Gender Differences In Technology Adoption And Welfare Impact Among Nigerian Farming Households

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15 August 2014

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ABSTRACT

This study examined gender differences in cassava production technology adoption and the impact on poverty status of farming households in southwest, Nigeria. The data were collected with the aid of structured questionnaire through a multistage sampling technique. The data were analyzed using Propensity Score Matching, descriptive statistics and Foster-Greer-Thorbecke weighted poverty index. Out of the 482 households, 387 with similar characteristics were used in the analysis. Adoption level was 26% higher among male adopters than their female counterparts. Adoption was significantly influenced by gender, participation in off-farm activities, distance to market, land area cultivated, years of farming experience, access to credit, cassava yield and level of education. The impact of the improved technology on the headcount index of the male (12.57%) was higher than female adopters (5.62%). This suggests that cassava improved production technology is poverty reducing, however, gender sensitivity should be incorporated into technology adoption and enabling environment should be provided to enhance participation of women.

Keywords: Gender, Technology adoption, Poverty, Cassava, Nigeria.

OVERVIEW AND PROBLEM STATEMENT

Cassava is the major source of calories for roughly two out of every five Africans. It serves as an important food source for an estimated 200 million people or averagely one-third of the population of sub-Saharan Africa (IITA et al., 2003). It has the potential to increase farm incomes, close the food gap as well as reduce rural and urban poverty. Cassava is available to low income rural households in form of simple food products such as dried roots, leaves, garri, fufu and lafun which are significantly cheaper than grains (Nweke et al., 2001).

Nigeria is known to be the leading producer of cassava in the world with an annual output of 52 million tonnes of tuberous roots (FAO, 2011). This could be attributed to the cassava multiplication programmes in the country.

Yield-enhancing technologies are vital to agricultural growth and development because merely expanding the area under cultivation (except in a few places) to meet the escalating food needs of growing populations is no longer adequate. Consequently, research and adoption of new technology are crucial to increasing agricultural productivity which is the key to global food security and fight against poverty (Braun *et al*, 2008).

Poverty is endemic to rural areas where the main occupation is farming (Fields, 2000; World Bank, 2008). According to the Nigerian Living Standard Survey (NLSS) Report (2012), 73.2% of the rural population are poor compared to 61.8% in the urban area. Incidentally, the rural sector is the predominant sector in the nation's economy as it plays some primary roles such as serving as a base for food and fibre production; the major source of capital formation for the country; a principal market for domestic manufacturers; job creation at relatively low unit costs and in general, engages in primary activities that form the foundation of any economic development, and thus, remains the most important growth priority of the country (Stewart, 2000). Moreover, achieving the Millennium Development Goal of halving the proportion of people living in absolute poverty by 2015 will require agriculture to play a major role (Lipton, 2001).

However, growth in the agricultural and rural sectors is undermined by gender-related constraints and unequal access to productive resources as well as opportunities (IFAD, 2011). There has been misconception about gender as being the promotion of women only. Nevertheless, gender focuses on the relationship between men and women, their roles, access to and control over resources, division of labour and needs. Gender relations determine household security, well-being of the family, planning, agricultural production and many other aspects of rural life (Frischmuth, 1997). Millions of women work as farmers, farm workers and natural resource managers (Onyemobi 2000), thereby contributing to national agricultural output, maintenance of the environment and family food security (Brown et al, 2001). According to FAO (2005), rural women in particular are responsible for half of the world's food production and produce between 60-80% of the food in the developing countries. Despite their contribution in agriculture, women are frequently underestimated and ignored in development strategies.

Furthermore, there are evidences that men and women do not adopt new technologies at the same rate or benefit equally from their introduction in developing countries. In Africa, women adopt high-yielding varieties and improved management systems at low rates (Doss

2001). It is therefore, expedient on the development agenda to devise strategies promoting gender equality in access to improved technology and economic opportunities. This will contribute to the empowerment of rural women and men as well as agricultural and economic development.

