



# **Assessment of Agricultural Technology Adoption Behaviour among Crop Farmers in Ikwerre Local Government Rivers State**

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### **Authors' contributions**

*This work was carried out in collaboration between both authors. Authors AUN and WIR designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors AUN and WIR managed the analyses of the study. Author AUN managed the literature searches. Both authors read and approved the final manuscript.*

### **Article Information**

DOI: 10.9734/ARJA/2020/v12i230079

#### Editor(s):

(1) Mevlüt Gül, Associate Professor, Department of Agricultural Economics, Faculty of Agriculture, Suleyman Demirel University, Isparta, Turkey.

#### Reviewers:

(1) Nyong Princely Awazi, University of Dschang, Cameroon.  
(2) David Kimenchi Mugambi, Meru University of Science and Technology, Kenya.  
Complete Peer review History: <http://www.sdiarticle4.com/review-history/54798>

**Original Research Article**

**Received 12 December 2019**  
**Accepted 18 February 2020**  
**Published 26 February 2020**

## **ABSTRACT**

The study assessed agricultural technology adoption behavior among small scale crop farmers in Ikwerre local Government, Rivers state. The aim of the study was to assess small scale farmers' adoption behavior on new farm input, farm techniques and farm machineries/tools. One hypothesis was tested to determine the influence of crop farmers' socioeconomic characteristics on agricultural technology adoption behavior. The study adopted a correlation survey design. The population of the study was all registered crop farmers in Ikwerre local Government Rivers State. Eighty (80) small scale crop farmers were selected using cluster random sampling technique. The instrument used for the study was a self-structured questionnaire which was face and content validated by research experts. The reliability of the instrument was established using Cronbach Alpha which gave to 0.88 reliability coefficient. Mean and standard deviation were used to analyze the data gathered from the respondents and the hypothesis was tested using multiple regression analysis at 0.05 level of significance. The study found that uncertainty, fear of taking risk to test the new inputs and waiting to see the consequences of the new technology on early adopters among

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others are the agricultural technology adoption behaviour among crop farmers in Ikwerre local Government Rivers State. The study also concluded that socio-economic characteristics of farmers significantly influence agricultural technology (Farm input, techniques, and machineries/tools) adoption behavior among crop farmers. It was recommended that Agricultural extension agents should publicize the positive result of the new farm technology among rural farmers so as to increase the adoption rate of agricultural technology.

*Keywords: Assessment; agriculture; technology; adoption; behaviour.*

## 1. INTRODUCTION

Agriculture remains one of the mainstay of most African economies and its sustainable role is hinged upon the emergence of new agricultural technologies that encourage maximal productivity. One of the most important factor responsible for high productivity in any industry is the integration of new technologies that reduce human efforts and ensure maximum output. According to FAO [1], increase in agricultural yields stems from the intensification of agricultural production through the use of new technologies by farmers. This intensification is highly needed because the world is expected to grow in her demands for food, feed and fibre by 70 percent at the first half of this century [2]. Presently, agricultural sector struggles to accommodate the demand of the masses due to increasing population growth. Consequently, there is need to implement agricultural technologies in farm practices.

Over the years, various technologies in agricultural sector have emerged leading to growth in global inorganic fertilizer, consumption of pesticides, animal feedstuff, tractors and other sophisticated farm machineries [3]. Agricultural technologies are application of techniques to control growth and harvesting of animal and vegetable products [4]. It is the integration of advanced engineering principles, farming techniques and scientific development to manipulate the growth, maturity and well-being of crops and livestock. In relation to this, many literature considered agricultural technologies to include; improved seeds, inorganic fertilizers, land conservation practices, tractors, stall-feeding management and irrigation technologies [5]. According to Ifeanyieze, Nwankwo, Ikehi [6] agricultural technologies are devices or information utilized by farmers for crop production.

Rural areas remain the back bone of Nigerian agriculture, and needs to be given the needed attention. Essentially, this can be achieved by

implementing modern technologies in the processing, storage and marketing of food and livestock produced in the area. The rhetoric of technological revolutions in agriculture is geared towards building technological capacity in response to changes in the rural economy (FAO, N.D). Agricultural technologies in agricultural sector increases agricultural production and sustainability substantially. For example, new disease resistant hybrid reduces the rate of risk and uncertainties in crop and livestock farming. Nowadays farmers can easily combat pests and diseases by using disease resistant varieties of crops and livestock. By adopting these varieties of crops, there tends to be reduction in the rate of using pesticide in the farm, soil degradation and food poisoning. Many more crop deficiencies are being remedied through the development of improved crop seeds [1]. Apart from seeds, other farm inputs that have been improved upon includes fertilizer, feed additives, feedstuffs and many more have high efficiency track record.

