance of technology development and usage in agricultural development cannot be over emphasized as inadequate technology transfer constrains the expansion of agricultural output directly, while indirectly contributes to rural poverty and insufficient labour utilization, aggravates inflation as well as unemployment, limits the capacity of the rural market to assist industrial growth and worsens the balance of payment problems through laggard export performance and food import dependence (FAO, 2007). One major staple food for more than 400 million people in both rural and urban areas of the tropics and sub-tropics (FAO, 2008), of which not much attention seems to have been given particularly in Nigeria by research, government and farmers was cocoyam (Okoye and Onyenweaku, 2009). Cocoyam is a member of the aroid family, aracease that is widely cultivated in developing countries in Africa, Asia and the Pacific (Ekwe *et al*., 2007) with its' two common genera being *Colocasia* and *Xanthosoma* of which the most extensively cultivated species are *Colocasia esculenta* L. *Schott* and *Xanthosoma sagittifolium* L. Schott (Asumugha *et al*., 2006).

Nigeria is the largest producer of cocoyam in the world in terms of volume of production with the annual output of 5,068,000 metric tons/annum, (which represents 37 % of the world output of cocoyam) as against the potential of 160 million metric tons/annum (Essien, 2006). It is usually cultivated solely, especially where other crops may not thrive well or inter-planted with plantation crops, such as oil palm, coconut and intercropped with arable crops, like yam, maize, cassava, and others (Edet and Nassak, 2006).

Cocoyam is an important food security crop in varied ways either cooked or eaten on its own or together with other dietary staples or pound into flour, processed forms (crisp, soup thickener, flour and starch) (Okwuowulu, 2000). Nutritionally, cocoyam compares favourably with those rival crops (roots and tubers) and in some aspects excels in terms of nutrients (like protein, carbohydrates, vitamins, minerals and low starch grain) and often recommended to diabetics, nursing mothers, aged, children with allergy and people with intestinal disorder (Duru and Uma, 2002). Furthermore, cocoyam is used for industrial materials (manufacturing of alcohol and drugs) and used in livestock feeds formulation in order to reduce total cost of production especially now the conventional feed is costly (Ekwe *et al.,* 2007). Several studies observed that cocoyam production in Nigeria recorded an increase from 1,040.8 which is although below the nation's potential of 160 million metric tons (Dimelu *et al.,* 2009). These production figures were largely due to technology adoption by small proportion of the farmers, whereas the vast majority of the farmers concentrate on increase in land area (Ume, 2014). Although, the cultivated area of cocoyam increased its production but the growth rate declined tremendously from the average of 23.7 % between 1987 – 1992 to 4.5 % in 2001 – 2006 periods. The decline in an average yield per hectare has been more drastic. It dropped from 13.6 % in 1987 to 1992 and 4.5 % in 1999 – 2003 (Okoye, 2006). The declining trend in cocoyam production may not be unconnected with low productivity. Eze and Akpa (2010) asserted that low production and productivity have continued to characterize Nigerian agricultural sector, thereby, limiting the ability of the sector to perform its traditional roles in economic development.

Nevertheless, the efforts of National Root Crop Research Institute (NRCRI) Umudike Abia State, Nigeria and International Institute for Tropical Africa (IITA), Ibadan through the development of technologies which were disseminated to the farmers by the extension agents of Agricultural Development Programme (ADP), the only national extension programme that has easy access to farmers since it has extension agents at rural villages where farmers reside (Ewe *et al.,* 2006). The specific technologies spread to the farmers were (i) use of improved cocoyam varieties: The improved cocoyam varieties as developed and introduced by National Root Crop Research Institute (NRCRI)

