



Socio-economic Determinants of Climate Change Adaptation among Crop Farmers in Ahoada West and Ogba/Egbema/Ndoni Local Government Areas, Rivers State

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ABSTRACT

The study examined the socioeconomic determinants of climate change adaptation among crop farmers in Ahoada-West and Ogba/Egbema/Ndoni Local Government Areas (ONELGA). Two hundred crop farmers were selected through purposive and simple random sampling methods from the registered farmers with the Agip Oil Green River Project. Descriptive statistics and logistic regression were used to analyse the data. The findings revealed that 62% of the respondents were females and 43% were males. About 73% of the respondents had varied levels of education. A mean household size of 4 persons and a mean age of 57 years was recorded, and about 85% had farming experiences ranging from 11-30 years. The logistic regression was run to determine the impact of gender, age, farming experience, education, and income on the probability of participants' ability to adapt to climate change. There was a statistically significant logistics regression model (61.201, $p < .005$). The model correctly classified 84% of instances and accounted for 40.20% (Nagelkerke R^2) of the variation in adaptation. The ability of farmers to adjust to climate change was influenced by factors such as age and farming experience. The probability of the crop farmers to adjust to climate change decreased as their age increased (Odd Ratio (OR) = -1.248, 95% CI [0.144, 0.578]). It is recommended that the crop farmers look out for and engage themselves in off-farm activities to raise funds to supplement their farming engagements.

Keywords: socio-economic, crop farmers, adaption capacity, climate change

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INTRODUCTION

The socio-economic analysis of crop farmers' adaptation to climate change aims to assess how farmers adjust their farming practices and coping mechanisms in response to changing environmental conditions. This study examined the socio-economic factors influencing farmers' ability to adapt to climate change, providing valuable insights into strategies for building resilience in agricultural communities in Ahoada-West and Ogba/Egbema/Ndoni

Local Government Areas (ONELGA) of Rivers State, Nigeria. These two local government areas were selected because they had experienced the 2012 and 2022 flooding in the State. The findings of this analysis could inform policies and interventions aimed at supporting the crop farmers in the face of climate variability and change. Climate change is no longer a novel situation, as its effects are seen and experienced globally. The rainfall variability,

heat intensity, and drought in most parts of the globe leave much to be desired. Vast areas of farming land are affected, thus reducing crop output and animal production in sub-Saharan Africa, where this phenomenon is more pronounced because many farmers are poor, uneducated, do not have access to extension services, funds, or information, and lack the technology to cope with the trend. The capacity of a system to adapt is how well it can deal with the effects of climate change, such as its unpredictability and extremes, and how it can mitigate harm, seize opportunities, or both (IPCC, 2001). Ahoada-West and Ogba/Egbema/Ndoni Local Government Areas (ONELGA) of Rivers State, where this study is conducted, are not spared from the vagaries of climate effects. There have been repeated and devastating effects of floods, covering farmlands, leading to unaccountable losses. The farmers are faced with these challenges which have a significant impact on agricultural productivity and the livelihoods of farmers in these LGAs. Some of the current challenges faced by crop farmers due to climate change include irregular rainfall patterns that have resulted in prolonged dry spells followed by heavy rainfall, making it difficult for farmers to plan their planting and harvesting schedules (Okorie and Ezechinna, 2022). Droughts, floods, and storms have become more frequent and intense as extreme weather events have increased. These incidents can cause significant crop damage, resulting in yield losses and financial losses for farmers (Anete and Amusa, 2010). He further observed that the warmer weather encouraged the spread of illnesses and pests, which further reduced crop yields. Rising temperatures and altered rainfall patterns can provide an ideal environment for the growth of pests and the spread of illnesses (Ajire and Weli, 2018). Heavy rainfall has exacerbated soil degradation and erosion in Rivers State, resulting in topsoil loss and nutrient depletion. This has negatively impacted crop productivity and the long-term sustainability of agricultural practices (Ajire and Weli, 2018). According to Okorie and Ezechinna (2022), many crop farmers in Rivers State may lack access to climate-smart technologies and information that can help them adapt to the changing climate. This includes drought-resistant crop varieties, technologies such as improved irrigation systems, and weather forecasting tools. Limited access to these resources can hinder farmers' ability to mitigate the impacts of climate change on their crops. Finding solutions to these challenges is why this study, which investigates the socioeconomic analysis of crop farmers' adaptive capacity to climate change in Ahoada West and ONELGA, is so important. Understanding the social and economic factors that influence farmers' ability to adapt to climate change can help in developing effective policies and interventions. It can provide valuable insights into the specific challenges faced by farmers and allow for the implementation of targeted strategies to improve their adaptive capacity. This analysis can also identify existing resources and capabilities within the community that can be leveraged to build resilience against climate change

