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ASSESSMENT OF PERCEPTION TO CLIMATE CHANGE AND MITIGATION RESPONSE AMONG SMALLHOLDER RICE FARMERS IN EBONYI STATE OF NIGERIA

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ABSTRACT

The study assessed the perception to climate change and mitigation response among small holder rice farmers in Ebonyi State of Nigeria. The study used multistage sampling procedure in selection of 254 respondents for the study. Data were collected using structured questionnaire administered to 254 selected rice farmers. Data were analyzed using a combination of analytical tools such as descriptive statistics, multiple regression and factor analysis. Result showed that majority (66.1%) of the respondents were male with mean age of 41 years. Majority (70.1%) of the respondents were married with mean household size of 6 persons. The mean years spent schooling by the rice farmers was 12 years. The average farming experience of the respondents was 15 years with an average farm size of 1.5 hectare. The mean annual income of the respondents was ₦740,011.42k. The result of the multiple regression analysis indicated that the coefficient of determination (R^2) was 0.757. The Goodness-of-Fit of the model was confirmed by the value of F-statistics (4.534). The overall model was statistically significant ($P<0.05$). Further result showed that critical constraints that limit the smallholder rice farmers' capability to mitigate the effects of climate change on rice production were: infrastructural, institutional and economic constraints. The null hypothesis tested were rejected and alternative hypothesis accepted. The study concluded that there is significant relationship between the socio-economic characteristics of the rice farmers and their response to climate change in Ebonyi State, Nigeria. The study recommended that extension agents are expected to provide climate change information and training to farmers on how to cope and adapt to climate change effectively. However, these agents are hardly available as a result of inadequacy; government should therefore recruit additional extension agents to carry out this essence duty.

KEYWORDS: Perception, climate change, mitigation, climate change responses, rice farmers

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1. Introduction

Agriculture is one of the effective ways to alleviate hunger, poverty and remained one of the top and widely profitable business sectors (Amungwa & Baye, 2014; Idu *et al*, 2021). The transformation of agricultural sector and food production to satisfy the hungry population as well as bridge the gap between population growth and food availability remains one of the major problems facing the policy makers in Nigeria. One of the factors identified as a challenge to increase in food production is changes in climate due to global warming. The resultant effect of these changes on agricultural sector especially on animals and crop production has become an issue of increasing importance all over the world (Oguntegbe *et al*, 2019). According to Ayuba and Oruonye (2022), climate change is perhaps, the greatest challenge facing our planet. The changes manifest in the form of alteration in rainfall, excessive flooding, increased temperature, long period of drought, devastation of surface and groundwater, destruction of ecosystem and low agricultural productivity. Studies have shown that these unforeseen changes due to global warming affects rice production.

The vulnerability of Nigerian agriculture to climate change is of particular interest to government because it is key sector in the economy accounting for between 60-70% of the labor force and contributing about 30% of the nation's GDP (Gusmanov *et al*, 2022). They further stated that the sector is the source of raw materials used in local industries and providing foreign exchange earning to the country. Smallholder farmers can only achieve their food, income and livelihood security objectives in the face of changing climatic and socio-economic conditions by making tactical responses to climate change adaptation (Nhemachena and Hassan (2007) and Oloyede *et al*, 2020). Federal Ministry of Agriculture and Rural Development (2012) noted that Nigeria is ecologically endowed to attain self-sufficiency in rice production with potential land area for rice production between 4.6 million and 4.9 million Ha. They further reported that, in spite of the immense untapped potential of rice production in Nigeria, only 1.8 million ha of Nigeria's total land mass suitable for rice production is cropped to rice. In spite of the very favourable ecologies for rice production in Nigeria, production of rice remains low due to resultant effects arising from climate change variabilities. Therefore, the choice for a balanced approach to the use of rice production systems to mitigate effect of climate presents an opportunity to be exploited (Sakhiya *et al*, 2021).

