

Socioeconomic Determinants of Modern Agricultural Technology Adoption among Farmers in Rivers State: A Case Study of Etche Local Government Area

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ABSTRACT

This research examined the socio-economic determinants of modern agricultural technology adoption among farmers in Rivers State. The specific objectives were to examine how education; gender; farm size; marital status and annual farm income influences the adoption of modern agricultural technology. Primary data was collected and inferential statistics (linear regression, Probit regression and Logistic regression) were used in the analysis of collected data. The results showed that 72% of the respondents were female, 30% being majority of the respondents fell between the age category of 36-43 years, 64% were married, 34% being majority have primary education as their highest educational qualification, 46% of the farmers earn ₦120,000 and above annually. The results also revealed that only 14% of the farmers adopted high yielding varieties as their modern agricultural technology while 86% reported not adopting any agricultural technology. 30 % of the farmers grow cassava as their main farm crop. None of the farmers reported using reported using inorganic fertilizers; only 5% reported using poultry droppings. 76% reported not using high yielding varieties, while only 24% reported using high yielding varieties. 86% reported getting their high yielding varieties from other sources other than ADP and government sources. 100% of the respondents reported the absence of extension training to be a limiting factor to adoption of modern agricultural technology. 38% reported lack of awareness. The logistic regression results had an R^2 of 74% indicating that a 74% variation in modern agricultural technology adoption is determined by variations in the independent variables. The independent variables had significance values of 0.04 for level of education, 0.00 for f., [arm size, annual farm income has a p-value of 0.03, 0.714 for gender and 0.701 for age. Only annual farm income, farm size and educational level had significant influence on farmers' adoption of modern agricultural technology. The study concluded that the adoption of modern technology is low in the study area and recommended the establishment of agricultural research centres and pilot farms by both the government and private establishments to make modern agricultural technology available and accessible to the farmers and Extension services should be adequately made available by the government to enlighten farmers on the available modern agricultural technology.

Keywords: *Determinants, Modern Agricultural Technology, Adoption, Diffusion, Socioeconomics*

INTRODUCTION

Increasing agricultural efficiency is critical to satisfying the nations rising need for sustenance. The world's largest economic sector is agriculture, and a greater number of individuals are engaged with the agriculture than in all different occupations put together (EU, 2009). The population of the world is increasing rapidly; necessitating the need to ensure food security, which is hinged on effective and efficient agricultural production.

The broad objective of the nation's agricultural advancement programs and arrangements is increasing agricultural profitability for accelerated financial development. Agricultural technologies are critical in increasing efficiency in farm enterprise. The need to examine the socioeconomic characteristics that influences farmers to adopt new agricultural technologies cannot be overemphasized.

When agricultural production efficiency is enhanced, it is capable of reducing poverty level by boasting the earning capacity of the farmers. This infers that agricultural profitability won't be conceivable without creating and disseminating financially savvy yield increasing technologies, since the food need of the growing population cannot be met by merely expanding the area under cultivation or depending on irrigation (Dat and Ravalling, 1996; Hossain, 1989).

Statement of the Problem

Most European nations and parts of Asia have met the food requirement for their teeming population or are in the process of attaining self-sustenance, different nations in Africa and parts of Asia are still struggling to feed their increasing population.

Worries over food insecurity are driven by the need to feed an increasing population and one means of addressing these worries is to increase productivity and local supply by improving agricultural efficiency through adoption of present day agricultural technology, and thus framing the basis and importance of directing this examination.

Based on the above issue, the investigation answered the accompanying research questions; what are the socioeconomic determinants of adoption of modern agricultural technology among farmers in Rivers State? What are the constraints hindering farmers' adoption of present day agricultural technology? How does adoption of present day agricultural technology increase farmers' productivity and profitability?

Literature Review

Theoretical Background of the Study

The theoretical background for the study is anchored on T.W Schutz's high pay off input model. The high-payoff input model emphasizes that agricultural development relies upon the availability and cost of current agricultural factors. Schultz blamed lack of agricultural advancement on the restricted technical and monetary open doors for peasant farmers.