impacts. Overall, socio-economic analysis is crucial for developing sustainable and tailored solutions to support crop farmers in the study areas. Deressa (2008) investigated some of the techniques that have been used in the Ethiopian Nile Basin, including planting trees, growing crops at various times of the year, conserving soil, planting early and late, and using irrigation. The utilized discrete choice model found that farmers' decisions are impacted by factors such as the head of household's wealth, education, gender, age, and access to loan and extension services, as well as climate, social capital, agroecological environment, and temperature information. Inadequate knowledge of adaptation strategies and limited funding are the primary obstacles. Agro-ecological contexts, social capital, the age of the family head, and wealth all have a role in how farmers perceive climate change and their ability to adapt. The coping strategies of the farmers in the study area are not different from the observation of Deressa (2008) in Ethiopia. Additionally, because the farmers are poor and cannot cope with the magnitude of climate change, they are left with the choice of off-farm engagements. Due to the land tenure system, they have fragmented plots of land where they grow different crops to cope with the challenges. However, in the face of extreme weather conditions, such as the 2012 flooding, they were forced to abandon all their crops to save their lives and wait for government interventions, which have never been effective. For these reasons, the study is being conducted to investigate the socioeconomic determinants of climate change adaptation among crop farmers in the Ahoada West and Ogba/Egbema/Ndoni (Onelga) local government areas of Rivers State, with the following objectives: to determine the socio-economic characteristics of the crop farmers and to ascertain the socioeconomic factors that determine the crop farmers' adaptation to climate change.

METHODOLOGY

The study was conducted in Ahoada West Local Government Area (LGA) in the northwestern part of Rivers State, as well as Ogba/Egbema/Ndoni LGA in the north. Both LGAs lie in the same geographical area and were affected by the previous floodings in the State. Each has two distinct seasons: one wet (beginning in March and continuing until October) and one dry (beginning in November and continuing until March). In Rivers State, the two most productive local governments are ONELGA and Ahoada-West, which produce cassava, yam, oil palm, plantains, bananas, and potatoes. There are more than 20,000 households involved in farming and fishing. A larger portion of this group grows cassava, yam, and plantain (www.riversstate.gov.ng, 2010).

The crop farmers for this research were chosen using a combination of purposive and simple random sampling methods. In the first stage, ten farming communities were purposefully selected based on the volume of crop farming activities and the fact that they were prone to the effect of

flooding. This was aided by the Green River Project (GRP), funded by the Nigerian Agip Oil Company (NAOC). The communities include Omoku, Egbada, Obrikom, Akabuka, and Mgbade from ONELGA, and Abarikpo, Anakpa, Ihuechi, Odiapiti, and Oruama from Ahoada West. In stage two, twenty crop farmers were chosen at random from the lists of farmers maintained by the Green River Project's (GRP) Farmers' Associations in each community to arrive at one hundred and twenty (120) crop farmers. The questionnaire was the primary instrument used to gather the data used for the study. The data obtained mostly concerned the impact of external agents on the adaptability of the crop farmers and their socioeconomic factors, including gender, age, education, marital status, family size, years of agricultural experience, and income.

Model specification

The logit regression model was used to examine objectives. Specifically, Onyeneke (2010) employed the following formula:

$$Pr(Y_i = j) = \frac{e^{\beta_j x_{ij}}}{n}, \quad j = 0, 1, 2, 3, \dots, n$$

$$1 + \sum e^{\beta_m x_{ij}} \quad m = 0.$$

$$P_j = \Pr(Y_i = j) = \frac{e^{\beta_j x_{ij}}}{n} \quad j = 0, 1, 2, \dots, n.$$

Where P = response probability (J = 0, 1).

Y = adaptation (Dummy "Yes" = 1, "No" = 0)

The explanatory variables are as follows:

$Y = f(X_1, X_2, X_3, X_4, X_5, X_6) + e$

X_1 = age of the crop farmers

X_2 = gender (male = 1, female = 0)

X_3 = educational level (tertiary = 3, secondary = 2, primary = 1, Nil = 0)

X_4 = farming experience

X_5 = marital status (married = 1, single = 0).

X_6 = access to credit facilities (dummy: yes = 1, no = 0).

$\beta_s = (\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7, \beta_8)$ = Respective parameter estimates of the explanatory variables.

e_i = error term.

RESULTS AND DISCUSSION

Socioeconomic characteristics of the crop farmers

Effect of gender on farmers' adaption to climate change

Of the 200 respondents, 124 are female (62%), and 76 are male (38%), according to the results shown in (Table 1). This suggests that in the study areas, women were more involved in crop farming than men. Adesina et al. (2000) also observed that of the farmers who used enhanced rice varieties, 64% were female.

