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Selected factors influencing rural women in adoption of improved agricultural technologies in Enugu state, Nigeria

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Abstract
This study investigated the factors that influence agricultural technology adoption among women in Enugu State. 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. Data generated were analysed using descriptive statistics, like frequency distributors and mean scores. Multiple regression was used to determine the factors influencing the adoption of the technologies. Major results indicated that age, marital status, access to credit and extension services 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.

Keywords: technology adoption, women and balance is better

Introduction
Agricultural technologies are seen as an important route out of poverty in most of the developing countries (Mwangi and Kariuki, 2015) [9]. 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) [2]. However, the rate of adoption of these technologies has remained low in most countries especially among women. Agwu (2004) [1] in his findings revealed that most of these women relies on traditional methods and this has lowered their level of productivity. The present economic meltdown in the country presents serious challenges to women in particular in 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) [3]. According to Leoinsohn et al (2013) the most area of technology development/promotion for crops new varieties and management regimes.

Soil as well as soil fertility management, weed and pest management. By virtue of new improved input/out relationship, new technology tends to raise output and reduces average cost of production which in turn results in substantial gains in farm income (Mwangi and Kariuki, 2015) [9]. Adoptions of improved technologies increase productions, 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 as well as earnings for landless labourers (Kasing, 2010). 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). Their livelihood is 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. The World Bank (2007) [12] 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. According to Mwangi and Kariuki, (2015) [9], 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) among them, 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 (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 absolutely very necessary. 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 with the following specific objectives to:

1. describe the socio-economic characteristics of the women in the study area
2. ascertain the livelihood activities engaged by the women
3. examine their access to productive resources.
4. ascertain their level of adoption of agricultural technologies
5. determine factors influencing their level of adoption of the technologies

Methodology

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 $5^\circ 56^` - 7^\circ 6N$ and longitude $6^\circ 53^`E$ and $7^\circ 55^`E$ (Ezike 1988). Enugu State is bounded on the North east by Ebonyi State on the north by Benue and Kogi on the South by Abia State, on the east by Cross – River State and on the West by Anambra State. The state occupies an area of $8022.95Km^2$ and has a population of about 2,123,968 people (Enugu State official gazette No. 25, 1997). The state according to ENADEP (2004) has been 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 state. One LGA each was purposively selected from each of the six agricultural zones on the basis of ESBS respectively.

Three communities were also randomly selected using simple random techniques. In each of the selected communities 15 farmers were selected and interviewed, bringing the sample size to 135 farmers. Data were collected using structured questionnaire and Focus Group Discussions (FGDs) and later analyzed with simple descriptive and inferential statistics.

Objective 1 & 2 which were to describe the socio-economic characteristics of the respondents and access to productive resources were realized using descriptive statistics. For objectives 3 and 4, a 4-point Likert scale type of: very high = 4, high= 3, low = 2 and very low = 1 were used to generate the mean scores for the analysis. The value of the four responses were added and further divided by 4 to obtain 2.5 which was regarded as benchmark for decision making. Factors influencing the adoption of selected technologies were realized using multiple regression

analysis and the implicit form is stated below:
$Y = f(X_1, X_2, X_3, X_4, X_5, X_6)$

Where Y = Adoption index (number of technologies adopted by the respondents).
and where $X_1 – X_6$ is the Independent variables
X_1 = Age of the farmer measured in years
X_2 = Level of formal education measured in years
X_3 = Marital status – during variable
X_4 = Access to extension services
X_5 = Access to credit
X_6 = Membership of an organization

Results and Discussion

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
Not visited		
1 – 3	100	75.6
4 – 5	35	26.0
6 – 7	-	-
Member of an organization		
Non member	58	43.0
1 – 2	56	41.5
3 – 4	21	15.6

Source: Field survey, 2018

Results in Table 1, shows the socio-economics of the respondents. The results show that most of the respondents (46%) were between the age range of 45 – 50 years. This is an advantage for increased investment and improved adoption and technology utilization. Majority of the respondents were literate (66%) and this has an advantage for adoption of farm technologies as education has shown to be a factor in adoption of high yielding modern farm practices (Agwu et al., 2008) [1]. Table 1 further revealed that majority of the respondents (40%) had a 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) [10].

For type of farming engaged by the respondents the result revealed that (68.1%) were into crop farming, (20%) livestock while (11.9%) were involved in both activities. Table 1, further revealed the institutional characteristics of the respondents. The table shows that majority of the respondents (75.6) have not had extension contacts with extension agents in the last one year. From the foregoing analysis, it can be concluded that the respondents were not receiving as much extension contact support as necessary.

