NIGERIAN AGRICULTURAL JOURNAL
ISSN: 0300-368X
Volume 51 Number 3, December 2020 Pg. 178-184
Available online at: http://www.ajol.info/index.php/naj

DIFFERENTIALS IN ADOPTION OF IMPROVED AGRICULTURAL TECHNOLOGIES AMONG RURAL WOMEN IN ENUGU STATE, NIGERIA

Anyim C. O., Okorie N. U. and Odoemelam L. E.

[1]External Relations, Shell Petroleum Development Company Nigeria Ltd, Port Harcourt, Rivers State
[2]Department of Agricultural Economics and Extension,
Akwa Ibom State University, Ikot Akpaden Akwa Ibom State
[3]Department of Agricultural Extension and Rural Development,
Michael Okpara University of Agriculture Umudike, Abia State
Corresponding Authors' email: lovinasteve@gmail.com

Abstract
This study investigated the factors that influence agricultural technology adoption among rural women in Enugu State. A multistage sampling procedure was used in the selection of 135 respondents from the three agricultural zones in the State. Data for the study were collected using structured questionnaire and focus group discussion, and analyzed using descriptive and inferential statistics. Results on socio-economic characteristics indicated that majority (63%) of the women were between the ages of 45 – 50 years, and many (43%) who attained primary level of education, with 10 – 19 years of farming experience (40%). About 68.1% of the farmers were involved in crop farming only, (20%) in livestock farming and (11.9%), and many (54.1%) involved in farming as means of livelihood. About 41.5% belong to 1 – 2 social organizations. Important technologies available to the farmers include: improved land preparation (77.8%), planting of early season crops (62.2%), improved methods of fertilizer application (89.6%), processing of cocoyam into chips/flour (91.9%) and early maize cultivation (78.9%). Determinants of rural women adoption of improved technologies, indicate that age (5.246***), marital status (2.586**), access to credit (6.611***) and extension services (2.876***) were significantly related to adoption of technologies. Therefore, the study recommends that policy makers should increase female access to productive resources, extension services and training programme on agricultural based practices in the study area.

Keywords: Technology adoption, women and productive resources

Introduction

Agricultural technologies are seen as an important route out of poverty in most developing countries (Mwangi and Kariuki, 2015). In Africa and Nigeria in particular, 80% of the agricultural production comes from small scale farmers, who are mostly rural women Awotide *et al.* (2016). Agwu (2004) revealed that most of these women rely on traditional methods and this has constrained their level of productivity. The present economic meltdown in the country presents serious challenges to women in particular, with their position as wives and mothers. Increasing agricultural productivity is crucial to meet expected rise in demand and as such it is instructive to examine recent performance in cases of modern agricultural technologies (Challa, 2013).

By virtue of new improved input/output relationship, new technology tends to raise output and reduce average cost of production, which in turn results in substantial gains in farm income (Mwangi and Kariuki, 2015). Adoption of improved technologies increases production, leading to constant socio-economic development. Adoption of improved agricultural technologies has been associated with higher earnings and lower poverty, improved nutritional status, lower staple food prices, increased employment opportunities and earnings for landless labourers. A new agricultural technology that enhances sustainable production of food and fiber is therefore essential for sustainable food security and economic development. Rural population in Nigeria is put at 48% of the total populace with 35 million females living in rural areas (IFAD, 2010), and livelihoods under increasing demands. Moreover, women are obliged to engage in economic activities in order to fend for their families or to supplement husband's income. World Bank (2007) affirms that women comprise about 43% of agricultural labour force in developing countries including Nigeria. They

typically bear the responsibility of family nutrition and household provisioning. Women are the backbone of the rural economy. They make up almost half of the world's farmers and over the last few decades they have broadened their involvement in agriculture Leoinsohn *et al.* (2013). According to Mwangi and Kariuki (2015), the number of female-headed households has increased as more men have migrated to the cities. As the primary caregivers to the families and communities, women provide food and nutrition, they are the human link between the farm and the table.