The model advocates for (i) interests in agricultural research; (ii) investments in capabilities for the generation, supply and availability of modern inputs; and (iii) interests in human capital (that is, capabilities of farmers to acquire and utilize new information)

Ruttan, (1977) stated that there are three conditions for this model to work, He further stated that public and private sector research institutions must be able to innovate, followed by the ability to develop, produce and market new technical inputs by the industrial sector and that the farmers must be able to acquire and effectively use the new knowledge and inputs.

Agriculture can be developed and transformed into a viable enterprise when farmers have access to high yielding inputs and engage in sustainable new improved agricultural practices.

Many researchers in their different findings have reinforced the potency of this model to turn peasant agriculture into a profitable business venture and the benefits of agricultural research to trigger such economic transformation. This is necessitated by the fact that food production can no longer be ensured by merely increasing the areas of cultivation; this is more so considering the competitiveness on land for other non-farm uses.

Agricultural Technology Adoption

The realization of the potential incentives of technological advancements in agriculture is in its adoption and utilization; the choice to adopt includes a comprehensive or detailed cost-benefit analysis of the new technology as per the old practice (Uaiene, 2011).

Various researchers characterize technology in various ways. According to Loevinsohn et al. (2013) technology are the means and strategies for delivering merchandise and enterprises, including strategies for organization as well as physical strategy.

The aim of technology is to improve a given standard to a more efficient level. According to Bonabana-Wabbi, 2000 it assists the adopter to effectively and efficiently carry out task in ways than would have been possible without adoption.

Adoption is an incorporation of another technology into prevailing technique and is always followed by experimentation and periods of adaptation (Loevinsohn et al., 2013). Adoption is divided into two classes; frequency and amount of adoption. The frequency of adoption is the fastness with which the new technology is inculcated into the existing practices by the farmers, while the amount or rate of adoption alludes to the volume of usage of the new developed technology.

Determinants of Modern Agricultural Technology Adoption

Various research works has put forward different factors that influence the decision of farmers to adopt a new agricultural technology or not. These factors are majorly the socioeconomic characteristics of the farmers which include age bracket, annual farm income, farm size, gender, education and the major occupation of the farmers.

The age of farmers play prominent role in the decision to adopt modern agricultural technology as middle aged farmers are more likely to try out new practices than old farmers. As the annual incomes of farmers improve their capacity to acquire and make effective use of modern agricultural technologies increases, this is because the conviction and willingness to adopt new practices must be backed up by the financial capacity to acquire and put same to use. Farmers

whose major occupation is agriculture are more likely to adopt new technology than those who are partially into farming.

Uaiene (2011) examined the components affecting agrarian technology adoption by farmers in Mozambique. The findings established that increased farm income, extension services, educational status and membership of agro based organizations significantly influence adoption.

Empirical Literature

Asfaw and Adamassie (2004) carried out a study wherein they investigated the nexus between formal education and the decision to adopt to chemical fertilizers by farmers in Ethiopia in relation to varying socioeconomic conditions. The findings of the study revealed a positive relationship between formal education and the decision to adopt chemical fertilizers in Ethiopia.

Conley and Udry (2000) observed that peer group interaction is crucial to creating awareness and the decision to adopt new technologies, when they examined farmers in Ghana who are involved in the production of pineapple.

Olawande et al (2009) analyzed a board examination of smallholder farmers' fertilizer use in Kenya and saw that the extent of families utilizing manure significantly ascended in the most recent decade while manure application rates expanded gradually.

Dimara et al (2003) in their study stated that the decision to adopt a new technology is a partial observation which involves a dual stage process, the period of contemplation to adopt or not and the actual adoption stage which is characterized by the integration of the new technology or practice.

Smale et al (2001) suggested that adoption is a three simultaneous decision-making processes; the decision of whether to embrace the part of the proposed technology, the choice of the amount of some input, for example, compost, to utilize, and the choice of how to distribute various advancements over the land zone.