The low percentage of times visited by extension agents is a clear evidence that they are not rendering their services effectively. A greater proportion of the respondents did not belong to any farm organization. This implies low innovativeness among the respondents due to lack of group dynamic effect. According to Tanallari et al., (2014) [11] he stated that collectivization brings about new identify inside group, facilitating their responsibilities through sharing of information, knowledge, experience-skills, time frames and other resources like money.

Table 2: Percentage distribution and level of adoption of technologies disseminated to the farmers in the study area

Technology	Not aware	Aware	Interest	Evaluation	Trial	Using	Reflection
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 past 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 2 shows the different stages of adoption of improved technologies by the respondents. The result shows that the harvesting of yam and storage in barn has 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 attributed to the fact that these crops are stable 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).

It is worthy of note 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. Even though Ma and Shi (2005) cited that reasons of gender gap in technology adoption have been attributed to differences between male and female farmers in farm size, asset ownership, access to inputs such as land.

Table 3: Multiple regression result of personal and institutional factors influencing women's adoption of agricultural technologies in the study area

Parameters	Linear	Exponential	Semi-log	+Cob Douglas
Constant	65249.516 (1.286)	10.467 (16.207)***	1.292E6 5.446***	4.305 (4.731)***
Age	25772.915 (1.723)*	0.153 (-0.755)	93237.124 (2.914)***	0.756 (5.256)***
Education	418.022 (0.806)	.006 (0.845)	21777.121 (0.644)	.371 (1.048)
Marital status	-4445.507 (-0.359)	-0.052 (0.529)	-33766.830 (-1.203)	.172 (2.586)**
Access to credit	246.548 (10.152)***	0.011 (5.537)***	1613.220 (7.055)***	0.188 (6.611)***
Access to extension services	2945.011 (1.841)*	.023 (1.714)*	38490.305 (2.284)**	.298 (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
Key: * Significance at 10%, ** Significance at 5%, *** Significance at 1%, + = Lead Equation and the values in bracket are the t-values.

Results on Table 3 shows that age, marital status, access to credit and extension services had significant relationship with adoption of the agricultural technologies. Age of the women had a positive significance on adoption of improved agricultural technologies, this may be as a result of the total

age proportion of the respondents. Older 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 (Mamudu et al., 2012) [5] in their studies stated that at the younger age, farmers may not be able to adopt

modern agricultural technologies, especially capital-intensive ones because of the fact that they may not have adequate resources to do so.

Marital status was significantly related to adoption (2.586**) at 5% level of significance. This means married men are more likely to adopt the technologies than the wives. The reason for this is that men are the people who make productions and also control productive resources such as land, labour and capital which are critical for adoption of new technologies. Access to credit was found to have a positive significant relationship with adoption of modern agricultural technologies. This means that credit is an important facilitating factor of 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) [7]. 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 significantly related to adoption at 1% level of significance. Acquisition of information about new technology is another factor that determines adoption of technology (extension services). It enables the women to learn the existence as well as the 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).

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

Variables (Statements)	Mean (x)
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

Sources: field data, 2018

Results on Table 4, revealed the constraints faced by the respondents in adopting technology disseminated to them. From the result, limited access to resources had a mean score of (x =1.24) indicating a low access to land in particular. According to Muzari et al, (2012) [8] 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 on various agricultural aspects. Therefore, concerted efforts are needed to promote women access to resources as this will encourage adoption technologies.

Limited access to input and credit had a mean score of (x = 1.12), indicating a 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 (x = 2.3). Mapilila, (2012) in his studies cited that though women are involved in almost all agricultural operations, yet they have inadequate technical competency due to limited exposure to outside World. 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 village level.

Poor participation of the women in certain decision making process in our rural communities had a mean score of (x = 2.1), decision regarding the activities requiring technical competency and money 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.

The table further revealed that poor gender consideration in extension services had a mean score of (x = 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 to 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 (x = 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. According to Odoemelam (2014) at present broadcast of agricultural programmes on (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 (x = 1.2) which is also low. Muzari et al, (2012) [8] in his studies discovered 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 institute 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 agriculture production of women on sustainable basis.Limited access to literacy programmes had a mean score of (x = 1.2) which is 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.

Conclusion and recommendation
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

decisions 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.

Recommendations
- 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.
- Finally, women should be bold because balance is better.

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