As the global community works towards achieving the Sustainable Development Goals (SDGs), which aims to end hunger and malnutrition by 2030, women can be the key agents of change in agriculture, nutrition and development if their access to economic resources is improved. With better access to productive resources, training and technology, women can alter food production and consumption so that land and resources are used sustainably. Gender issues in agricultural technology adoption have been investigated for a long time and most studies have reported mixed evidence regarding the different roles male and female play in technology adoption (Bonabana-Wabbi, 2002). They concluded that technology adoption decisions depend primarily on access to resources, rather than on gender.

Adopting modern agricultural technologies could improve productivity and reduce rural poverty, but there is little evidence on the constraints that limit the adoption and diffusion of better practices. If sustainable agricultural development is to be translated into food security, adoption behaviour of women is important. This will enable them move beyond production for consumption to high value commercial market-oriented production. Therefore, the study investigated factors influencing rural women adoption of agricultural technologies in Enugu State.

Methodology

Study Area

The study was carried out in Enugu State, Nigeria. Enugu State is one of the 36 states of the federation and it is located between latitude 5º56` - 7º6N and longitude 6º53`E and 7º55`E. The State occupies an area of 8022.95Km^2 and has a population of about 4,411,100 people (NPC, 2016). The State is divided into six agricultural zones namely: Agwu, Agbani, Enugu, Nsukka, Enugu Ezike and Udi.

Population and sampling procedures

The population of the study consists of all farmers in the six Agricultural Zones of the Atate. One Local Government Area (LGA) was purposively selected from each of the six Agricultural Zones. Three communities were also randomly selected using simple random techniques. In each of the selected communities 15 rural women farmers were selected and interviewed, giving a sample size of 270 rural women farmers. Data were collected using structured questionnaire and Focus Group Discussion (FGD) and analyzed with simple descriptive and inferential statistics. Adoption index at each stage of adoption was captured using percentage distribution. A 3-point Likert type scale was used to generate the data on constraints militating against adoption and the mean scores used in the analysis and categorized as high (3), moderate (2) and low (1). Respondents with mean score of 2 and above imply important constraint, and mean score less than 2 imply that the constraint is not important. To determine the mean likert level = Xs = ΣX. Xs of each item was computed by multiplying the frequency of each response pattern with its appropriate nominal value and dividing the sum with the number of respondent to the items. This can be summarized with equation below.

$Xs = \Sigma Fn/N$ …… (1)

Where,

Xs =mean score

Σ = summation

F = frequency

n = likert nominal value

N= number of the respondents

Xs=1+2+3= 6/3 =2.0

The determinants of level of adoption (using the percentage adoption index) was analysed by the use of multiple linear regression procedure and expressed implicitly thus:

$Y = f(X_1, X_2, X_3, X_4, X_5) + e$ ….. (2)

Where,

Y = Level of adoption (%)

X_1 = Age of the farmer measured in years

X_2 = Level of formal education measured in years

X_3 = Marital status (dummy variable: 1 = married, 0 = otherwise)

X_4 = Access to credit (dummy variable: 1 = yes, 0 = no)

X_5 = Access to extension services (number of times in a year)

e = error term

Results and Discussion

Results in Table 1 show the socio-economics of the respondents in the study area. The results show that many (46.7%) of the respondents were between the age range of 45 – 50 years, indicating they were still in their productive years. This is an advantage for increased investment and improved adoption and technology utilization. Majority (76.3%) of the respondents were literate and this had an advantage for adoption of farm technologies because of ease of access and ability to process innovation. Table 1 further revealed that many (40%) respondents had farming experience of 10 – 19 years in the study area. Long farming experience is an advantage for increase in farm productivity since it encourages rapid adoption of farm innovation (Suri, 2011).