According to Kiker et al. (2002), women have greater access to knowledge about new agricultural and climate change adaptation methods because they are more likely to attend extension meetings in conventional setups.

Effect of age on farmers' adaption to climate change

Another interesting finding is that 32% of the farmers in the study area were between the ages of 55 and 64. In Dereje's (2012) view, a farmer is likely to grow more conservative as they age. So, it stands to reason that farmers' embrace of technology would decline with age. Younger farmers may be more open to and eager to use new technology in the agricultural industry. Adebayo et al. (2012) found that farmers are most productive between the ages of 35 and 55, and this result is in line with that. Farmers in this age range can better handle the stresses of farming, which may affect production and the adoption of new technologies.

Effect of education on farmers' adaption to climate change

The farmer's educational status was determined by the total number of years he or she had spent in formal education. People generally believe that farmers will be better able to embrace climate adaptation measures if they get formal education. People with more education should be able to decide which adaptation techniques to use. The amount of time spent in formal schooling was considered a categorical variable in this research. While 43% of respondents have completed just elementary school, 21% have completed secondary school, and 18% have completed college, the results suggest that 27% of the farmers have no formal education. It suggests that most farmers are literate and able to assess adaptation techniques. While most farmers in the study area rely on crop production for sustenance, those with advanced degrees are more likely to diversify into off-farm enterprises. Literacy rates, according to Adewumi et al. (2007), have a role in reducing the prevalence of ignorance and increasing the uptake of new technologies. The technological packages that development organizations provide to farmers are easier to understand using this tool. As a result, it stands to reason that farmers with more knowledge would be more willing to experiment with new, enhanced adaptation types because they are more open to new ideas and innovations. Education has a major impact on farmers' ability to adapt.

Effect of farming experience on farmers' adaption to climate change

From (Table 2) the crop farmers fall into different ranges. About 15% had 10 years and below, the majority of the farmers (71%) had 11-20 years of farming experience, and 14% had 21-30 years. This suggests that they are well-versed in the fundamentals of successful adaptation

Table 1: Registered Communities/ Crop Farmers with the Green Rivers Project.

LGA Selected Communities	No of Respondents
Onelga Omoku	20
Egbema	20
Obrikom	20
Akabuka	20
Mgbede	20
Ahoada-West Abarikpo	20
Anakpa	20
Ihuechi	20
Odiapiti	20
Oruama	20
Total	200

Source: Field Survey, 2023.

Table 2: Distribution of the Socio-Demographic Characteristics of the Crop Farmers.

Variables	Frequency (f = 200)	Percentage (%)	Mean
Sex			
Male	76	38.0	
Female	124	62.0	
Age			
35-44	20	10.0	
45-54	58	29.0	
55-64	65	32.5	57
65-74	55	27.5	
75 and above	2	1.0	
Level of Education			
Non formal	54	27.0	
Primary	86	43.0	
Secondary	42	21.0	
Tertiary	18	9.0	
Household Size			
0	2	1.0	
1-4	148	74.0	4
5-8	50	25.0	
Marital Status			
Single	8	4.0	
Married	158	79.0	
Widowed	14	7.0	
Divorced	12	6.0	
Separated	8	4.0	
Farming experience			
<10 years	30	15.0	
11-20	142	71.0	
21-30	28	14.0	

Source: (Field, 2023)

methods (local) and have had sufficient exposure to the uncertainty of climate change. The farmers' wealth of agricultural knowledge guarantees that they will be capable of making prudent decisions when it comes to managing their farms. This agrees with the findings of Johannes et al. (2010) and Kudi et al. (2011), who stated that farmers' ability to assess the advantages of new technology increases with experience, leading to a higher rate of adoption. Concerning the utilization of improved adaptation strategies, farmers can draw on their experience to make decisions. This suggests that most local farmers are well-sophisticated and have sufficient knowledge of climatic fluctuations and their consequences. Older farmers are better able to weather the storms of climate change and adaptation, and they are more likely to rely on tried-and-true methods from their communities rather than cutting-edge technology, which

may be complicated but ultimately more successful.

Crop farmer's economic adaption to climate change

The study considered lack of money, lack of access to credit and alternative income as the farmers' economic capacity to climate change adaption. Table 3 shows the distribution of the economic adaptive capacity amongst the respondents. Most farmers (74.5%) agreed that their capacity to adopt the adaptive techniques was influenced by a lack of money. Only 19% disagreed, and 6.5% were unsure. Another finding is that although 33.5% of respondents felt that limited access to financial facilities hindered their capacity to implement adaptive methods, 66.5% of respondents disagreed. Most respondents (76%) had other sources of income, while 24% did not.