Dayo et al. (2008) and Afua et al. (2009) examined constraints to increasing agricultural productivity in Nigeria and constraints to fertilizer use in Nigeria. They were in agreement on the overwhelming importance of modern agricultural technology to increasing and sustaining agricultural productivity which is panacea to food insecurity. The studies also identified farm income, education, farm size and non-availability as factors affecting fertilizer use in Nigeria.

Other researchers examined the fundamental policies surrounding modern agricultural technology adoption, reviewing the choice of specific component of the technology adopted and its suitability in a particular area.

METHODOLOGY

Research Design

Primary and secondary data was used in this study. The secondary data was obtained from relevant literatures bordering on the research topic, while the primary data was obtained with the aid of structured questionnaires administered personally to the respondents, interviews and focus group discussions (FGD). Data collected include modern agricultural technology (High yield variety (HYV) and inorganic fertilizer) adopted, crop yield, farm size, labor and capital input utilized, farm income as well as farmers' perception of modern agricultural technology and their effect on agricultural production and farm income. Information on the socioeconomic characteristics of the farmers was also obtained. Data was analysed using descriptive statistics, Ordinary Least Square (OLS) and Multiple Regression Analysis. Multiple Regression Analysis was used in determining the socioeconomic factors influencing the adoption of modern agricultural technology in the study area. Three functional forms; Linear, Logistic and probit regression was tried and the lead equation chosen was based on econometric criteria such as number of significant variables, F-values, and value of apriori expectation

The OLS model used is specified below;

$$Y = f(X_7) \dots \dots \dots (i)$$

$$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, e_i) \dots \dots \dots (ii)$$

The explicit form of the model is presented as follows;

Linear Form

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + e_1 \dots \dots \dots (iii)$$

Where

Y is the dependent variable and it represents the adoption of modern agricultural technology. The independent variables are listed below;

X₁ = Farm Size

X₂ = Annual Farm Income

X₃ = Marital status (Dummy variable where 1=married 0=otherwise)

X₄ = Age group of farmer

X₅ = Education (Dummy variable where 1= formal schooling 0= no formal schooling)

X₆ = Major Occupation (Dummy variable where Employed= 1 Unemployed = 0)

X₇ = Gender

E = Error term

Socio-economic characteristics of farmers in Etche LGA

Data gathered via structure questionnaire on the respondent's socio-economic characteristics were subjected to statistical analysis and the results are as presented in table below.

Table 1.0 Socio-economic characteristics of respondents

Characteristics	Frequency (n=50)	Percentage (%)	Mean
Gender			
Male	14	28.00	
Female	36	72.00	
Total	50	100.00	
Age			
36-43 Years	15	30.00	
44-50Years	7	14.00	
51-59 Years	29	28.00	
60-69 Years	14	28.00	
Total	50	100.0	
Marital Status			
Single	14	28.00	
Married	32	64.00	
Divorced	2	4.00	
Widowed	2	4.00	
Total	50	100	
Educational Level			
No formal education	13	26.0	
Primary Education	17	34.00	
Secondary Education	16	32.00	
Tertiary Education	4	8.00	
Total	50	100.00	
Farmsize			
0.1-0.5 Hectares	41	82.00	
0.6-1.0 Hectares	9	18.00	
Total	50	100.00	
Annual Farm Income			
20000-49000	9	11	
50000-99000	7	14	
100000-120000	11	22	
Above 120000	23	46	
Total	50	100.00	

Source: Field Survey 2022

Table 2 shows the breakdown of the types of modern agricultural technology adopted by farmers in the study area

Table 2.0 Modern Agricultural Technology Adopted

	Frequency	Percentage(%)
HYV	7	14.00
Inorganic Fertilizer	0	0.00
Both	0	0.00
None	43	86.00
Total	50	100.00

Source: Field Survey 2022

Table 3.0 Crops Grown in Etche

Crops Grown	Frequency	Percentage (%)
Cassava	15	30.00
Plantain	8	16.00
Vegetable	5	10.00
Yam	3	6.00
Corn	10	20.00
Cucumber	4	8.00
Melon	2	4.00
Pepper	3	6.00
Total	50	100.00