This study is imperative in providing information that will be helpful in designing programmes that are gender responsive thereby contributing to overall agricultural development and poverty alleviation in Nigeria. Therefore, this study examined gender differences in adoption of improved cassava production technology and impact on poverty alleviation among farming households in Southwest, Nigeria.

The specific objectives are to:

1. Estimate the gender difference in the adoption level of cassava improved production technology in Southwest Nigeria.
2. Examine the factors influencing the adoption level of production technology by cassava-based farming households in the study area.
3. Profile the poverty status of cassava-based farming households in the study area.
4. Evaluate the impact of the technology adoption on poverty alleviation among cassava-based farming households in the study area.

Materials and methods

The study was carried out in Southwest, Nigeria. South west is one of the six geopolitical zones in Nigeria. It falls on latitude 6^0 to the North and latitude 4^0 to the South while it is marked by longitude 4^0 to the West and 6^0 to the East. It is bounded in the North by Kogi and Kwara States, in the East by Edo and Delta States, in the South by Atlantic Ocean and in the West by Republic of Benin. The climate is equatorial with distinct wet (rainy) and dry seasons with relatively high humidity. The mean annual rainfall is 1480mm with a mean monthly temperature range of 18^0-24^0C during the rainy season and 30^0-35^0C in the dry season. Southwest Nigeria covers approximately an area of 114,271 kilometer square that is approximately 12 percent of Nigeria's total land mass and the vegetation is typically rainforest. The total population is 27,581,992 as at 2006 and the people are predominantly farmers. The climate in the zone favours the cultivation of crops like maize, yam, cassava, millet, rice, plantain, cocoa, kola nut, coffee, palm produce, cashew etc (NPC,2006). The zone comprises of six states namely: Ekiti, Lagos, Ogun, Ondo, Osun and Oyo states.

Data Collection and Sampling Procedure

Primary data were collected for the purpose of this study using structured questionnaire. Some of the data include: socio-economic and demographic characteristics, cassava production, cassava production technology adoption and household expenditure details. Multistage sampling technique was employed in this study. The first stage was the random selection of Ondo and Ogun states from the six states in Southwest, Nigeria. The second stage involved the random selection of four LGAs from each state while in the third stage, three communities were randomly selected from each LGA. The final stage involved a random selection of 45 households from each of the communities selected (comprising of adopters and non-adopters) resulting to a total of 540 respondents. However, a total of 482 were retrieved and completely filled from the field.

ANALYTICAL TECHNIQUES

Analytical techniques employed in this study includes: descriptive statistics, Tobit regression model, Propensity Score Matching (PSM) and Foster- Greer- Thorbecke (1984) class of poverty measures (FGT).

Following (Tiamiyu et al, 2009) and adapting it to this study, technology-use ranked score was computed for each respondents based on the identified elements of the technology package (improved varieties, recommended spacing, timely maintenance, fertilizer and herbicide application) and adoption index was generated for individual farmer. Adoption index of individual farmer was calculated as follows:

$$AI_i = \frac{TS_i}{TTS} \quad \text{.............(1)}$$

$$AAI = \sum_{i}^{n} \frac{AI_i}{N} \qquad (2)$$

Where,

AI_i= Adoption index of the i^{th} farmer

TS_i= Technology-use score of the i^{th} farmer

TTS= Total technology-use score obtainable

AAI= Average adoption index

Tobit regression model was used to analyze objective 2, Following Maddala, (1992); Johnston and Dandiro, (1997) and Negash, (2007), the Tobit model for the continuous variable adoption level, can be expressed as:

$$AL_i^* = \beta_0 + \beta_i X_i + \mu_i$$

$$AL_i = AL_i^* \quad if\ \beta_0 + \beta_i X_i + \mu_i > 0 \qquad (3)$$

$$= 0 \quad if\ \beta_0 + \beta_i X_i + \mu_i \leq 0$$

Where,

AL_i^* = the latent variable and the solution to utility maximization problem of level/ extent of adoption subjected to a set of constraints per household and conditional on being above certain limit