For type of farming engaged by the respondents, the result revealed that 68.1% were into crop farming, 20% livestock, while 11.9% were engaged in both activities. For institutional characteristics of the respondents, the

table shows that majority (75.6) of the respondents have not had access with extension in the last one year. From the foregoing analysis, it shows that the respondents did not receive much support from extension agents or service providers as needed. The low percentage of times visited by extension agents is clear evidence that they are not rendering their services effectively. A greater proportion of the respondents did not belong to any form of social organization. This implies low level of innovation among the respondents due to lack of group dynamic effect. According to Tanallari *et al.* (2014), collectivization brings about new identity inside a group, facilitating their responsibilities through sharing of information, knowledge, experience-skills, time frames and other resources like money.

Table 1: Socio economic characteristics of the respondents

Variables	Frequency	Percentage
Age:		
25 – 30	18	13.3
35 – 40	41	30.4
45 – 50	63	46.7
55 – 60	13	9.6
65+	-	-
Educational level		
Non-formal	32	24.0
Primary	58	43.0
Secondary	42	31.1
Tertiary	3	2.2
Farming Experience		
1 – 9	24	17.7
10 – 19	54	40.0
20 – 29	42	31.1
30 – 39	15	11.1
Types of farming		
Crop farming	92	68.1
Livestock farming	27	20.0
Livestock crop	16	11.9
Occupation		
Farming	73	54.1
Trading farming	41	30.4
Artisans farming	21	15.6
Access to Extension Services (number of times)		
No access	100	75.6
1 – 3		
4 – 5	35	26.0
6 – 7	-	-
Membership of social organization		
Non-member	58	43.0
1 – 2	56	41.5
3 – 4	21	15.6

Source: Field survey, 2018

Results in Table 2 revealed different technologies available to the farmers for adoption in the study area. Many agricultural technologies were available to them, even though level of adoption of the technologies will depend on access and utilization of those practices by the farmers.

Table 2: Distribution of Respondents according to Available Technologies

Variables	Frequency	Percentage
Improved land preparation	210	77.8
Planting of early season crops	168	62.2
Improved methods of fertilizer application	242	89.6
Modernized drying of processed cassava chips for storage	118	43.7
Harvesting of yam and storage in barn	101	37.4
Processing of tomatoes into paste and purees	134	49.6
Vaccination of small ruminants	121	44.8
Processing of cocoyam into chips/flour	248	91.9
Early maize cultivation	213	78.9
Disinfection and restocking of day old chicks	264	97.8
Weeding and fertilizer application on cassava, yam and maize	266	98.5
Pest control in food crop farm	234	86.7
Harvesting, drying and storage of maize in cribs	252	93.3

Multiple responses
Field survey, 2018

Table 3 shows the levels of adoption of improved technologies by the respondents. The result shows that harvesting of yam and storage in barns had the highest level of adoption (84.0), followed by weeding and fertilizer application in yam + cassava + maize intercrop (55.7) among others. This could be because these crops are staple food in the State. Technologies with high levels of unawareness include: routine vaccination of small ruminants (23.0), improved soil conservation in food and cash crops (25.2), processing of tomatoes into paste and purée (56.8), disinfection and restocking of day-old chicks (15.1) and vaccination of small ruminants (22.2). The results imply that the level of adoption of these improved technologies by the women is low. The implication of this result is that extension agencies are not properly addressing the women's agricultural needs. As a result of low improved technologies employed by women, the desirable level of increase in agricultural productivity will be difficult to achieve. Ma and Shi (2015) cited that reasons of gender gap in technology adoption have been attributed to differences between male and female farmers in farm size, asset ownership, and access to inputs such as land.