Umudike Abia State, Nigeria were NX_1001, NX_2002 and NX_3001. These varieties are noted to be tolerant to cocoyam blight and root rot diseases (*Pythium myriotylum*) and of high yielding (Okwuowulu, 2000), (ii) Use of fertilizer: Fertilizer is chemical that add extra nutrients needed to restore soil fertility to the level necessary for high crop yield (Ume *et al.,* 2008). Fertilizer has positive and immediate effect on crop yield especially when the right type is used, at the right time and correct quantity was used. The popular fertilizer for corms and tuberous crops in the study area is N P K 20; 10; 10, (iii) Spacing and stands geometry: Cocoyam corms and cormels should be planted at 1 meter × 1 meter in ridge for sole cropping with plant population of 10, 000 stands per hectare, while 50 cm × 50 cm for intercropping at 20,0000 stands per hectare (Dimelu *et al.,* 2009), (iv)Weeding: weeding should be timely and appropriate whether it is done manually or with use of chemical. The first initial weed control must coincide with the critical weed control of 2 – 3 weeks after planting (WAP) and subsequent weeding comes 8 – 12 WAP, (v) Minimum tillage: Tillage can be zero, minimum or maximum and it helps to pulverize the soil for easy penetration of plant root and aeration, (vi) Timely planting: Cocoyam planting should be from 1st week of June to middle of July and (vii) Pesticide use: Pesticides should used to treat prepared corms and cormels before planting to against micro and macro organisms infestation and for pests and disease treatment and control. The adoption of these technologies by the farmers contributed significantly to cocoyam production in Nigeria. For instance, National Root Crop Research Institute (NRCRI, 2010) reported that the average output of cocoyam produced in Nigeria have changed drastically between 1970 - 2009 as shown in the Table - 1.

For instance, according to (Ume, 2014) from 1970 - 1984, the average output level declined sharply from 1,040.8 million metric tones (1970 - 1974) to 237.4 thousands metric tonnes (1980 – 1984) with variability indices of 2.7 and 6.7 respectively. Hence, from 1985 – 2009, because of technology adoptions, there had been a steady increase in the average output level of 458.40 thousand mt (1985 - 1989), 2,176.66 million mt (2000 – 2004) and 2,276.8 million mt (2005 – 2009) with variability indices of 2.2, 2.8 and 3.0 respectively (Edet and Naskok, 2010).

Table – 1: Estimated average output of cocoyam (1970 - 2009)

Year	Mean MT	CV (covariance)
1970 – 1974	1040.8	2.78
1975 – 1979	339.2	1.86
1980 – 1984	237.4	6.73
1985 – 1989	458.4	2.25
1990 – 1994	938.8	5.73
1995 – 1999	1359.6	10.95
2000 – 2004	2176.66	2.81
2005 – 2009	2276.8	3.0

Source: Edet and Naskok (2010)

However, there is paucity of information on the socio–economic factors that affect the adoption of these technologies by the farmers and this knowledge gap is that this study tends to a bridge. Specifically, this study tends to determine: the socio economic characteristics of the farmers, determine the factors affecting cocoyam technology adoption by the farmers and the constraints to the adoption of the technology. This study is justified in many ways; first, adoption studies help to quantify the number of technology users over time in order to assess the impact or determine extension requirements for modification of extension system by extension policy designers or makers. Furthermore, the determination of factors influencing the rate and extent of adoption of technology would go a long way in aiding policy makers and extension planners for further modifications of the system. The study would further serve as source of research information for scholars for further studies in related subjects and also provides useful information for agricultural extension agents for effective dissemination of information to farmers. Also, through identification of problems limiting cocoyam production, policy options could be instituted by government and researchers on how best to overcome the constraints to boost food security

especially now the crop is facing possible extinction. The study could serve as a baseline for evaluating cocoyam production for the ongoing cocoyam rebirth project at National Root Crop Research Institute at mid or end term, and equally as reference for further research work.

2. Materials and Methods

The present study was carried at South East states of Nigeria. The zone lies between latitude 5^0 91' and 7^0 75' N of equator and longitude $6^0$85' and $8^0$46' East of Greenwich Meridian. It has a total land mass of 10,952.400 ha. The zone has population of 16,381.729 people (NPC, 2006). The zone is made up of five states: Abia, Anambra, Ebonyi, Enugu and Imo States. It lies within the rainforest and derived savanna region of the country and bordered in the North by Benue and Kogi States in the West by Delta and Rivers States, in the South by Akwa Ibom State and in the East by Cross River State. South east states have two major seasons in the year; the rainy season which last from the month of April – October and the dry season that lasts from November to March. The temperature of the area varies between 18 ^{0}C – 34 ^{0}C. About 60 – 70 % of the inhabitants engage in agriculture mainly crop farming, cocoyam production inclusive. Other non-agricultural activities engaged by people for sustenance include civil service, petty trading, vulcanizing, driving, carpentry, mechanics and others.