In Nigeria, rice is consumed by both poor and rich families (Ayuba & Oruonye, 2022). The changes in employment and diets pattern, population growth and urbanization, has made rice acceptable to an average Nigerian leading to increase in its demand and importation (Adesola & Okoruwa, 2019). According to the United Nations for Food and Agricultural Organization (2015), Nigeria imported 2.3 million tonnes of rice in 2016 which represents about half of the nation's estimated requirement (5.2million tonnes), spending about 5 million dollars a day for rice shipment. It also reported that rice accounted for about 1.26% of the entire budget for 2017. However, studies within and outside country has attributed the low production of rice to impact of climate change (FAO, 2015). Ugwu *et al*, (2013) observed that drought, extreme rainfall and flood as a result of changes in climate negatively affected rice yield in predominately rain-fed areas. Similarly, the assessment conducted on the effect of climate change on rice production in Anambra State by Nwaleji and Uzuegbunam (2013), showed that deforestation and indiscriminate bush burning were some of the causes of climate change. Onoja and Achike (2014), posed that the adverse consequences of climate change will take an irreplaceable toll on food production and food security if not checked.

Ebonyi state rice farmers has the potentials to feed the nation but is severally affected by climate change. Several empirical studies have measured the impact of environmental changes on agriculture in Africa. For instance, study by Mano and Nhemachena (2006), revealed that environmental change had a remarkable change on African agriculture. Evidence from World Bank (2011) confirmed the effects of climate change on farm net revenue in different parts of the globe through rainfall and temperature variability. A lot of efforts have been made to improve the production of rice in Ebonyi State. In 2016, the ministry of Agriculture and natural resources made available improved rice varieties and other farm inputs to farmers at a subsidized rate. The installation of rice milling machines in strategic locations where rice is grown brought smile to the farmers face. Irrespective of these, there persist a supply gap for rice. The ability of rice farmers in Ebonyi State to meet the demand for the crop is assumed to be limited due to changes in climatic factors and the farmers' perception and response towards it. Estimates indicated that over 90 percent of domestic rice production comes from resource poor and weakly organized smallholder rice farmers (Angelucci, 2013).

Studies on rice production were geared towards maximizing profit, ignoring the climatic factors that influence and contribute to rice production negatively. Information on perception of these climatic changes by small holder farmers have been lacking. There has been paucity of information on the perception, mitigation and responses to climate change by smallholder rice producers in Ebonyi State, hence the choice for the research. This study aims to close this gap. In view of the importance, this study provides information on the responses to climate change on rice production by smallholder farmers in Ebonyi State, Nigeria. This research could be beneficial to farmers by giving them access to full knowledge of the dominant strategies to mitigate climate changes.

This study assessed perception to climate change and mitigation response among smallholder rice farmers in Ebonyi State, Nigeria. The specific objectives were to: describe the socio-economic characteristics of the rice farmers; assess the smallholder rice farmers' perception and mitigation responses to climate change; identify the dominant rice farmers' strategies to mitigate climate change; determine the relationship between socioeconomic characteristics of the smallholder rice farmers and their response to climate change; and identify critical constraints that limit the smallholder rice farmers' capability to adapt strategies to mitigate the effects of climate change on rice production.The hypothesis of the study is that socioeconomic characteristics of the smallholder rice farmers have no significant relationship with their responses to climate change.

2. Methodology

The Study Area

The study was conducted in Ebonyi State which is located in the southeastern part of Nigeria. The geographical coordinates for Ebonyi State are approximately Latitude: 6.2649° N, Longitude: 8.0137° E. Ebonyi State is made up of thirteen local government areas and three agricultural zones thus: Ebonyi North, Ebonyi Central and Ebonyi South. The state is bordered in the North by Benue State, East by Cross River State, South by Abia State and West by Enugu State (Nwinya, Obienusi & Onuoha, 2014). It has the total land mass of about 5,530 sq/km and a population of about 2.1 million people (NPC, 2006 in Nwinya, Obienusi& Onuoha, 2014). The area has a tropical climate with annual rainfall of about 180mm and relative humidity between 65-75%. Ecologically, it falls within the tropical rainforest zone and it is suitable for the cultivation of many types of crops such as yams, cassava, rice, maize, plantain, banana, fruits, vegetables and tree crops. Basically, majority of the people are civil

servants, public servants and farmers who practice mostly mixed type of cropping such as maize, yam, cassava, potatoes, and rice. Goats, sheep, cow, and chicken are the types of animals they kept in the area.