Table 3: Percentage distribution and level of adoption of technologies disseminated to the farmers in the study area

Technology	Not aware	Aware	Interest	Evaluation	Trial	Adoption
Improved land preparation and planting of early season crops	62.2	17.0	-	-	-	25.2
Improved fertilizer application in irrigated rice	91.0	19.0	-	-	-	19.0
Modernized drying of processed cassava chips for storage	87.1	13.4	-	-	-	37.0
Harvesting of yam and storage in barn	25	15.8	-	-	-	84.0
Processing of tomatoes into paste and purée	98.4	4.3	-	-	-	56.8
Vaccination of small ruminants	88.2	14.3	-	-	-	22.2
Site selection/bushing/clearing/packing	65.0	2.2	-	-	-	22.1
Processing of cocoyam into chips and flour	62.8	7.40	-	-	-	29.5
Early maize cultivation	59.4	-	-	-	-	14.0
Disinfection and restocking of day-old chicks	94.0	-	-	-	-	15.1
Weeding and fertilizer application in cassava yam + maize	48.3	6.4	-	-	-	55.7
Pest control in food crop farm	66.8	-	-	-	-	44.3
Routine vaccination of small ruminants	64.0	8.50	-	-	-	23.0
Harvesting, drying and storage of maize in cribs	85.0	13.4	-	-	-	-

Source: Field survey, 2018

Table 4: Mean scores on constraints influencing the adoption of the technologies

Variables (Statements)	Mean
Have limited access to resources	1.24
Limited access to input/credit	1.12
Inadequate technical competency	2.3
Poor participation in decision making	2.1
No gender consideration in extension services	2.0
Limited exposure to mass media	2.4
Untapped women potential	1.2
Limited access to literacy programme	1.2

Source: Field survey, 2018

Results in Table 4 show constraints militating against technology adoption by the respondents. Limited access to resources had a mean score of 1.24 indicating a low access to land in particular. According to Muzari *et al*. (2012), access to assets is the single most urgent need for the upliftment of women in general and farm women in particular. Rural women still do not have ownership on land, and as such cannot take independent decision in agriculture (Ekong, 2003). Therefore, concerted efforts are needed to promote women access to resources, as this will encourage adoption of technologies (by giving them soft loans). Limited access to input and credit had a mean score of 1.12, indicating low access. Though women make substantial contribution to agricultural development, their access to credit and farm input is limited. This in turn limits their adoption of certain technologies. Farm women should be recipient of credit for which possession of assets may not be insisted upon.

Inadequate technical competency had a mean score of 2.3. Mapila (2012) cited that though women are involved in almost all agricultural operations, yet they have inadequate technical competency. This has compelled them to still follow their age-old practices, which in turn results in poor work efficiency and drudgery. For building technical competency among farm women, specialized need based and skill-oriented training should be organized preferably at the village level. Poor participation of the women in certain decision-making processes in our rural communities had a mean score of 2.1. Decision regarding the activities requiring technical competency and finance related matters were taken by male members. Since knowledge and economic independence are the parameters of women empowerment, enhancing the technical knowledge, skills and building greater involvement in various farm activities will go a long way in helping them to adopt technologies. Poor gender consideration in extension services had a mean score of 2.0. Though several technological breakthroughs have been observed in the recent past the technologies by the researchers are not tailored to the specific needs of the farm women leading to non-adoption. In order to cater for the technological needs of the farm women, there is need to re-orient the entire research system. Scientific information should be tested and refined keeping in view the different farming situation in socio-cultural milieu.

Limited exposure to mass media had a mean score of 2.4. The transfer of technology approach which mainly includes mass media are also not paying due attention towards dissemination of adequate and timely agricultural information to farm women. Present broadcast of agricultural programmes (radio and television) is only about 8% of the total broadcast time, out of which, the programmes related to women are negligible. Therefore, there is utmost need to provide adequate broadcast time to the programmes related to women as this will enhance their adoption rate. Untapped potential of women had a mean score of 1.2 which was also low. Muzari *et al*. (2012) indicated that women are considered as reservoirs of rich traditional wisdoms with respect to various agricultural practices. This potential could be explored by the rural extension agents and be communicated to the Research Institutes for proper molding of traditional technologies with modern ones. This will reduce the complexity of the technology and aid the women in adoption. This could certainly help in agricultural production by women on sustainable basis. Limited access to literacy programmes (adult education and other educational campaign) had a mean score of 1.2, which was also low. But when women have access to this, it enables them to acquire new knowledge and technology required for improving and developing their tasks in all fields.