Multistage random sampling technique and purposive selection were used to select states, agricultural zones, local government areas, communities and respondents. In stage 1, three out of five states in South East Nigeria were purposely selected because of high intensity of cocoyam production (Okoye, 2006; Dimelu *et al.*, 2009). The selected states were Abia, Anambra, and Enugu. Stage 2 involved the random selection of two agricultural zones out of three from each state, since all the states are involved in cocoyam production in large scale. This brought to a total of six agricultural zones. The agricultural zones selected were: Enugu North and Enugu West for Enugu State, Anambra and Aguata Zones for Anambra State, while Umuahia and Ohafia Zones for Abia State. These selected zones were further stratified into local government areas. In the third stage, one local government area each out of six local government areas was purposively selected from each zone based on cocoyam production performance (Ume, 2014). The local government areas were Nsukka local government area for Enugu North, Aninri local government area for Enugu West, Oyi local government area for Anambra, Orumba South for Aguata and Ikwuano and Umunneochi Local Government Areas for Umuahia and Ohafia zones respectively.

In the next stage, two communities out of four were randomly selected from each of the local government areas, giving a total of 12 communities. The lists of the cocoyam farmers with the help of agricultural extension agents and local leaders in the communities were obtained to form the sample frame. Thus, 10 cocoyam farmers were randomly selected from each community. This gave a total of one hundred and twenty farmers for the study. Questionnaire was used to elicit information from the respondents on the relevant inputs and output necessary for the study and as well as respondents' socio-economic characteristics. Descriptive statistics such as percentage and frequency distribution was used to describe farmers socio economic characteristics and the constraints to adoption of cocoyam production technology, while Tobit model analysis was used to capture the effect of socio – economic factors on the rate of technology adoption by the farmers.

Tobit analysis is used to determine the extent of adoption of technology. The Tobit model, (Tobin, 1957) is

$$y^* = X'\beta + \varepsilon \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

$$y = \begin{cases} y^* \ if \ y^* > 0 \\ 0 \ \ if \ y^* \le 0 \end{cases}$$

Where, B is a vector unknown coefficient,

x is a vector of independent variables, e is an error term that is assumed to be independently distributed with mean zero and a variance of S^2. Y is a latent variable that is unobservable. If the data for the dependent variable is above limiting factor, zero is this case; Y is observable as continuous variable. If Y is the limiting factor, it is held at zero. This illustration is presented mathematically in the following two equations.

$Y = Y^X$ if $Y^X > Y_0$, $Y = 0$ if $Y^X < Y_0$ ---------- (2)

Where: Y_0 is the limiting factor. These two equations represent a censored distribution of the data. The Tobit model can be used to estimate the expected value of Y as a function of a set of cocoyam explanatory variables (x) weighed by the probability that $Y > 0$.

Maddala (1998) shows that the expected intensity of adoption

$\sum(Y)$ is $\sum Y = xy^3 f(Z) + f(>)$ and $Z = x\beta/\sigma$ -- (3)

Where f(Z) is the cumulative normal distribution of Z, f(Z) is the value of the derivative of the normal curve at a given point (unit normal density). Z is the Z score for the area under the normal curve and S is the standard error of the error term. The coefficients for variables in the model, β do not represent marginal effect directly but the sign of the coefficient will give the researcher information as to the direction of the effect.

Empirical Model

The variables used in Tobit model = f $(x_1,x_2,x_3,x_4,x_5,x_6,x_7 \ldots x_n)$ + e

x_1 = age of the farmer (years), x_2 = educational level (years) x_3= extension visit (access =1, non access =0) x_4 – membership of organisation (member =I, non member =0), x_5 = access to credit(access =1, non access =0) x_6 = off farm income of the farmer (N),

Table 2: Description of the Variables

Variable	Description
Age of the farmer	It is the number of years of the farmer from the day he/ she was born to the day the farmer is being interviewed. It is expected that the age of the farmer will have negative effect on technology adoption.
Level of education	It is the number of years somebody spent in schooling which is usually measured in years. It is expected that the level of educational attainment would affect the adoption of cocoyam production technology positively.
Extension visit	It is the number of visits made to the farmer and his /her farm by the extension agent. It is expected that extension contact in terms of frequency of visits of the extension agent to the farmer, vice-versa would enlighten the farmers and create a greater awareness for the potential gains of improved agricultural technology. This could affect positively technology adoption.
Membership of organization	It is the ability of the farmer to belong to social organization such as of cooperative, social club and age grade.It enables members to have access to information on improved innovations, material inputs of the technology (fertilizer and chemicals), credit for payment of labour, capacity building and training. These attributes are capable of influencing farmers' adoptability of technology in positive direction.
Access to credit	It is farmer's ability to have access to credit facility. The access to credit of the farmers' tendencies of enhancing the likelihood of affecting technology adoption positively.
Off farm income	It is the extra income farmer earn outside his/ her farm. Income from off farm income help to enhance technology adoption positively as the farmer has extra fund in his/her disposal to pay for hired labour, procuring improved production inputs and attending to family's welfare