Loevinsohn, Sumberg, Diagne, and Whitfield [7] posited that sustainable production of food and fiber is moored to effective utilization of agricultural technologies at all level of agricultural production. Modern agricultural technologies are geared towards the achievement two major important goals, which includes; profitable economy and better output. It is in this regard, agricultural research institutes consistently work towards developing new farming techniques to better farmers' output, especially the small holder farmers (Mamudu, Akudugu & Dadziel 2012). For instance, rain fed farming is new farm techniques which was recently recorded to increase rice yields up to 20-50 percent, conservation agriculture is also another techniques advocated to have contributed to soil sustainability, maximizing soil moisture and fertility maintenance [8]. Typically market driven technological progress has led to intensification of farming systems by the use of more industrial inputs and the adoption of management methods that stress low costs and high yields [9]. Also International Institute of Tropical Agriculture

(IITA) an agricultural research institute in Nigeria, has recently proposed the combination of inorganic fertilizers and organic matter provides much needed additional nutrients that are efficiently used up by crops, this method is confirmed to double the yield of coffee and banana [10]. However, for ease of adoption among rural farmers, agricultural technology must possess characteristics such as observability, ease of use, time requirement, cost-effectiveness, flexibility of conservation standards, and relative advantage conferred [11].

Despite the great potential of agricultural innovations, the adoption by smallholder farmers in sub-Saharan Africa seems to be slow [1]. According to the World Bank [12], the fundamental cause of low agricultural productivity in Nigeria is the very low use of modern technology evidenced in weak research and extension, limited use of improved seed varieties (and breeds) and lack of irrigation. There has been a limitation on how to speed the process of modern technological adoption in agriculture. This can be attributed to the fact that speeding up this concept involves a lot of knowledge and the understanding of some of the elements that influence the decision of farmers to adopt modern technology in farming.

Modern farm technologies are significantly impactful on national food security when they are adopted at the rural farm level (Egwu, 2015). Unfortunately, majority of the rural farmers have been found to have poor attitude to adoption of agricultural technologies. Rural farmers are predominantly aged men and women and therefore may be less interested in advanced farming methods (Egwu, 2015). Adams (1982) opined that, it is partly justified that farmers prefer to see the working benefits of the new innovation on others before they try to consider adopting it. According to Robert, Arnold and Lori (1989), behavior of farmers towards agricultural technology also emanates from their financial constrain and restricted access to agricultural technologies. In the same vein, Dessert, Bravel and (2019) posit that farmers' personality, reluctant to change, low interest, unwilling to adopt any new techniques are among distal behavioural factors which make farmers to behave certain way based on their perception on cost and benefits of an innovation. All the various models of adoption behaviour recognize that the fundamental factor influencing the decision to adopt an innovation is the extent to which the innovation can contribute to better satisfying the

needs of the purchaser [13]. Extension workers consistently complained that rural farmers are laggards and very late adopters who even at present evidences, they still find it difficult to adopt innovations [6].

Research findings have established that human capital variables are major determinants that explain farmers' decisions to adapt and modify to new agricultural technology [14]. To further buttress this view Max [15] asserts that household income, age of farmers, farmer education and number of family responsibility are significant socio-economic characteristics that determine farmers' behavior towards the adoption of agricultural technology. Singh and Baruah [16] in their study found that farmers are poor in adoption of technologies that are relatively complex in nature such as seed treatment, application of manure and fertilizers and plant protection measures under different farming systems. Also, Ogunlana [17] in his study concluded that farmers easily adopt innovations that can enhance their economic status. Again, Sighn and Bauah [16] posited that majority of the farmers could not adopt new agricultural practices, because by and large, they were poor in education and economic conditions, accompanied by other associated factors. Based on the forgoing, it is clear that adoption of agricultural innovation is a system of enhancing agricultural productivity. However, majority of farmers in the study area are yet to fully accept the promising agricultural future offered by emerging agricultural technologies. This amounts to the reason there is growing food insecurity in the nation. It is in this view that Akinwunmi and Jonas [14] noted that in order to promote greater adoption of agricultural technology, attention should be placed on the use of appropriate socioeconomic characterization, to better target technologies to areas with higher adoption. Therefore the study tends to assess agricultural technology adoption behavior among small scale crop farmers in Ikwerre local government.