Source: Field Survey 2022

Table 4.0 Type of Fertilizer Used

Fertilizer	Frequency	Percentage (%)
Poultry Droppings	5	10.00
Ash (Burning)	45	90.00
Npk	0	0.00
Total	50	100.00

Source: Field Survey 2022

Table 5.0 Use of High Yielding Variety

Characteristics	Frequency	Percentage (%)
Yes	12	24.00
No	38	76.00
Total	50	100.00

Source: Field Survey 2022

Table 6.0 Source of HYV

Source	Frequency	Percentage (%)
Government	4	8.00
ADP	2	4.00
Other Sources	44	88.00
Total	50	100.00

Source: Field Survey 2022

Table 7.0 Barriers to adoption of modern agricultural technology

Barriers to Adoption	Frequency	Percentage (%)
No extension training	23	46.0
Lack of awareness	19	38.0
Fertile soil	8	16.0
Total	50	100.00

Table 8.0 Probit Regression output showing the effects of Age Gender Education level farm size and annual farm income on adoption of modern agricultural technology

Variables	Coefficients	Std. Error	Wald	Sig.
Constant				
Gender	-.174	.174	.069	.793
Age	-.668	.314	4.518	.918
Educational level	.046	.444	.011	.918
Farm Size	1.404	.863	2.645	.104
Annual Farm income	.336	.336	.534	.104
-2Log Likelihood	26.335			
Cox & Snell R Square	.164			
Nagelkerke R Square	.316			
Overall Percentage	66.0			
F- Probability	.110			

Dependent Variable: Modern Agricultural Technology Adopted

Discussions of the socio-economic characteristics of the respondents

Table 1.0 contains the data which have been subjected to statistical analysis on the socioeconomic characteristics of the respondents. Majority (72%) of the sampled farmers were female while the remaining (28%) were male. This reveals that in Etche local government area, farming activities (planting of crops) are done predominantly by the women. This is in contrast with the findings of Ajibefun et al (2002) and Rahman, (2011) who in their respective findings stated that there are more male farmers. This is also an indication that Etche women are hardworking and industrious and do contribute meaningfully to the wellbeing of their families and the community in general. Majority of the farmers (30%) fell between the ages of 36-43 years of age which implies that a considerable number of the young people in their prime are actively engaged in agriculture. Rahman (2000) found out that the age of a farmer greatly influence crop production decisions, farm management practices and the decision whether or not to adopt modern agricultural technology. This finding nearly conforms to Afolami et al., (2012) and Igwe, (2013) that identified mean age of 48 and 53 years in their respective studies among farmers in southeastern Nigeria. Rahman, (2008) and Shiyani, et al. (2002) all highlighted the significant relationship between farming experience, age and the decision to adopt modern agricultural technologies in their various studies. (28%) of the farmers fell between the ages of 50-59 years of age, while another (28%) fell between the ages of 60-69 years of age. It also shows that even those advanced in age are also engaged in farming activities. The results reveal that farming is a major employer of labour in Etche local government area. Majority of the farmers (64%) were married, (14%) were single, (2%) of the sampled population were divorced while another (2%) were widowed this is an indication that family value system is being upheld in Etche which is one of the core values of rural agrarian societies.

The educational status of a farmer greatly influences his/her decision to adopt agricultural technology, as education enables the farmer to easily access information on the pros and cons of the new technology (Miah, 2000). From the results in table 4.1, majority of the farmers (34%) reported primary education to be the highest education they acquired; this was followed by another (32%) which reported secondary education to be the highest level of education they possess. Those farmers who reported having no formal education were (26%) while only (8%) reported having tertiary education but are actively engaged in farming as a source of livelihood since they are not able to secure government or private jobs after completing their studies.

Land is the major factor in agricultural production and the single most important asset for any farmer. The results reveal that the majority (82%) of the sampled farmers used between 0.1 – 0.5ha of land for farming while only (18%) of the sampled farmers used between 0.6 – 1.0 ha of land for farming. This also reveals that much of available land in Etche local government area is being used for farming activities.