The Table - 3 shows that an average typical cocoyam farmer is 36.4 years old with 7.2 years of educational attainment. The Average sampled farmers had 12 years of cocoyam farming experience with an average farm size of 0.72 hectares. In addition, an average cocoyam farmer had household size of 7 persons, average number of extension contact of 3 visits, average annual off farm income of N57, 427.42 and mean farm output of 6,776 kilogram (kg).

The Table – 4 showed the estimated results of the Tobit model analysis. The result indicated that nine variables were significant in explaining the adoption rate of cocoyam production technologies by the farmers in the study area. The chi-square (X^2) (0.3885) was highly significant at 1 % level of probability, indicating goodness fit of the model. Surprisingly, against apriori expectation the estimated coefficients of credit (0.1501) and age (0.250) were negative and positive respectively and both statistically significant at 5 % risk level. As expected, the statistical test of the coefficients of levels of schooling (0.729) and extension contact (0.700) in line with a priori expectation were positive and significant at 1 % risk level. In addition, the coefficient of membership of organization (0.1852) and off farm income (0.1942) were positively signed and statistical significant at 10 % respectively

The Table - 5 shows the constraints to Cocoyam production in South East Nigeria (reported in descending order) of which poor access to credit posed the highest challenge as indicated by 82.5 % of the respondents, followed by high labour cost (81.7 %), high cost of fertilizer (80.8 %), high cost of planting material (80 %) and inadequate extension contact (78.3 %)

4. Discussion

The Table - 3 revealed that the farming population was predominantly youths who according to Asiabaka (2002) are often energetic, motivated and adaptive individuals. This finding contradicted the finding of Awoke and Obeta (1998) whose work was dominated by aged farmers, who are often conservative to technology adoption and as well cannot withstand the rigors and strains involved in farming. The value of the mean educational level (7.5 years), implied that most of the sampled farmers had formal education and they are expected to be more receptive to improved farming techniques than farmers that have no formal education (Iheke, 2010). More so, the level of educational attainment by farmer as affirmed by (Eze and Akpa, 2010) will not only increase his/her farm productivity but also enhance his/her ability to understand and evaluate new production technologies. Furthermore, most of the respondents were highly experienced in cocoyam production with mean of 10 years. Tanko, and Opara (2010) remarked that years of farming experience enable farmers to set a realistic goal. However, Ume *et al.* (2008) reported that farmers counted on farming experience more than educational attainment to attain higher productivity.

The poor extension outreach in the study area as reported in Table - 3 could be linked to termination of Agricultural Development Programme (ADP) (Agricultural extension services arm in Nigeria) as a result of World Bank sponsorship withdrawal (Nwakor *et al.*, 2010). The major problem in the Sub-Saharan Africa is that year after year extension workers who are hardly afforded in-service training and are loosely linked to research continue to disseminate the same messages repeatedly to the same audience. This situation has consequently arisen where the disseminated messages to the majority of the extension audience have become technically redundant and obsolete (Effiong, 2005). Farmers with diversified off farm income have the possibility to overcome some of their credit and insurance market constraints.

The positive relationship between the coefficient of farmers' age and technology adoption as shown in Table - 3 is thought to stem from accumulated knowledge and experience of the farmers obtained from years of observation and experimenting with various technologies. In

addition, since adoption pay-offs occur over a long period of time, while costs occur in the earlier phases (Omoruyi *et al.*, 1999). This finding disagrees with (Obasi, 2005) who reported that innovativeness, motivation and adaptability of individual decrease with age.