## 1.1 Purpose of the Study

The purpose of the study is to assess agricultural technology Adoption Behaviour among Small Scale crop farmers in Ikwerre Local Government Rivers State. More objectively, the study tends

1. Determine the socio-economic characteristics of small scale farmers in Ikwerre local government Rivers state.

2. Assess farmers behavior towards the adoption of improved farm inputs.
3. Assess farmers behavior towards the adoption of new farming techniques.
4. Assess farmers behavior towards the adoption of farm machineries or farm tools.

## 1.2 Research Questions

The following research questions guided the study

1. What are the socio-economic characteristics of small scale farmers in Ikwerre local government Rivers state.
2. What are the farmers behavior towards the adoption of improved farm inputs in Ikwerre local government Rivers state.
3. What are the farmers' behavior towards the adoption of new farming techniques in Ikwerre local government Rivers state.
4. What are the farmers' behavior towards the adoption of new machineries or farm tools in Ikwerre local government Rivers state.

## 1.3 Hypothesis

The following null hypothesis was tested at 0.05 level of significance

- There is no significant relationship between the socio-economic characteristics of farmers and their behavior in the adoption of agricultural technology in Ikwerre local Government Area Rivers State.

## 2. METHODOLOGY

The study adopted a descriptive correlation design. The study was carried out in Ikwerre local government Area Rivers state. Ikwerre L.G.A is one of the three L.G.As that made up ikwerre ethnic group and also one of the twenty-three L.G.As in Rivers. The study area lies on latitude 4°65 North and longitude 5° to 7° 12 East (National Population Census, 2006) and covers 530 sq mi (1,380 km<sup>2</sup>) in Rivers state. The study area is enriched with fertile soil suitable for crop production. Due to this, residents in the study area are predominantly farmers ranging from fishing crop and livestock production.

The population of the study was all registered small scale farmers in Ikwerre Local Government Area, Rivers State. Cluster random sampling was

used to select eighty (80) farmers as the sample size. Ikwerre Local government farmers were grouped into four clusters and ten (20) farmers were randomly selected from each of the cluster. The instrument used for the study was a self-designed questionnaire that was constructed in a four point rating scale of agreement. The instrument was face and content validated by research experts. Subsequently, the reliability coefficient of the instrument was established using Cronbach Alpha, the reliability coefficient obtained was 0.86 which affirmed the internal consistency of the instrument. Mean and standard deviation were used to analyze each items in the instrument. However, multiple regression was also employed to test the hypotheses at 0.05 level of significance. Farmers' income, educational level, gender, household size and membership of organization are the socio-economic characteristics that were used to determine or predict farmers' behavior to adoption of agricultural technology. However, most of these data are not quantitative, numbers were assigned to each attributes of socio-economic characteristics ranging from 1-6 for computation purpose.

Below is the regression equation employed

$$Y = a + bx_1 + bx_2 + bx_3 + bx_4 + bx_5 + bx_6 + ei$$

Y= Agricultural technology adoption behavior  
 b= unknown coefficient to be estimated  
 a= constant term  
 x<sub>1</sub>= Farmer's Income  
 x<sub>2</sub>= level of education  
 x<sub>3</sub>= gender  
 x<sub>4</sub>= Age  
 x<sub>5</sub>=household size  
 x<sub>6</sub>= membership of organization  
 ei= unobservable error

## 3. RESULTS AND DISCUSSION

**Research Question 1:** What are the socio-economic characteristics of small scale farmers in Ikwerre Local Government Rivers State?