Sampling technique

A multistage sampling procedure was adopted selecting respondents for the study. Stage one: there was 10% proportionate sampling from 2959, 3381 and 2113 list of rice farmers in each of the zones using a list obtained from EBADEP. Hence, 296, 338 and 211 were selected from each zone. Stage two: There was purposive selection of 2 Local Government Areas (LGAs) from each of the 3 zones of the state. The selected LGAs are Izzi and Abakaliki from the North, Ezza South and Ikwo from the Central, Afikpo North and Onicha from the South. The choice of purposive at this stage was based on the intensity of rice production in the area. Again, purposive sampling helps in selecting LGAs that are not contiguous to each other. Stage three: Proportionate selection (15%) of the proportionately selected farmers from the zone. Hence, a total of 254 smallholder rice farmers were selected with 88, 102 and 64 from Ebonyi North, Central and South respectively.

Data Collection

Data were collected from primary source. The primary data were collected using structured questionnaire.

Analytical technique

Descriptive statistics such as percentage, frequency, mean, were used to achieve objectives i, ii, iii. Objective iv was realized using multiple regression technique. Objective v was achieved using factor analysis to realize the major constraints that limit rice farmers from responding to climate change in the study area.

Ordinary Least Square (OLS) Regression

The implicit form of the regression is shown as:

$Y = F [X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}, e]$ …….. (1)

The explicit function is stated as:

$Y = a+b_1AGE+ b_2GEND +b_3MRS +b_4HHS + b_5LE + b_6FE + b_7MCA + b_8FS +b_9AI + b_{10} MLA+ E$ …….. (2)

where: Y = Number of adaptation strategies used by the rice farmer.

X_1 (AGE) = Age [Years]

X_2 (GEND) = Gender [F = 0, M = 1]

X_3 (MRS) = Marital status [Single = 1, Married = 2, Divorced = 3]

X_4 (HHS) = Household size [Number]

X_5 (LE) =Level of education [Years]

X_6 (FE) = Farming Experience [Years]

X_7 (MCA) = Membership of co-operation society [No= 0, Yes=1,]

X_8 (FS) = Farm Size [hectares]

X_9 (AI) = Annual Income [₦]

X_{10} (MLA) = Method of Land Acquisition [inheritance 1, family 2, communal 3, purchase 4, Lease = 5]

E = stochastic error term

3. Results and Discussion

Table 1: Socio-economic characteristics of the respondents in the study area

Variables	Category	Frequency	Percentage	Mean
Age (Years)	21-30	30	11.8	
	31-40	84	33.1	41
	41-50	100	39.4	
	51 – 60	31	12.2	
	Above 60	9	3.5	
Gender	Male	168	66.1	
	Female	86	33.9	
Marital Status	Single	49	19.3	
	Married	178	70.1	
	Widowed	27	10.6	
Family size	1 – 3	12	4.7	
(No of persons)	4 – 6	180	70.9	
	7 – 10	51	20.1	6
	Above 10	11	4.3	
Level of education	Primary Education (0 - 6)	46	18.1	
(years)	Secondary Education (7-12)	111	43.7	12
	Tertiary Education (> 12)	97	38.2	
Farming experience	≤ 5	52	20.5	
(years)	6 - 10	46	18.1	15
	11 - 15	34	13.4	
	Above 15	122	48.0	
Farm size (ha)	≤ 1.0	101	39.8	
	1.1– 1.5	65	25.6	
	1.6 – 2.0	66	26.0	1.5
	2.1 – 2.5	8	3.1	
	Above 2.5	14	5.5	
Level income	≤ ₦200,000	48	18.9	
	₦200,001- ₦500,000	62	24.4	
	₦500,0001-₦1,000,000	86	33.9	740,011.42
	Above ₦1,000,000	58	22.8	
Membership of	Yes	165	65.0	
cooperative society	No	89	35.0	
Environmental agent	No contact	37	14.6	
	Regular contact	189	74.4	
	Very regular contact	28	11.0	
Land acquisition	Purchased land	54	21.3	
	Leased/rented the land	25	9.8	
	Used community land	32	12.6	
	Inherited the land	120	47.2	
	Used family land	23	9.1	