Table - 3: Mean socioeconomic statistics of cocoyam farmers

Variables	Mean value
Age in years	36.4
Educational level (yrs)	7.27
Extension contact	3
Farming experience (yrs)	12.00
Membership of coop.	3.0
Access to credit	8.00
Off Farm income	N57,427.42
Farm output	6,776 kg

Source: Field Survey, 2015

The positive relationship between adoption and the coefficient of education as observed by (Nwaru, 2007) could be related to the fact that the more educated farmer is, the more ability he gains in understanding and applying improved technologies in order to move his farm enterprise forward. This finding was in consonance with Ume (2014) who posited that high educational status facilitates adoption as it makes one to be more objective in evaluating innovations which would positively influence his/her production. Okoli (2012) found the coefficient of schooling to be inversely related to the adoption index of the improved cassava technology package. The negative sign of the coefficient could have risen due to the composite nature of improved cocoyam technology adoption. The adopters with higher levels of schooling seemed to have been more critical in evaluating the components of cocoyam technology package. As a result, they might have been adopting the technology in bits which influenced the sign of the coefficient.

The negative sign for coefficient of credit agreed with the evidence from (Ekwe *et al.*, 2006) that such negative sign could be an indication of poor access to credit facilities by the farmers. Nevertheless, Obeta and Nwagbo (1998) in their works found positive relationship between the coefficient of credit and rate of technology adoption. They opined that credit promotes the adoption of risky technologies through relaxation of the liquidity constraints as well as through boosting of household risk bearing ability. This is because with an option of borrowing, a household can do away with the risk reduction but inefficient income diversification strategies and concentrate on more risky but efficient investment.

The coefficient of extension services was positive as shown in Table - 4, implying that the more farmers' access to the extension services, the higher the rate of adoption of such innovation. This could be because extension services helps to disseminate information on the mode of application or usage of the technologies as well as the availability of the technological inputs to the farmers. Therefore, frequent extension contact is likely to minimize doubts among farmers, ensure timely procurement of inputs and most probably encourage sustained usage of the improved technologies (Rogers, 2003). Nwakor *et al.* (2010) reported positive relationship between adoption of improved cassava varieties in Abia State of Nigeria and the number of extension visits. Nevertheless, this assertion contradicted Eze and Akpa (2010) who cited inefficient transfer of information to farmers as well as a bottleneck that militated against enhancing the adoption of technology as a critical reason for the behaviour of the variable.

Membership of organization coefficient had positive relationship with technology adoption rate and according to Onyenweaku *et al.* (2010) cooperative organization is capable of enhancing members' access to agricultural information, training, credit and other production inputs for effective adoption of innovation. Several authors (Akpa, 2007; Ume and Okoye, 2009) concurred to this assertion. The coefficient of off farm income was positive, implying that farmers that engage in off farm income have the probability of having additional income which could be used to purchase modern inputs, hire labour and reduce

the variability of farm income and smooth out their consumption. Several studies confirm this assertion (Idachaba, 2003).

Table - 4: Tobit Estimates of Determinant Factors to the Adoption of Cocoyam Technologies in South East Nigeria

Variables	Coefficient	Standard Error	t-rate
Age	0.250	0.108	2.310**
Level of education	0.728	0.223	3.262***
Extension visit	0.700	0.203	3.370***
Farming experience	0.157	0.437	-0.358
Credit access	-0.1501	0.05249	-2.8676**
Membership organization	0.1852	0.1354	1.3677*
Gender	0.0599	0.0624	0.9602
off-farm income	0.1942	0.14678	1.3231*
X^2	0.3457***		
Log likelihood	-179.8825		
Total sample size	60		

Source : Computed from STAT 84 Tobit Result/Field Survey, 2015

***, **, * are significant levels at 1.0%, 5.0% and 10.0% respectively.

The result in Table - 5 showed that poor access to credit was the most prominent problem that confronted cocoyam farmers and represented by 81.7 per cent of the respondents. This finding agrees with Iheke (2010) who asserted that paucity of fund for adoption of the technology was a persistent problem in the adoption process. Credit is a very important production resource which helps in transforming agriculture from subsistence to commercial type (Adepogu and Daramola, 2008). Unfortunately, this resource eluded most farmers because of lack of collateral, lack of knowledge and experience on how to complete loan application forms, rigorous process involved in obtaining loan and high interest rate (Ume and Okoye, 2009). This agreed with the findings of Nwakar *et al.* (2010) who opined that agricultural credit procurement had been dwindling over the years in Nigeria. More so, a high proportion of sample farmers (81.7 %) encountered the problem of high labour cost. Labour cost constituted about 35 – 40 % of the total cost of production as most of traditional farm level operations are nearly zero mechanized Tanko and Opara (2010). It was remarked that with increase in population, rural-urban migration, the ageing of the rural farming population and feminization of agriculture, labour would likely to be inelastic and expensive. The effect was high cost of production and consequently low returns.