AL_i = Adoption level for ith farmer

X_i = vector of factors affecting adoption and level of adoption

β_i = vector of unknown parameters

μ_i = error term

Selection of explanatory variables

The explanatory variables specified as determinants of adoption level of RTEP improved production technology were selected according to Chilot *et al,* (1996); Asfaw *et al,* (1997); Nkonya *et al* (1997); Mulugeta (2000); Mesfin(2005); Omonona *et al,*(2005) and Negash (2007)

The variables are defined as follows:

X_1= Age of the household head (years)

X_2= Age square of the household head (years)

X_3= Gender of the household head (male=1, 0 otherwise)

X_4= Marital status of the household head (married=1,0 otherwise)

X_5= Participation in off-farm activity (yes= 1, 0 otherwise)

X_6= Level of education of household head

X_7= Years of experience of household head in cassava production (years)

X_8= Main occupation (farming = 1,0 otherwise)

X_9= Household size (numbers)

X_{10}= Land area cultivated (ha)

X_{11}= Distance of farm to nearest market (km)

X_{12}= Access to credit of the household head (yes=1, 0 otherwise)

X_{13}= Cassava yield (tonnes/ ha)

X_{14}= Contact with extension agents (yes=1, 0 otherwise)

Propensity Score Matching, one of the most commonly used quasi-experimental methods was used to address the evaluation problem (Mendola, 2007; Nkonya *et al,* 2007; Akinlade *et al*, 2011). The sample collected was matched using PSM; the aim of PSM is to find the comparison group from a sample of non-adopters that is closest to the sample of adopters so as to get the impact of the technology on the beneficiaries. Though, the adopters and comparison groups may differ in unobservable characteristics even if they are matched in terms of observable characteristics, however, it has been put forward that selection on unobservable is empirically less important in accounting for evaluation bias (Baker, 2000). Also in a situation where the same questionnaire is administered to both groups (so that outcomes and personal characteristics are measured in the same way for both groups) and the participants and controls are placed in a common economic environment (such as the case in this study), matching substantially reduce bias (Heckman *et al*, 1996).

Main steps involved in the application of statistical matching to impact evaluation are: estimating the propensity score, matching the unit using the propensity score, assessing the quality of the match and estimating the impact and its standard error.

Out of 482 only 387 adopters and non-adopters that had comparable propensity scores were matched which includes 157 adopters and 230 Non-adopters. After matching, the testing of comparability of the selected groups was done and the result shows statistically insignificant difference in the explanatory variables used in the probit models between the matched groups of adopters and non-adopters.

Since the match has been deemed of good quality, this study then used the matched sample to compute the Average Treatment Effect for the Treated (ATT) to determine impact. This is defined by Rosembaum and Rubin (1983) as follows:

$$E\left(Y^1 - Y^0 / D = 1\right) = E\left(Y^1 / D = 1\right) - E\left(Y^0 / D = 1\right) \qquad (3)$$

where, $E\left(Y^1 / D = 1\right)$ is the observed outcome of the treated, that is, the expected income earned by adopters and $E\left(Y^0 / D = 1\right)$ is the counterfactual outcome - the expected income they would have received if they had not adopted the technology. The counterfactual outcome represents outcome of the non-adopters since they have similar characteristics with adopters. Standard errors were computed using bootstrapping method suggested by Lechner and Smith (2002) to generate robust standard errors in light of the fact that the matching procedure matches control households to treatment households with replacement.

Changes in poverty of adopters and Non-adopters were achieved by using the Foster- Greer-Thorbecke (1984) class of poverty measures (FGT) which include the Headcount Index (P_0), the Poverty Gap Index (P_1), and the severity of Poverty Index (P_2). The three indices can be expressed into one general form and distinguish themselves for the different weights attributed to the distance between expenditure of the poor and the poverty line. P_0 attributes equal weight to all expenditure of the poor while P_1 and P_2 attribute increasingly more weight to distance of expenditure of the poor from the poverty line. They are widely used because they are consistent and additively decomposable (Verme, 2003).