Table 3: Economic Distribution of the Crop Farmers' Adaption to Climate Change.

Impacts	Frequency (f=200)	Percentage (%)
Lack of Money		
Yes	149	74.5
No	38	19.0
Lack of access to Credit		
Yes	67	33.5
No	133	66.5
Alternative income		
Yes	48	24.0
No	152	76.0

Table 4: Results of the Ordered Logistic Regression Model of Determinants of Adaptive Capacity.

Variables in the Equation	B	S.E	Wald	Df	Sig.	Exp (B)	95% C.I for EXP (B)	
							Lower	Upper
Gender	-0.375	0.451	0.690	1	0.406	0.687	0.284	1.665
Age	-1.242	0.354	12.329	1	0.020	0.289	0.144	0.578
Farming experience	-1.458	0.474	9.448	1	0.002	0.233	0.092	0.590
Education	1.699	1.022	2.765	1	0.096	5.471	0.738	40.557
Income	0.001	0.006	0.030	1	0.862	0.999	0.987	1.011
Constant	7.207	1.547	21.706	1	0.000	1348.178		
Nagekkerke R ²	40.20%							
Probability	0.05							
Number of Observations	200							

Source: (Field, 2023). Variable(s) entered on step 1: gender, age, exp, edu, income.

Lack of income

Farmers' adaptation ability is affected by economic distribution factors, as shown in the results. 74.5 per cent of respondents believe that a lack of funds is a factor in their failure to implement adaptation methods and 19 per cent disagree. Since they lack the capital to implement viable adaptation techniques, this demonstrates that the farmers in the study areas have very few options. This is backed by the conclusions drawn by Antwi-Agyei et al. (2012), who theorized that inadequate financial capital causes the vulnerability index to grow, rendering adaptation almost difficult and increasing vulnerability, regardless of whether a family is situated in a resilient or susceptible neighbourhood.

Lack of access to credit

Additionally, the results demonstrated that 67% of the participants believe that their capacity to implement effective adaptation measures to climate change is further hindered by a lack of access to financing facilities. They agree that obtaining finance would improve their lot in terms of implementing effective ways to adapt to climate change. In times of poor harvest or drought, having access to loans is a crucial way to rectify income deficiency, according to Coker and Audu (2015).

Alternative income

Regarding the availability of other income sources, 48% of respondents reported having sources of income other than

farming, while 76% said that they relied solely on farming for their livelihood. This means that most farmers cannot make use of efficient adaptation techniques since they don't have anything else to earn money outside farming. However, farmers' financial capabilities would be enhanced if they had access to alternate income. This would enable them to weather the catastrophic impacts of poor yield and adjust to unpredictable climate change. For marginal rural areas, the findings stress the significance of non-farm income in creating chances for long-term adaptation methods to climatic unpredictability. Robert et al. (2006) argued that farmers need to diversify their livelihoods beyond agriculture as the consequences of climate change endure, and this is in line with their ideas. For the sake of Nigeria's impoverished rural farmers, this is of the utmost importance. Profits from off-farm sources may help farmers maintain or increase their income, which they can then use to reinvest in their farms. Another key adaptation strategy is diversification via value chain activities. Thus, the ability of farmers to adjust is directly related to their revenue.

Ordered logistic regression of the determinants of climate change adaption

Table 4 shows the results of the Ordered Logistics Regression Model of determinants of adaptive capacity. The logistic regression was run to determine the impact of gender, age, Farming experience (exp), Education (Edu), and income (I), on the probability of participants' ability to adaption to climate change (Table 4). There was a statistically significant logistics regression model (61.201,

$p < .0005$). The model accurately categorized 84.0% of instances and explained 40.20% (Nagekkerke R^2) of the variation in adaptation. Because the model's "YES" option was more popular with adaptable people than its "NO" option, it demonstrated high sensitivity (Target group). The model accurately predicted that 95.5% of the crop farmers could adapt to climate change. The probability of farmers' abilities to adjust to climate change decreased as their age increased (OR= -1.242, 95% CI [0.144, 0.578]). In addition, the probability of adaptation increased with decreasing farming experience (OR= -1.458, 95% CI [0.092, 0.590]). As a result, we can say that Socio-demographic factors of age and farming experience significantly affected the farmers' adaptation to climate change.

Conclusion and Recommendation

Crop farmers' adaptation capacity to climate change was significantly affected by the farmers' age, and farming experience based on the multinomial logistic regression model that was utilized to examine the relationship between socioeconomic characteristics and farmers' adaptation to climate change. Based on the findings, it is recommended that the crop farmers look out for and engage themselves in off-farm activities to raise funds to supplement their farming engagements.

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