The Table - 4 also revealed that 80.8 per cent of these respondents complained of high cost of chemical fertilizer as hindrance in achieving their production objective of self-sufficiency in food production as observed in many developing countries of the world. Fertilizer according to CIMMYST (1993) is among the major factors limiting productivity growth of agriculture in Sub-Saharan Africa. Its effect on crop yield was positive and immediate. Hence, the most readily adopted technology. The price of this resource-input is prohibitive and scarce at the farm level (Ajibefun and Daramola, 2004). In addition, inadequate extension contact (78.3 %) was reported by the respondents. Several authors had reported a wide ratio of extension agent - farmers in the developing countries and limits the interpersonal contacts which play a decisive role to eventual adoption of technology (Asiabaka, 2003; Rogers, 2003).

5. Conclusion and Recommendations

The result of the study revealed that youths and educated farmers dominated the farming population in the study area contrary to other related studies. This is ideal for sustainable agricultural development of the nation as our able

bodied youths form part of farm laborers which had for long been abandoned to our aged and feeble fathers, mothers and their children. The high rate of unemployment as result of economic recession in the country has pushed many youths into clinching to any vocation, farming inclusive for subsistence. The free education and adult education programmes of Federal of Nigeria could be invoked to explain for the high literate level of farmers as reported in the study. Furthermore, in line with other related studies, the poor extension outreach and high rate of farmers' involvement in off farm income as reported in the study could be linked to poor motivation of the change agent and the necessity to augment the poor farm income especially now the country is witnessing economic recession respectively.

Table - 5: Distribution of Respondents According to Constraints to Cocoyam Production in the Study Area

Problems	Frequency	Percentage
Poor access to credit	98	81.7
High labour cost	98	81.7
High cost of fertilizer	97	80.8
High cost of planting material	96	80
Inadequate extension contact	94	78.3
Theft problem	57	47.5
Low soil fertility	55	45.8
Problem of soil erosion	34	28.3
Illiteracy	32	26.2

*Multiple responses
Source: Field Survey, 2015

Also, in line with other related studies, the coefficients of extension visits, off farm income, membership of organization and educational level of the farmer were all positive to technologies adoption. However in contrary, the coefficients of age and credit were positive and negative respectively. Moreover, the major limitations to the adoption of cocoyam production technology were poor access to credit, unavailability and high cost of labour, high cost of planting material high cost of fertilizer.

Based on the results, the following recommendations were proffered:

a) Policies aimed at encouraging farmers to form cooperative/association should be advocated as it helps in capacity building, acquisition of credit, training and provision of production inputs to the members at reduced cost.
b) The positive influence of education on farmers' technology adoption has been noted, in this direction, there is need to strengthen the Federal Government of Nigeria current policies on education (such as the universal basic education, adult education and nomadic education) and as well farmers should be exposed to conferences and workshops in order to enhance their knowledge and skills in order to boost their productivity.
c) The problem of high cost of labour could be tackled through the sponsoring of the development and dissemination of labour saving devices such hand driven ploughs to farmers at subsidized cost by government.
d) The poor extension outreach as observed in the study could be redressed through motivations of the change agents by providing them with the necessary incentives such as mobility, allowances and training as these will help to enhance their efficiency in the job.
e) On the problem of high cost of fertilizer, there is need to tackle the problem of hoarding, misallocation and black market which have made fertilizer prices at farm level very expensive and at times unavailable. There is need for government to sustain the fertilizer subsidy programme that made fertilizer to be affordable to farmers at farm level.
f) Farmers should be encouraged to engage in off farm income as it helps to manage risk, by providing more opportunities to spread risks and coping strategies and in complementing other activities, for example, in the agricultural off-season, or part-time.
g) Credit should be made available to farmers through micro-finance banks, agricultural credit scheme and any other government agencies at reduced interest rate and affordable collaterals.