The FGT is presented below:

$$P_\alpha = \frac{1}{n}\sum_{i=1}^{q}\left[\frac{Z-y}{Z}\right]^\alpha \qquad (4)$$

Where,

Z = the poverty line defined as 2/3 of Mean per capita expenditure

Y = the annual per capita expenditure –poverty indicator/welfare index per capita

q = the number of poor households in the population of size n,

α = the degree of poverty aversion; α =0; is the Headcount index (P_0) measuring the incidence of poverty (proportion of the total population of a given group that is poor, based on poverty line). α =1; is the poverty gap index measuring the depth of poverty that is on average how far the poor is from the poverty line; α =2; is the squared poverty gap measuring the severity of poverty and inequality among the poor.

3. Results and Discussion

Distribution of Respondents by Socio-economic Characteristics

Table 1 shows the distribution of the respondents by socio-economic characteristics across the two types of respondents considered which are: adopters and non-adopters. The average values of their socio-economic characteristics are within the same range due to propensity score matching (PSM) used in selecting the respondents with similar observable characteristics. Majority (74.63%) of the adopters are males while only 25.37% are female which shows that technology adoption was higher among males. The average household size was 6. The majority of the respondents have their household sizes falling within the range of 5 to 9 people, with the average age of the respondents being 44 and 45 for adopters and non-adopters respectively. Implicit in these findings is that a large proportion of the respondents were middle aged and can therefore be regarded as active, agile and with more energy to dissipate and concentrate on productive effort. The average years of experience in cassava farming was 16 years for all respondents. The average area of land cultivated was about 1 hectare for all the respondents. Accessibility to credit facility and participation in off-farm activity was higher among adopters compared to non-adopters.

Table 1: Distribution of Respondents by Socio-economic characteristics

Characteristics	Categories/ Statistics	Adopters n=157 Percentage	Non-adopters n=230 percentage
Gender	Female	25.37	22.17
	Male	74.63	77.83
	Total	100	100
Household size			
	0-4	16.25	26.09
	5-9	77	68.26
	>9	6.75	5.65
	Total	157	230
	Mean	6	6
	SD	1.9942	1.9576
Age	≤30	13.12	6.09
	31-40	30.25	26.09
	41-50	35.63	36.95
	>50	21	30.87
	Total	157	230
	Mean	44.2685	45.1913
	SD	10.1317	10.7219
Level of education	No formal	35.67	26.09
	Primary	51.59	36.52
	Secondary	12.74	37.39
Credit access	Yes	82.50	48.26
	No	17.50	51.74
Area of land cultivated(ha)	≤0.5	26.75	22.17
	0.6-1.0	64.33	50.00
	1.1-1.5	8.92	28.63
	Total	157	230
	Mean	0.98	1.01
	SD	0.35	0.56
Off-farm activity	Yes	73.13	67.78
	No	26. 87	32.22

Source: Field Survey, 2011

Gender difference in technology adoption level

The adoption level refers to the intensity of use of improved technology by the farmers measured using their adoption scores. The adoption index generated shows to what extent the farmers have adopted the whole technology package. The adoption level (technology-use) of cassava improved production technology was 76.01%. The level of adoption by gender revealed that adoption level was higher among male adopters than their female counterparts. From Table 2, the mean adoption index of the male adopters was 0.89 while that of their female counterparts was 0.63. This implies that male farmers adoption level was 26% higher than the females. This might be that male headed households have better access to information and other resources on improved production technology.