Source: Data from the field, 2023

Socio-economic Characteristics of the Respondents in the Study Area

Results of the socio-economic characteristics of the respondents are presented in Table 1. Result revealed that majority (66.1%) of the respondents were males. This indicates dominance of male farmers in rice production suggesting that rice production in the area is

predominantly male occupation. This finding was corroborated with FAO (2010) report which noted that responses to climate change in agriculture must be gender – specific, initiatives need to ensure that male and female are included. The study also revealed that 39.4% of the smallholder farmers were in the age range of 41– 50 years. The mean age was 39 was observed among the smallholder rice farmers. This is an indication that farmers are their active and productive age group. This age group is important considering that rice farming is still carried out using manual labour and as such, the huge energy requirement. The finding of this study agrees with Oyekale and Idjesa (2009) who reported that the mean age of farmers in Nigeria is between 41-50 years who are advantaged to adoption of innovation. The result equally shows that 70.1% of the respondents were married. This result suggests that rice farming is a viable economic venture which couples consider attractive enough as a means of livelihood and income generating enterprise. These couples because of their desire to earn reasonable income for maintaining their marital obligations, adopt innovations that will improve income generation. This is in agreement with the finding of Agbom (2012) who reported that more married farmers were involved in adoption of agricultural technology in Oyi local government area of Anambra State. The family size of respondents indicates that 70.9% have between 4 – 6 persons. The mean household size was 6 persons. The result indicates relatively moderate family size, which is advantageous to the rice farmers because it provides free labour for rice farming operations. The result of this is in conformity with that of Amusa *et al* (2011) who observed that the family size of most farmers in Nigeria is between 6-10 persons. The result equally shows that the education attainment of most (43.7%) of the respondents was secondary education. The mean years spent schooling by the rice farmers was 12. This finding is an evidence that the smallholder rice farmers in the study area were literate and as such could read and write which is vital to technology acquisition and knowledge assimilation for mitigating climate change impact on rice production. This is a great advantage for mitigation of climate change as Agwu*et al*., (2009) and Eboh *et al*., (2006) have noted that better education promotes the adoption and use of technologies more efficient for farm management practices.The result of farming experience indicated that 48% of the respondents had been involved in rice production for more than 15 years. The average farming experience of the respondents was 15 years. This implies that rice farmers have been engaged in rice production for reasonable length of time. This level of experience is important for developing positive perception and response to climate change. This findings is in line with the work of Gadédjisso-Tossou, (2015) who reported that farmers who had the benefit of rice farming over years may have gathered enough experience, knowledge and information concerning climate change and therefore their approaches towards handling climate change issues. The result further revealed that 39.8% of the respondents cultivated less than or equal to 1 ha of farmland. The average farm size was 1.5ha. This suggests that the respondents are still operating at small scale level probably due to land fragmentation which is a common practice in Ebonyi State. Thus, subsistence farming system is still predominant in the area. This result is consistent with works of Edeh *et al* (2011), Nwinya et al., (2014) who noted that most farmers in Ebonyi, Oyo and Cross River States respectively operate at peasant level, possessing 1 - 4 hectares of farm land. The mean annual income of the respondents was ₦740,011.42k. This level of income is moderate, considering the current economic reality in the country. However, Okello (2005) remarked that increase in income would enable poor households save more financial resources and consequently gain financial stability to mitigate climate change.