Table 1 reveals the socio-economic characteristics of the selected eighty (80) respondents. In details, 47.5% were male and 52.5% were females. Also, 2.5% of the respondents are within the age range of 20-29 years, 25% are 30-39 years, 45% are 40-49, 15% are 50-59 while 12.5% are 60 above. Respondents with no formal education are 20% of the total sample size while 7.5%, 45%, 25% and 5% underwent adult education, primary,

**Table 1. The Socio-economic characteristics of the small scale farmers in Ikwerre Local Government Rivers State**

S/N	Socio-economic characteristics	Variable type/criteria	F	%
<b>1</b>	<b>Gender</b>			
	Male	1	38	47.5
	Female	2	42	52.5
<b>2</b>	<b>Age</b>			
	20-29	1	2	2.5
	30-39	2	20	25.0
	40-49	3	36	45.0
	50-59	4	12	15.0
	≥60	5	10	12.5
<b>3</b>	<b>Educational level</b>			
	No formal ed.	1	16	20.0
	Adult ed.	2	6	7.5
	Primary ed.	3	32	45.0
	Secondary ed.	4	20	25.0
	Tertiary ed.	5	6	5.0
<b>4</b>	<b>Farming experience (years)</b>			
	<5	1	20	25.0
	5-9	2	12	15.0
	10-19	3	34	42.5
	20-39	4	10	12.5
	≥ 40	5	4	5.0
<b>5</b>	<b>Membership of organization</b>			
	Yes	1	24	30.0
	No	2	56	70.0
<b>6</b>	<b>Number of household</b>			
	1-5	1	61	76.5
	6-10	2	12	15.0
	11-above	3	7	8.75
<b>5</b>	<b>Income per month (₦)</b>			
	0-20,000	1	42	52.5
	20,000-40,000	2	32	40.0
	40,000-60,000	3	6	7.5
	60,000-80,000	4	0	0
	80,000-100,000	5	0	0
	100,000 above	6	0	0

Field Survey, 2019

secondary and tertiary education respectively. In terms of farming experience, 25% have less than 5 years, 15% have 5 to 9 years, 42.5% possess 10-19 years, 12.5% have 20-39 years and 5% have less than 40 years. Majority of the respondents (70%) indicated to be non-members of farmers' organization whereas others (30%) claimed membership of farmers' organization.

Moreover, 61% of the respondents have household size of 1-5, 12% have 6-10 household size and others (8.8%) have 11-above. Finally, income of the respondents per month are as thus, 52.5% have 0-20,000, 40.0% have 20,000-40,000 and 7.5% have 40,000-60,000.

**Research Questions 2:** What are farmers' behavior on the adoption of improved farm inputs?

Table 2 shows respondents' opinion on farmers' behavior on the adoption of improved farm inputs. Based on mean decision rule, farmers agreed that ease of access to improved inputs boost their conviction to adopt hybrid seeds (3.23), can't afford modern farm chemicals (2.78), fear of taking risk to test the new inputs (3.08), uncertainty on the claimed efficiency of the improved seeds and fertilizer (3.23), difficulty of adopting the new farm inputs (2.50) are farmers' behavior to adopting new farm inputs. However, farmers' disagreed that, never ready

**Table 2. Farmers’ behavior on the adoption of improved farm inputs**

S/N	Items	SA	A	D	SD	$\bar{X}$	Std.dev	Remark
1	Never ready to use any hybrid seeds	18	18	24	20	2.43	1.09	Disagree
2	Not comfortable using modern fertilizers and chemicals	16	17	28	19	2.48	1.01	Disagree
3	Can’t afford modern farm chemicals	26	28	10	16	2.78	1.11	Agree
4	Ease of access boost my conviction to adopt hybrid seeds	36	30	10	4	3.23	0.85	Agree
5	Dislike changes in using farm inputs	22	10	12	36	2.23	1.27	Disagree
6	Fear of taking risk to test the new inputs	32	24	22	2	3.08	0.88	Agree
7	Uncertainty on the claimed efficiency of the improved seeds and fertilizer	34	34	8	4	3.23	0.82	Agree
8	Not always motivated by the result of early adopters	4	18	20	38	1.85	0.94	Disagree
9	Difficulty of adopting the new farm inputs	32	4	16	28	2.50	1.32	Agree
10	Indifferent to use to use modern chemicals and fertilizers	16	18	24	22	2.35	1.09	Disagree

Field survey, 2019

to use any hybrid seeds (2.43), not comfortable using modern fertilizers and chemicals (2.48), dislike changes in using farm inputs (2.23), not always motivated by the result of early adopters (1.85) and indifferent to use (2.35) are farmers behavior on the adoption of farm inputs.

**Research Question 3:** What are the farmers’ behavior on the adoption of farming techniques?

Table 3 shows respondents’ opinion on farmers’ behavior on the adoption of farming techniques.