The results in Table 5 show the regression estimates of the determinants of level of adoption of adoption of agricultural technologies among the women in the study area. The Cobb-Douglas functional form was chosen as the lead equation because of a high R^2 value, number of significant factors and agreement with *a priori* expectations. The R^2 value of 0.790 indicate a 79% variability in level of adoption explained by the independent variables. The F-ratio was highly significant at 1% level indicating goodness of fit of the regression line.

Table 5: Multiple regression result of personal and institutional factors influencing women's adoption of agricultural technologies in the study area

Parameters	Linear	Exponential	Semi-log	+Cobb- Douglas
Constant	65249.516	10.467	1.292E6	4.305
	(1.286)	(16.207)***	5.446***	(4.731)***
Age	25772.915	0.153	93237.124	0.756
	(1.723)*	(-0.755)	(2.914)***	(5.256)***
Education	418.022	.006	21777.121	.371
	(0.806)	(0.845)	(0.644)	(1.048)
Marital status	-4445.507	-0.052	-33766.830	.172
	(-0.359)	(0.529)	(-1.203)	(2.586)**
Access to credit	246.548	0.011	1613.220	0.188
	(10.152)***	(5.537)***	(7.055)***	(6.611)***
Access to extension services	2945.011	.023	38490.305	.298
	(1.841)*	(1.714)*	(2.284)**	(2.876)***
R-square	0.887	.617	0.608	0.790
R-Adjusted	0.861	0.538	0.508	0.766
F – ratio	34.833***	7.157***	6.038***	28.966***

Sources: Field data, 2018
***, **, and *** is significant at 10%, 5%, and 1%**
+ = Lead Equation
Values in bracket are the t-values

Results shows that age, marital status, access to credit and extension services had significant relationship with level of adoption of the agricultural technologies. The coefficient of age was positive and significant at 1% level. This implies that a 1% increase in age will lead to a 0.756% increase in adoption of agricultural technologies among the women in the study area. This may be as a result of the total age proportion of the respondents. This is against a priori expectations because aged farmers may not accept new technologies as fast as the younger ones. The younger the farmers, the more active and innovative they will be. But Akudugu *et al.* (2012) in their study stated that at a younger age, farmers may not be able to adopt modern agricultural technologies, especially capital-intensive ones because they may not have adequate resources to do so.

Marital status was positively signed and significant at 5% level. This implies that married women are more likely to adopt the technologies. Access to credit was positive and significant at 1% level. This implies that credit is an important facilitating factor for agricultural technology adoption. This is consistent with the view that high poverty levels among rural women and lack of access to credit make it almost impossible for them to afford technologies (Munshi, 2014). This is because most modern technologies are expensive, which makes it difficult for the rural women famers to acquire and utilize them without any form of financial assistance.

Access to extension services was positive and significantly related to adoption at 1% level. Acquisition of information about new technology is another factor that determines adoption of technology (extension services). It enables the women to learn the existence and effective use of technology, and this facilitates its adoption. Farmers will only adopt the technology they are aware of, or have heard about. Access to information reduces the uncertainty about the technology performance hence may change individual assessment from purely subjective to objective over time (Caswell *et al*., 2001).

Conclusion

The factors that influence adoption of agricultural production technologies are broadly categorized into economic, social and institutional factors respectively. All the factors were found to significantly influence the decision of the women to adopt agricultural technologies while the major constraints to adoption include the following: access to resources, access to input/credit, inadequate technical competency, poor participation in decision making, no gender consideration in extension services, limited exposure to mass media, untapped women potential and limited access to literacy programme. Because adopting technology in the current period is the key determinant of adopting in the later periods, technology adoption environment should be made favourable for women when introducing modern technology to market. This means policy makers should increase female's access to farming plots, literacy, extension services and training programs on modern technology use.