Table 2: The adoption index by gender

Gender	Percentage	Mean adoption index
Male	74.63	0.89
Female	25.37	0.63

Effect of Socio-economic Characteristics on Adoption Level of Cassava Improved Production Technology

The result of the determinants of adoption level of cassava improved production technology by farming households in the study area is shown in Table 3. The result of the Tobit regression model shows that the log likelihood is -199.69 and is significant at 1% level of significance. This indicates that the model has a good fit to the data. The result shows that out of the 13 explanatory variables included in the model, participation in off-farm activity and seven other variables were found to significantly influence level of adoption. These are gender, distance to input market, land area cultivated, years of experience in cassava production, cassava yield, access to credit and level of education. A positive sign on a parameter indicates that the higher the value of the variable, the higher the adoption level and vice-versa.

Participation in off-farm activity has a positive and significant ($p<0.05$) influence on level of adoption. During slack periods many farmers can earn additional income by engaging in various off-farm activities. This is believed to raise their financial position to acquire new inputs.

Participation in off farm activity will increase adoption level by 0.0468. This is in line with Chilot *et al* (1996). The gender of the farmer is significant ($p<0.01$) and has a positive sign implying that male are more likely to adopt the use of improved cassava production technology than their female counterparts. From the result, being a male farmer will increase the level of adoption by 13.83%. This shows that male farmers have better access to information and other resources on improved cassava production technology and are more likely to adopt new technology than their female counterparts. This result is in agreement with Tesfaye *et al* (2001); Mesfin (2005) and Omonona *et al* (2006).

The coefficient of years of experience in cassava production is positive and significant ($p<0.01$). A unit increase in years of experience in cassava production will increase the adoption level by 0.0506. This is due to the fact that farmers with higher experience in cassava production appear to have full information and better knowledge hence able to evaluate the advantage of the technology. This finding is in accordance with Chilot (1994). The level of adoption of improved cassava production technology is significantly but negatively influenced by distance to the nearest input market. Market distance significantly ($p<0.01$) reduced adoption level. This indicates that farmers nearer to the markets have more access to input. The result from this study showed that a unit decrease in market distance will increase the likelihood of adopting technology by 0.0180. This is line with Mesfin (2005); Tesfaye (2006) and Hailu (2008) who reported that market distance is negatively and significantly associated with adoption of crop technologies in different parts of Ethiopia.

Access to credit has positive and significant influence ($p<0.01$) on the adoption of improved cassava production technology. From the result of this study, access to credit facilities leads to 15.82% increase in the adoption level. This is attributed to the fact that credit increases the farmers' economy to purchase improved seed, fertilizer and other inputs. This is in agreement with Mulugeta (2000) and Tesfaye *et al* (2001). The level of education of the household head positively and significantly ($p<0.05$) influenced adoption level of improved production technology. Educational level will increase adoption level by 0.1755. Education increases farmers' ability to obtain, process, and use information relevant to technology adoption. This result is in line with Chilot (1994).

The coefficient of land cultivated is positive and significant ($p<0.01$). From the result of this study, a unit increase in land cultivated will increase adoption level of improved production technology by 0.6345. Land is perhaps the single most important resource, as it is a base for any economic activity especially in rural and agricultural sector. It is frequently argued that farmers cultivating larger farm land are more likely to adopt an improved technology (especially modern varieties) compared with those with small farmland. This finding is consistent with Hailu (2008) that farm size exerts a positive influence on adoption of improved teff and wheat production technology in northern and western shewa zones of Ethiopia. Cassava yield has a positive and significant ($p<0.01$) influence on adoption level. A unit increase in last season's yield will increase the adoption level of improved production technology by 0.1431. This is in agreement with Omonona *et al* (2006).