Based on the mean criterion, agreed that they are, can’t afford modern irrigation techniques (3.40), used to traditional farming techniques (2.53), interested in using conservation agriculture (3.10), always motivated to use any new methods (2.83), very willing to adopt cover cropping techniques (3.15), tend to adopt fast if appropriately guided in conservation agriculture (3.15), can’t use integrated pest management in isolation (2.68), prefer others to use zero tillage before adopting (3.03), and readily adopts any new techniques (2.80). On the contrary, farmers disagreed they are indifferent to use agroforestry method (2.28).

**Table 3. Farmers’ behavior on the adoption of improved farming techniques**

S/N	Items	SA	A	D	SD	$\bar{X}$	Std.dev	Remark
11	Can’t afford modern irrigation techniques.	36	40	4	0	3.40	0.58	Agree
12	Used to traditional farming techniques	20	22	18	20	2.53	1.12	Agree
13	Interested in using conservation agriculture	36	22	16	6	3.10	0.97	Agree
14	Always motivated to use any new methods	24	28	18	10	2.83	0.99	Agree
15	Very willing to adopt cover cropping techniques	42	16	14	8	3.15	1.04	Agree
16	Tends to adopt fast if appropriately guided in conservation agriculture	32	20	14	14	2.88	1.12	Agree
17	Can’t use integrated pest management in isolation	32	10	20	18	2.68	1.23	Agree
18	Prefer others to use zero tillage before adopting	34	26	8	12	3.03	1.06	Agree
19	Indifferent to use agroforestry method	16	12	30	22	2.28	1.07	Disagree
20	Readily adopts any new techniques	26	20	30	4	2.80	0.94	Agree

Field survey, 2019

**Research question 4:** What are Farmers' behavior on the adoption of farm machineries or farm tools?

Table 4 shows respondents opinion on farmers' behavior on the adoption of farm machineries or farm tools. Based on the mean decision rule, farmers agreed that they are interested in modern farm tools (2.62), unavailability and inaccessibility to new farm machines hinders their decision to adopt (3.23), boredom due to complexity of some improved farm tools (2.90), unaffordability (3.13), rejects new farm tools due to complexity of usage (3.38) are the farmers' behavior on the adoption of improved farm machineries or farm tools. However, farmers disagreed that they do not adopt even others testifies (1.78) and never ready to use any farm machineries apart from the traditional ones (2.18).

### 3.1 Hypotheses

H<sub>01</sub>: There is no significant relationship on the socio-economic characteristics of small scale crop farmers and their behavior in the adoption of agricultural technology in Ikwerre Local Government, Rivers state.

Table 4 shows the multiple regression analysis on the socio-economic characteristics of farmers and their behavior on the adoption of agricultural technologies. The socio-economic characteristics used were gender, age, educational level, farming experience and income. However, while considering each of the predictors at 0.05 level of significance, the result shows that gender (0.352), educational level (0.555), years of experience (0.039) and membership of organization (0.044) and household size (0.522) do not influence

**Table 4. Farmers' behavior on the adoption of improved farm machineries or farm tools**

S/N	Item	SA	A	D	SD	$\bar{x}$	Std.dev	Remark
21	Interested in modern farm tools	20	26	18	16	2.62	1.07	Agreed
22	Unavailability and inaccessibility of new farm machines hinders decision to adopt	38	26	12	4	3.23	0.88	Agreed
23	Boredom due to complexity of some improved farm tools	24	32	16	8	2.90	0.94	Agreed
24	Unaffordability constrain my decision to adopt	36	28	6	10	3.13	1.00	Agreed
25	Reject new farm tools due to complexity of usage	38	36	4	2	3.38	0.70	Agreed
26	Do not adopt even when other farmers testifies	2	8	40	30	1.78	0.72	Disagreed
27	Never ready to use any farm machineries apart from the traditional ones	8	16	38	18	2.18	0.89	Disagreed

Field survey, 2019

**Table 5. Multiple regression analysis on the socio-economic characteristics of farmers and the adoption agricultural technologies**

Model	Unstandardized coefficients		Standardized coefficients	t	Sig
	B	Std.Error			
1 (constant)				14.581	.000
Age	0.073	0.033	0.190	2.225	0.002
Gender	0.042	0.078	0.626	1.464	0.352
Edu. Level	0.025	0.042	0.59	0.593	0.011
Years of Exp.	0.328	0.012	0.275	2.313	0.008
Income	0.480	0.083	0.609	5.801	0.000
Mem. of org.	0.523	0.063	0.187	3.420	0.044
Household size	0.462	0.072	0.378	0.672	0.034