6. References

1) Adepoju, A. A and Awodunyila, D. J. 2008. Economics of cocoyam production and marketing in Ekiti State, Nigeria. *Research Journal of Applied Science*, 3(2): 9 - 12.
2) Ajibefun, A and Daramola, A. 2004. Determinants of technical efficiency and policy implication in traditional agricultural production. Empirical study of Nigeria food crop farmers. Final report presentation of biannual research workshop of Africa. Economic Research Consortium, Nairobi, Kenya.
3) Akpa, C. E. 2007. A comparative analysis of the impact and technical efficiency of Fadama II and non Fadama arable crops farmers in Imo State, Nigeria. B.Sc. thesis, Department of Agricultural Economics and Extension, Abia State University, Uturu.
4) Asiabaka, C. 2002. Agricultural Extension: A handbook for development practitioner, Omoku River State Misinform, United States.
5) Asumugha, E. N. A., Onwubiko, M. O and Okoye, B. C. 2006. Cocoyam programme, NRCRI, Umuidike.
6) Awoke, M. U and Obeta, M. E. 1998. Effectiveness of credit utilization by small scale industries in Enugu state. An econometric approach. *Citadel Journal,* 2 (4): 243 - 257.
7) CBN. 2002. Central Bank of Nigeria annual report and statement of account for the year end 31st Dec, 2002.
8) CIMMYST. 1993. The adoption of agricultural technology. A guide for survey design. CIMMYT. Economic Programme, p.88.
9) Dimelu, M. U., Okoye, A. C, Okoye, B. C, Agwu, A. E, Aniedu, O. C and Akinpelu, A. O. 2009. Determinants of gender efficiency of small holder cocoyam farmers in Nsukka zone of Enugu State of Nigeria. "Scientific Research and Essay". *Mendwell Journal,* 6 (4): 28 – 32.
10) Duru, M and Uma, K. T. 2002. Post harvest spoilage of cornel of *Xanthosoma sagittifolia* (L.) schott. *Bioscience Research Communication*, 14: 277 - 283.
11) Edet, J. U and Nsikak, A. A. E. 2010. Cocoyam farms in Akwa Ibom, Nigeria: a stochastic production function frontier approach. *Mendel Agricultural Journal*, 15 - 26.
12) Effiong, E. O. 2005. Efficiency of production in selected livestock enterprise in Akwa Ibom State, Nigeria. Ph.D Dissertation, Department of Agricultural Economics, Michael Okpara University of Agriculture Umudike, Abia State.
13) Ekwe, K. C., Nwosu, K. I., Ekwe, C. C and Nwachukwu, U. I. 2006. Examining the under exploited values of cocoyam (*Cococasia* and *Xanthosomas* species) for the enhanced household food security, nutrition and economy in Nigeria. pp. 65 – 75.
14) Ekwe, K. C., Tokula, M., Onwuka, S and Asumugha, G. N. 2010. Socio-economic determinants of sweet potato production in Kogi State, Nigeria. *Nigeria Agricultural Journal*, 41(1): 188-192.
15) Ekwe, K. C, Nwosu, K.I, Ekwe, C.C. and Nwachukwu, U. I. 2007. Examining the under exploited values of cocoyam (*Cococasia* and *Xanthosomas* species) for the enhanced household food security, nutrition and economy in Nigeria. pp. 65 – 75.
16) Essien, M. U. 2006. Adoption of improved cassava varieties among small holder farmers' in Ikot Ekpene Agricultural Zone of Akwaibom state, Nigeria. *Global Approach to Extension Practice*, 2 (2): 41 – 50.
17) Eze, C. T and Akpa, C. E. 2006. Analysis of technical efficiency of National Fadama II facility on arable crop farmers in Imo State, Nigeria. *Nigeria Agricultural Journal,* 41(1): 109 - 115.
18) FAO. 2008. FAOSTAT. Statistics Division of the Food and Agriculture Organization.
19) FAO. 2007. FAOSTAT. Statistics Division of the Food and Agriculture Organization.
20) GCS (Green Culture Singapore). 2009. Cocoyam-more than just edible corm.
21) Idachaba, F. S. 2003. Some considerations on economic aspect of food and nutrition policy

for Nigeria. Good intentions are not enough, collected essay on Government and Nigeria Agriculture Vol. I. The agricultural policy process. University Press Ltd, Ibadan; pp. 233 – 238.