Table 3: Estimates of Tobit regression for the determinants of adoption level

Variables	Marginal effect	Standard error	t- value
Gender	0.1383***	0.0515	2.69
Age	-0.0223	0.0239	-0.93
Marital status	0.1834	0.1759	1.04
Level of education	0.1755**	0.0834	2.10
Main occupation	0.0248	0.0430	0.58
Off- farm activity	0.0468**	0.0229	2.04
Distance to market	-0.0180***	0.0058	-3.09
Land cultivated	0.6345***	0.1375	4.61
Year of experience	0.0506***	0.0086	5.88
Cassava yield	0.1431***	0.0115	12.41
Credit access	0.1582***	0.0567	2.79
Extension agent	0.0126	0.0566	0.22
Household size	0.0021	0.0048	0.08
Constant	-1.2732 ***	0.3942	-3.23
Sigma	0.5806	0.0319	
Prob>chi2	0.0000		
Pseudo R2	0.4458		
Log likelihood	-199.69		

Source: Field Survey, 2011

*,**,*** are significant levels at 10%, 5% and 1% respectively

Estimation of poverty line

This section focuses on household expenditure on food and non-food items, the estimation of poverty line, expenditure pattern by poor and non poor and the impact of improved production technology on the poverty status of cassava farming households. Table 4 presents the summary statistics of the expenditure profile of the households. The table shows that the estimated annual household expenditure on food consumed was ₦172726.53 which constitutes 58.40% of the total household expenditure. Other non-food items such as clothing and footwear, health and medicare, education, fuel and lightning, transportation, remittances (to dependants, gift to friends and family members), rent and other unlisted consumption goods accounted for the remaining 41.60%. The result indicates that the mean expenditure of households in the study area is ₦295764.60 while the mean per capita household expenditure (MPCHHE) is ₦51709.49. The poverty line was computed for respondents using the two-thirds MPCHHE, the poverty line was ₦34473.00 per annum.

Table 4: Annual Household Expenditure Profile

Item	Average annual expenditure	% of total expenditure
Food	172726.53	58.4
Clothing and footwear	20111.99	6.8
Health and medicare	7098.35	2.4
Education	14196.70	4.8
Fuel and lightning	21886.58	7.4
Transportation	10351.76	3.5
Remittance	19816.23	6.7
Rent	14196.70	4.8
Others	15379.76	5.2
Total Expenditure	295764.60	100
Mean per capita household expenditure (MPCHHE)	51709.49	
Poverty line(2/3 MPCHHE)	34473.00	

Source: Field Survey, 2011

Poverty Status and Impact of Technology Adoption

Based on the poverty line, 55% of cassava farming households that are adopters of the live below the poverty line (poor) (Table 5). The poverty status of the respondents is presented in Table 5, the poverty incidence of the adopters was lower than that of the non-adopters, this reveals that the improved production technology has the potential to reduce poverty. The poverty incidence was 0.5500 for the adopters compared to 0.6113 for all non-adopters. The poverty gap and severity of poverty indices shows that the non-adopters are farther away from the poverty line and that poverty is more severe among them compared with the adopters. Furthermore, the table reveals the impact of the improved production technology on the poverty incidence, depth and severity of beneficiaries. It has a negative impact on the poverty incidence of adopters. The poverty incidence of the adopters reduced by 11.15%, indicating that 11.15% of the adopters moved above the poverty line due to participation in the programme.

The result also shows that poverty gap and severity of the adopters dropped when compared with non-adopters. The poverty gap of the adopters reduced by 28.91% while the poverty severity dropped by 47.53% when compared with the non-adopters. This is an indication that the improved production technology has reduced the average gap between poor households' standard of living and poverty line. Also, the inequality among the poor reduced due to participation in the programme.

Table 5: Poverty Status of the Respondents and impact of technology adoption

Type of Respondents	Statistics	Poverty status	ATT	Impact(%)
ADOPTERS	P0	0.5500	....	-11.15
	P1	0.1463	-0.0423	-28.91
	P2	0.0810	-0.0385	-47.53
NON-ADOPTERS	P0	0.6113		
	P1	0.2442		
	P2	0.1281		