**Table 6. Summary of regression model on the socio-economic characteristics of farmers and their behavior towards the adoption of agricultural technologies**

Model	R	R square	Adjusted R square	Std. error of the estimate	Change statistics				Remark	
					R square change	F change	df1	df2		Sig. F change
1	.768 <sup>a</sup>	.590	.574	.33433	.590	37.342	3	78	.000	P(0.00)<0.05 Rejected

*a. Predictors: (Constant), income, age, education. Level*



farmers' behavior to the adoption of farm inputs. In contrast, age (0.002) and income (0.000) are the socio-economic characteristics that influence farmers' behavior to adoption of farm inputs. This means that farmers who are of age and those with low income shows relatively poor behavior towards the adoption of farm inputs. Generally, the p-value obtained was also 0.000 which is less than the alpha level (0.05). Hence, based on these justifications the hypothesis is rejected.

Table 6 shows the summary of Regression model on the socio-economic characteristics of farmers and the adoption agricultural technologies. The table revealed that R-value (0.768<sup>a</sup>) signifies a strong positive relationship between the independent variables (Age, gender, educational level, years of experience, income, membership of organization and household size) and the dependents variable (Farmers' behavior). Also the R-square value (0.59) is a coefficient of determination which shows that the 59 percent of the variance in the behavior of farmers towards the adoption of agricultural technology can be predicted from the independent variables (Age, gender, educational level, and years of experience, income, membership of organization and household size). The analysis also shows that the p-value (0.000) obtained is less than the alpha level (0.05). Therefore, it can be concluded that there is a significant relationship between the socio-economic characteristics of farmers and their behavior towards the adoption of agricultural technologies. This implies that the independent variables can reliably predict the dependent variable.

### 3.2 Discussion

The findings of the study shows unaffordability and fear of taking risk are major constraint to farmers adoption to agricultural technologies. The findings are in conformity with Adams (1982) who opined in order to reduce risk and uncertainty farmers prefer to see the working benefits of the new innovation on others before they try to consider adopting it. Also, Dessert, Barreiro-Hurle and Bravel (2019), Catlett [18] buttressed that farmers' personality, reluctant to change, low interest, unwilling to adopt any new techniques are among distal behavioural factors which make farmers to behave certain way based on their perception on cost and benefits of an innovation [19].

The study also found there is a significant relationship between the socio-economic characteristics of farmers (age, gender, educational level, and years of experience, income, membership and household size) and their behavior towards the adoption of agricultural technologies. This finding is in conformity with Tsado [20] who established that there is a significant relationship between the following variables and the adoption of improved farm inputs by farmers: Marital status, Age of the farmers, household size and the educational level of the farmers [21]. He further explained that old-aged and illiteracy are common hindrance to adoption of farm inputs among crop farmers. Sighn and Bauah [16] also observed that majority of the farmers could not adopt new agricultural practices, because by and large, they were poor in education and economic conditions, accompanied by other associated factors. Akinwunmi & Jonas, [14], Max [15] and Ogunlana [17] jointly assert that farmer's level of adoption of farm machineries is highly dependent or could be traced to their socio-economic characteristics and environmental factors. Their findings established that farmers' income level and their psychomotor skills to manipulate farm tools/machineries are key predictors that tells farmers behavior to adopt farm machineries/tools.

### 4. CONCLUSION

The study concluded that socio-economic characteristics of farmers especially age, education and income are major factors that significantly influence agricultural technology adoption behavior among crop farmers in the study area.

### 5. RECOMMENDATIONS

Based on the findings of the study the following the recommendations were made;

- I. Agricultural Extension agents should publicize the positive result of the new farm technology among rural farmers so as to increase the adoption rate of agricultural technology
- II. Laggard farmers requires much more evidence to strengthen their conviction, because of this, extension workers should always present at least a testifier of the said technology to enhance their decision to adopt.

- III. Government should help agricultural extension agencies with funds so as to provide farmers with the new technology for farming at a subsidized rate, this will in turn encourage their adoption process.
- IV. Agricultural development inventions and schemes should always consider the socio-economic characteristics of farmers when proposing an innovation to farmers, this will help them focus on those that really need the innovation
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### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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