References

Agwu, A. E. (2004). Factors influencing adoption of improved cowpea production technologies in Nigeria. *International Journal of Agriculture and Extension Education*, 11(1): 81 – 89.

Awotide, B.A., Karimov, A. A. and Diagne, A. (2016), Agricultural Technology Adoption and Commercialization and Smallholder Rice Farmers' Welfare in Rural Nigeria. *Journal of Agricultural and Food Economics*, 4(3):1 – 24.

Bonabana-Wabbi, J. (2002). Assessing Factors affecting Adoption of Agricultural Technologies: The Case of Integrated Pest Management (IPM) in Kumi District, Eastern Uganda. Unpublished M.Sc Thesis, Dept. of Agricultural and Applied

Economics, Virginia Polythecnic Institute and State University USA.

Caswell, M., Fuglie. K., Ingram, C., Jans, S. and Kascak, C. (2001). *Adoption of Agricultural Production Practices: Lessons learned from the US. Department of Agriculture area studies Project.* Washington DC. US Department of Agriculture. Resource Economics Division, Economic Research service, Agriculture Economic Report No. 792. January 2001.

Challa, M. (2013). *Determining factors and impact of modern agricultural technologies in West Wollega,* Munich, GRIN Publishing GMbH.

Ekong E. E. (2003). Rural Sociology: An Introduction and Analysis of Rural Nigeria. Dove Educational Publishers, Uyo.

IFAD (2010). International Fund for Agricultural Development. Available at https://www.ifad.org/documents/38714170/41133075/RDR_report.pdf/7282d

Loevinsohn, M., Sumberg, J. and Diagne, A. (2012). Under what circumstances and condition does adoption of technology result in increased agricultural productivity? Protocol. *London EPPI Centre, Social Science Research Unit*, Institute of Education, University of London.

Ma, X., and Shi, G. (2015). A Dynamic Adoption Model with Bayesian Learning: An Application to U.S. Soybean Farmers. *Agricultural Economics*, 46 (1): 25–38. doi:10.1111/agec.12124.

Mamudu, A. A., Emelia, A. and Samuel, K. D. (2012). Journal of Biology, Agriculture and Health. 2(3).

Mapila, M. A. T. J. (2011). Rural livelihoods and agricultural policy changes in Malawi. *Agricultural Innovations for sustainable Development CTA and FARA*, 3: 190 – 195.

Akudugu, M.A., Guo, E. and Dadzie, S.K. (2012). Adoption of Modern Agricultural Production Technologies by Farm Households in Ghana: What Factors Influence their Decisions? Journal of Biology, Agriculture and Healthcare, 2(3):1-14.

Munshi, K. (2014). Social learning in a Heterogenous population. Technology Diffusion in the Indian Green Revolution. *Journal of development Economics*. 73(1): 185 – 213.

Muzari, G., Gatsi, W. and Muchunzi, S. (2012). The impact of technology adoption on small holder agricultural productivity in sub-Saharan Africa: A Review, *Journal of Sustainable Development.* 5(8).

Mwangi, M. and Kariuki, S. (2015). Factors determining adoption of new agricultural technology by smallholder farmers in developing countries. *Journal of economics and Sustainable development*, 6(5).

NPC (2016). National Population Commission. Population forecasts 2016. Available at https://nigerianstat.gov.ng/download/775.

Suri, T. (2011). Selection and comparative advantage in technology adoption. *Econometrica,* 79(1): 159 – 209. Doi: 10.3982/ECTA 7749.

Tanallari, L., Genti, K., Jackline, B. & Anthony, M. (2014). Gender impacts on adoption of new technologies. The case of improved groundnut varieties in Uganda. African *Journal of Agriculture & Resources Economics*. 9(4): 300 – 308.

World Bank (2008) *Millennium development Goals*. www.worldbank.org/mdgs/poverty /hunger.html