Source: Field Survey, 2011

Poverty Status of Respondents and Impact by Gender

From Table 6, the FGT poverty indices of female adopters were higher than that of the male adopters. The headcount of the female adopters was 0.5585 while it was 0.5139 for their male counterparts. This implies that 55.85% of female adopters were poor compared to 51.39% of their male counterparts. Also, for the non-adopters, the poverty indices of the female were higher than their male counterparts. Moreover, the table presents the impact of the technology on the poverty incidence, depth and severity of beneficiaries. The impact of the improved technology on the headcount index of the male (12.57%) was higher than female adopters (5.62%) when compared with the non-adopters. Similarly, though, the poverty gap and severity reduced for both male and female. The poverty gap and severity of male reduced more than that of female. Technology adoption reduced the poverty gap and severity of the male adopters by 31.07% and 48.47% respectively while there was a reduction of 18.57% and 19.09% for their female counterparts. This shows that the improved production technology reduced the average gap between poor households' standard of living and poverty line of the male beneficiaries more than their female counterparts.

Table 6: Poverty Status and Impact by Gender

Type of respondent/ Gender	Statistics	Poverty Status	ATT	Impact (%)
ADOPTERS				
Female	P0	0.5585	………..	-5.62
	P1	0.1664	-0.0309	-18.57
	P2	0.0660	-0.0126	-19.09
			.	
Male	P0	0.5139	………..	-12.57
	P1	0.1342	-0.0417	-31.07
	P2	0.0163	-0.0079	-48.47
NON-ADOPTERS				
Female	P0	0.5899		
	P1	0.1894		
	P2	0.0792		
Male	P0	0.5785		
	P1	0.1576		
	P2	0.0413		

Source: Field Survey, 2011

CONCLUSION

This study centered on gender differences in technology adoption and impact on poverty alleviation among cassava-based farming households. Empirical evidence from this study has revealed a higher adoption level and impact of improved cassava technology on the male farmers. Gender, education, credit accessibility, off-farm activity participation among other factors significantly influenced technology adoption. Furthermore, this study showed the poverty status of the households. The poverty status of the female adopters was higher than their male counterparts. Though there is reduction in poverty indices of both male and female adopters due to adoption of the technology, however, the impact was higher on the poverty indices of males. This implies that there is scope for reducing poverty through increased adoption of this technology by farmers.

Based on the findings of this study and conclusion drawn, the following are recommended:

- Equal opportunities for women and men to participate and benefit should be prioritized in Technology development and transfer.
- There should be wide dissemination of agricultural technology to regions with high poverty rates
- There should be provision of facilities for adoption of new technologies such as credit among women.
- Awareness programme and trainings on technology adoption should be intensified among farmers especially women.
- Policy measures should be oriented towards the support and improvement of rural off-farm income opportunities.
- Improving credit or grant access should be considered as a core component of any development intervention.

REFERENCES

Akinlade, R.J, Yusuf, S.A, Omonona, B.T and Oyekale A.S. (2011). "Poverty Alleviation Programme and Pro-poor Growth in Rural Nigeria: Case of Fadama II Project". *World Rural Observations*. Vol. 3(1). Pp27-33.

Baker, J.L. (2000). "Evaluating the impact of development projects on poverty. A handbook for practitioners". The International Bank for Reconstruction and Development/ The World Bank, 1818 H street, N.W, Washington, D.C.20433

Braun,J.V, Fan, S., Meinzen-Dick, R., Rosegrant, M.W. and Pratt. A.N. (2008). "International Agricultural research for food security, poverty reduction and the environment". International Food Policy Research Institute

Chilot, Y.(1994). "Factors Influencing Adoption of New Wheat Technologies in the Wolmera and Addis Alem Areas of Ethiopia". An M.Sc. thesis presented to the school of graduate studies of Alemaya university of Agriculture, Ethiopia. 108p

Chilot, Y., B.I. Shampiro, and M. Demeke (1996). "Factors Influencing adoption of new wheat technologies in Wolmera and Addis Alem Areas of Ethiopia". *Ethiopian Journal of Agricultural economics.* Vol (1): pp 63-83

Doss, C. (2001). "Designing Agricultural Technology for African Women Farmers: Lessons from 25 Years of Experience". *World Development* 29(12): 2075- 2092.