Table 2: Smallholder rice farmers' perception and responses to climate change in the study area

Climate Change Variables	Frequency	Percentage
Usual early rains that are follow by weeks of dryness	197	77.9
There is always irregular rainfall	235	92.5
There is delay in unset of rain	227	89.4
Longer period of dry season	189	74.4
Heavy and long period of rainfall during rainy season	235	92.5
Reduced harmattan period	140	55.1
There is increase temperature	173	68.1
Incidence of heavy winds	237	93.3
Increased incidence of flood	211	83.1
Long period of Drought	230	90.6
High rate of disease incidence	174	68.5
Loss of soil fertility	234	92.1
Overflowing of streams/rivers	196	77.2
Drying up of rivers & streams	228	89.8
Increased incidence of gully erosion	240	94.5

Source: Data from the field, 2023

Smallholder Rice Farmers' Perception and Responses to Climate Change in the Study Area

The result in Table 2 showed that the smallholder farmers' perceptions on climate change that affect rice production in Ebonyi State. Based on the smallholder rice farmers' responses, it was observed that; Usual early rains that are follow by weeks of dryness (77.9%), irregular rainfall (92.5%), there is delay in unset of rain (89.4%), longer period of dry season (74.4%), heavy and long period of rainfall during rainy season (92.5%), incidence of heavy winds (93.3), increased incidence of flood (83.1%), long period of drought (90.6%), loss of soil fertility (92.1%), overflowing of streams/rivers (77.2%), drying up of rivers & streams (89.8%), increased gully erosion (94.5%) were the major smallholder farmers' perceptions on climate change. These variations in climate elements and its manifestations impact greatly on agricultural activities and food production. The result is similar to that of Bomant (2018) who observed that an overwhelming majority of Nigerian farmers are now aware that climate change is already happening. However, this is contrary to the report of Aklilu and Desalegn (2017) who observed that climate change is still new in our system and its perception is still low to the society even the knowledge about it in our institutions and research stations are localized.

Table 3: Dominant rice farmers' adaptation strategies to mitigate climate change in the study area

Adaptation strategies	Frequency	Percentage
Early planting	229	90.2
Raising of nursery	213	83.9
Early transplanting of rice	189	74.4
Use of chemicals (herbicides, pesticide, insecticide)	167	65.7
Change in planting dates	150	59.1
Change in the time of land preparation	163	64.2
Use of improved variety of rice	146	57.5
Changing farm location	161	63.4
Terrace farm site	142	55.9
Irrigation practices	179	70.5
Use of manure/fertilizers	212	83.5
Later harvesting of rice	148	58.3
Paying homage to rain making (tradition rain)	198	78.0
Planting deeper than normal depth	201	79.1

Source: Data from the field, 2023

Dominant Rice Farmers' Adaptation Strategies to Mitigate Climate Change in the Study Area

Result in table 3 revealed that the major dominant rice farmers' adaptation strategies to mitigate climate change were: early planting (90.2%), raising of nursery (83.9%), early transplanting (74.4%), use of chemicals (herbicides, pesticide, insecticide) (65.7%), change in the time of land preparation (64.2%), changing farm location (63.4%), irrigation practices (70.5%), use of manure/fertilizers (83.5%), paying homage to rain making (tradition rain) (78.0%) and planting deeper than normal depth (79.1%). These are indications that the farmers had developed and practiced several adaptation strategies considered necessary to mitigate the impact of climate change. This follows the findings of Yusuf Idrisa (2012) who reported that the adaptation strategies practiced by framers in Sahel Savanna zone of Borno State, Nigeria were the use of irrigation to augment shortfall of rains, mulching/cover cropping, planting ahead of rains, intensive manure application and planting crop variety tolerant to climate change.