22) Iheke, R. O. 2010. Market access, income diversification and welfare status of rural farm households in Abia State, Nigeria. *Nigeria Agricultural Journal,* 4 (2): 13 - 18.
23) Maddala, G. S. 1998. Limited dependent and qualitative variables in Econometrical, Cambridge University Press; pp. 24 – 36.
24) NPC (National Population Commission). 2006. Population census of Federal Republic of Nigeria: Analytical report at the national level. National Population Commission, Abuja.
25) NRCRI. 2010. Annual report of National Root Crops Research Institute, Umudike, Umuahia.
26) Nwakor, F. N., Ifenkwe, G. E., Onummadu, F. N and Ekwe, K. C. 2010. Determinants of the adoption of improved cassava varieties (TME 419 and NR 8083) among farmers in Abia State of Nigeria. *The Nigerian Agricultural Journal,* 41(1): 94 - 98.
27) Nwaru, J. C. 2007. Gender and relative technical efficiency in small holder arable crop production in Abia State of Nigeria. *International Journal of Agriculture and Rural Development,* 10 (2): 25 – 34.
28) Obasi, L. N. 2005. Innovation programme in rural development in Nigeria: An evaluation of the better life programme using APBS framework. Published by Auto Century Publishing Company, Enugu.
29) Obeta, M. E and Nwagbo, E .C. 1998. The adoption of agricultural innovations in Nigeria. A case study of an improved IITA cassava technology packages in Anambra State, National Farming System Research of Nigeria.
30) Okoli, V. B. N. 2012. Determinants of youth participation in agriculture in Orlu Agricultural Zone of Imo Sate, Nigeria. *International Journal of Agriculture and Rural Development,* 15 (1): 809 - 812.
31) Okoye, B. C. 2006. Efficiency of small holder cocoyam farmers in Anambra State, Nigeria. M.Sc. Thesis Department of Agricultural Economics. Michael Okpara University of Agriculture, Umudike, Nigeria.
32) Okoye, B. C., Okoye, A. C., Okoroafor, O. N and Amaefula, A. B. 2007. Adoption analysis of improved cocoyam production process and storage technology across gender in Enugu North agricultural zone of Enugu State. Proceedings of the 45th Annual Conference of the Agricultural Society of Nigeria, "Abuja 2009", Pp. 619 – 623.
33) Okoye, B. C and Onyenweaku, E. C. 2009. Economic efficiency of small holder cocoyam farmers in Anambra State, Nigeria. A translog stochastic frontier cost function approach. *Mendell Journal,* 9 (4): 535 – 546.
34) Okwuowulu, P. A. 2000. Evaluation of performances of cocoyam (*Colocasia* sp. and *Xanthosoma* sp.) and sweet potato (*Ipoma batata*) in sole and intercropping system with rice and maize. Unpublished Ph.D. Thesis, University of Nigeria, Nsukka.
35) Omoruyi, S. A., Orhue, U. X., Akerobo, A. A and Aghimien, C. I. 1999. Prescribed agric science for senior secondary schools. Revised edition. Idodo Umeh Publishers Ltd.
36) Onyenweaku, C. E., Okoye, B. C and Okorie, K. C. 2010. Determinants of fertilizer adoption by rice farmers in Bende L.G.A. of Abia State, Nigeria. *Nigeria Agricultural Journal,* 41 (1): 1 – 5.
37) Rogers, E. M. 2003. Diffusion of innovation. Fifth (Ed) New York Free Press.
38) Tanko, L and Opara, C. 2010. Measurement of the technical efficiency in maize production in Bosso Local Government Area of Niger State, Nigeria. Proceedings of the 44th Annual Conference of Agricultural Society of Nigeria held at Tadoke Akintola University of Technology Ogbomoso, Oyo State Nigeria, pp.29-34.
39) Tobin, J. 1958. Estimation of relationship for limited dependent variables. *Econometrics,* 26: 25 - 27.
40) Ume, S. I., Okelola, O., Kadurumba,C. and Ogwulamba, S. I. 2008. Tobit analysis of extent of adoption of cocoyam production

among farmers in Nsukka Local Government Area of Enugu State, Nigeria. Proceedings of the Proceedings of the 44th of Technology, Ogbomoso, Oyo State, Nigeria held from 18-22nd October, 2008,pp .345-350.

41) Ume, S. I., Arene, C. I and Okpukpara, B. 2008. Adoption of improved crop production technology in Anambra State, Nigeria: T & V system approach. Farm Management Association of Nigeria, 20th Annual National Conference held at Jos.
42) Ume, S. I. 2014. Child labour in cocoyam production in Anambra State, Nigeria. *Journal of Agric. and Research,* 1 (2): 241 - 247.
43) Ume, S. I. and Okoye, F. U. 2009. Child labour in rice production. A case study of Anambra Agricultural Zone of Anambra State, Nigeria. *Journal of Arts and Social Science Education,*1(1): 233 - 239.