FAO (2005). The Special Programme for Food Security @ www.fao.org

FAO (2011). "The State of Food and Agriculture: Women in Agriculture- Closing the Gender Gap for Development". Rome: FAO.

Fields, G.S. (2000). "The Dynamics of Poverty, Inequality, and Economic Well-being: African Economic Growth in Comparative Perspective". *Journal of African Economies*, Vol. 9 (1): Pp. 45-78

Foster, J., J. Greer, and E. Thorbecke. (1984). "A class of decomposable poverty measures". Econometrica 52: 761–766.

Frischmuth, C. (1997). "Gender is not a Sensitive Issue: Institutionalising a Gender- Oriented Participatory Approach in Savionga, Zambia". Gatekeeper Series no. 72. International Institute for Environment and Development (iied). Sustainable Agriculture and Rural Livelihoods programme, 1997.

Hailu,B.(2008). "Adoption of Improved teff and wheat production in crop livestock mixed system in northern and western shewa zones of Ethiopia". Ph. D. Thesis University of Pretoria,.

Johnston, J. and Dandiro, J(1997). "Econometrics Methods", fourth Edition, McGraw Hill Companies, Inc. New York.

Heckman, J. (1995). "Instrumental Variables: A Cautionary Tale", NBER Technical Working Paper No. 185, Cambridge, Mass.

Lechner, M. and J. Smith (2002). "Some Exogeneous Information Should Not Be Used in Evaluation", mimeo

Maddala,G.S.(1997).“Limited Dependent and Quantitative Variables in Econometrics”. Cambridge University Press.

Mendola, M. (2007). “Agricultural technology adoption and poverty reduction. A propensity Score matching analysis for rural Bangladesh”. *Food policy* 32(2007): 372-393.

Mesfin A. (2005). “Analysis of factors Influencing Adoption of Triticale and its Impact. The Case Farta Wereda”. Msc. Thesis (Unpublished) Presented to School of Graduate Studies of Alemaya University.

National Population Census (NPC) (2006). National Bureau of Statistics Official Gazette (FGP 71/52007/2,500(OL24) Abuja. URL http://www.nigerianstat.gov.ng

Nkonya, E., T. Schroeder and D. Norman (1997). “Factors affecting adoption of improved maize seed and fertilizer in North Tanzania”. Indian j. Agri.econ. 48(1):1-1

Nweke, F. I., S.C. Spencer and J. K. Lynam 2002. “The Cassava Transformation; Africa’s Best Kept Secret”. Michigan State University Press. Michigan. Pp 60-65.

Omonona, B.T, O.A. Oni and O.A Uwagboe. (2005) “Adoption of improved Cassava varieties and its Impact on Rural Farming Households in Edo State, Nigeria”. *Journal of Agriculture and Food Information*, Vol 7(1) pp40-45

Onyibe J. E. 2001. “Technology dissemination through women groups. A quarterly Newsletter of the Nigerian”. Agricultural Question and Answer Service. (NAQAS Newsletter) Volume 1 (2)

Onyemobi F. I. 2000. “Towards agricultural revolution and rural development. In: Onyemobi F I (editor) Women in Agriculture and Rural Development Towards Agricultural Revolution in Nigeria. Enugu Nigeria”, Falude publishers.

Rosenbaum P.R, and Rubin D.R. (1983). “The Central Role of the Propensity Score in Observational Studies for Causal Effects”. *Bometrika* 70: 41-55.

Tiamiyu, S.A., J.O Akintola and M.A.Y Rahji (2009). “Technology Adoption and Production Difference among Growers of New Rice for Africa in Savanna Zone of Nigeria”. *Tropicultura* Vol 27(4) pp 193-197

Verme, P. (2003). “Growth, Poverty and Income Inequality in Kazakhstan 2001-2002. One of the papers series on Growth, Poverty and Income Inequality in Kazakhstan”. Prepared for the World Bank 2004 Kazakhstan poverty assessment. pp36.