Majority (46%) of the sampled farmers reported to earn ₦120,000 and above annually as proceeds from the sales of their farm produce, (22%) reported earning between ₦100,000 – ₦120,000 annually from agricultural produce sales, (14%) reported making annual sales of ₦50,000 – ₦99,000, while (11%) reported making sales of ₦ 20,000 - ₦ 49,000. The farmers' income was positively signed as expected. As the annual incomes of farmers improve their capacity to acquire and make effective use of modern agricultural technologies increases, this is

because the conviction and willingness to adopt new practices must be backed up by the financial capacity to acquire and put same to use.

Ekwe (2004) stated that there is a positive relationship between income and adoption as farmers are more likely to incorporate management practices that will trigger a massive boost of their farm income, and with the increasing income will adopt more modern agricultural technology.

Discussions on the Regression Analysis showing the effect of Age, gender, educational level, farm size and annual farm income on the adoption modern agricultural technology

Three regression analyses were conducted, the Linear regression, Logit regression and the Probit regression. The logit regression model result was selected owing to the fact that its R^2 (the Nagelkerke R square) is the highest among the three models. The Logit regression analysis result on the effect of Age, gender, education level, farm size and annual farm income on adoption of modern agricultural technology by farmers in table 8.0 shows that the coefficient of determination (R^2) = 74%. This implies that 74% variations in modern agricultural technology adoption is determined by variations in the effects of Age, Gender, Educational level, Farm size and annual farm income. This is an indication the model has an acceptable goodness of fit. The remaining 26% is explained by variables not included in the model.

Test of Significance

From the unstandardized coefficients which is the (B) coefficients, Age and Gender are negatively signed which is an indication they do not have influence on the adoption of modern agricultural technology, while educational level, farm size and annual farm income are positively signed indicating they do influence the decision to adopt modern farming technology. The standardized coefficients (Exp B) shows that there is a 0.2 likelihood that age will influence the decision to adopt modern agricultural technology, 0.7% likelihood that educational level influences adoption, there is a 13.7% likelihood that educational level influences adoption, there is a 17.0% likelihood that farm size influences adoption, and also there is a 7.5% likelihood that annual farm income influences adoption of modern agricultural technology.

From the Significance column, educational level had a P-value of 0.04 which is less than 0.05 hence the researcher concludes that educational level significantly influenced adoption, farm size has a P-value of 0.03 which indicates that farm size significantly influenced adoption and annual farm income has a P-value of 0.03 which is less than 0.05 indicating that annual farm income significantly influenced adoption of modern agricultural technology

CONCLUSIONS

This study, socioeconomic determinants of modern agricultural technology adoption among farmers in Etche local government area was conducted in Rivers State. From the results, majority of the sampled farmers were female members of the community, majority of the farmers fall between the age range of 36-43 years, majority of the sampled farmers were married, majority of the farmers reported primary education to be the highest level of education they possess, majority of the farmers use 0.5 and below hectares of land for crop cultivation, majority reported to earn ₦120,000 as their annual farm earnings. Majority of the respondents reported cassava as the main crop they cultivate, majority indicated not using inorganic fertilizers, bush burning and planting is the predominant practise among farmers. Only 24% of the respondents use high yielding varieties as modern agricultural technology. Of the farmers using high yielding varieties, majority reported getting it from when they travel out of their LGA or when they purchase from those who have acquired HYV. All the respondents reported lack of extension services and research centres to be the factors negating the development of modern agricultural technology, while majority reported lack of extension training as the barrier to their adoption of modern agricultural technology. The results of the probit regression analysis revealed that age and gender do not influence farmer's adoption of modern agricultural technology, while education level, farm size and annual farm income influences farmers' adoption of modern agricultural technology. On the basis of the conclusions derived from this study, the following recommendations are hereby put forward:

- 1) Establishment of agricultural research centres and pilot farms by both the government and private establishments to make modern agricultural technology available and accessible to the farmers.
- 2) Extension services should be adequately made available by the government to enlighten farmers on the available modern agricultural technology.

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