Table 4: Relationship between socioeconomic characteristics of the smallholder rice farmers and their responses to climate change

Parameters	Coefficients (B)	Std. Error	t-values
Age	0.002	0.022	0.099
Gender	-0.079	0.581	-0.136
Marital status	0.608	0.376	1.617
Family size	-0.021	0.099	-0.217
Level of education	0.008	0.002	3.478
Farming experience	0.026	0.008	3.250
Member of co-operative society	1.974	0.437	4.517
Farm size	0.469	0.413	1.135
Level of income	5.771E-7	0.000	3.897
Contact with the environment management agents	0.942	0.406	2.321
Constant	7.121	1.490	4.780
F-ratio	4.534		
R^2	0.757		
Adjusted R^2	0.723		

Source: Data from the field, 2023

Relationship between Socioeconomic Characteristics of the Smallholder Rice Farmers and their Responses to Climate Change

The result of the multiple regression analysis presented in Table 4 revealed that the coefficient of determination (R2) was 75.7%. This implies that 76 percent of the total variation observed in the dependent variable was sufficiently explained by the combined effects of changes in the independent variables included in the regression model. The Goodness-of-Fit of the model was confirmed by the value of F-statistics (4.534). The overall model was statistically significant ($P<0.05$), signifying that the socio-economic characteristics of the rice farmers have significant relationship with their responses to climate change. However, level of education, farming experience, membership of cooperative society, farm size, and annual income had positive coefficients, suggesting that these variables positively influenced the rice farmers response to climate change. Furthermore, educational level, farming experience, farm size, and annual income were statistically significant at different levels of probability.

Coefficient of level of educational was positive and statistically significant at 5% level of probability. This indicates that farmer with high educational background have better responses and strategies to mitigate climate change. In other words, education influences farmers' willingness to adapt to climate change. This is in conformity with the a priori expectation because educated farmers are expected to have more knowledge and information about climate change and agronomic practices suitable for their rice production. This supports the findings of Deressa *et al*., (2019) that education significantly increases farmers' responses to climate change.

The coefficient of farming experience was positive and statistically significant at 1% of level of probability. This implies that more experiences acquired as a result of years of rice farming ultimately led to increase in farmers' response to climate change and this conforms to the a priori expectation.

The coefficient of cooperative membership was positive and statistically significant at 1% of level of probability. This is an indication that membership of cooperative society influenced rice farmers responses to climate change. This finding is in line with the a priori expectation as cooperative society provides social platform for exchange of new ideas and acquisition of climate change adaptation strategies which are essential for cushioning the adverse effects of climate change.

The coefficient of annual income was positive and statistically significant at 1% level of probability. This implies that farmers with high income are more likely to respond to climate change. This is in conformity to the a priori expectation. Increase in farmer's income will enhance their capabilities to respond to effects of climate change. The findings of the study agreed with Tazeze *et al* (2012) that income of the farmer has a positive and significant impact on their adaptation practices to mitigate climate change.

.The coefficient of contact with environment management agent was positive and statistically significant at 5% level of significance. This implies that regular contact with environment management agent will enhance rice farmers' capability to respond to climate change. In other words, the contact with environmental management agents influences farmers' response to climate change.

Table 5: Critical constraints that limit smallholder rice farmers' capability to mitigate the effects of climate change on rice production

Constraints	Infrastructural constraints	Institutional constraints	Economic constraints
Inadequate access to land	0.136	**0.803**	0.046
Low farm income	0.242	**0.857**	0.256
Inadequate access to improved rice varieties	0.103	0.159	**0.755**
Lack of information	**0.761**	0.161	0.341
Poor social network	0.270	0.290	**0.904**
No access to weather forecast	0.298	0.308	**0.886**
High cost of farm labour	0.279	0.266	**0.896**
Lack of government assistance	0.118	0.838	0.445
High cost of organic fertilizer	**0.829**	0.088	0.096
Lack of irrigation facility	**0.846**	0.135	0.295
Poor extension service	0.026	**0.768**	0.268
Low level of education	**0.833**	0.130	0.177

Source: Data from the field, 2023

Critical Constraints that limit Smallholder Rice Farmers' Capability to Mitigate the Effects of Climate Change on Rice Production

Table 5 showed the result of critical constraints that limit the smallholder rice farmers' capability to adapt strategies to mitigate the effects of climate change on rice production. The study identified infrastructural constraints such as; lack of information, high cost of organic fertilizer and lack of irrigation facility; institutional constraints such as inadequate access to land, low farm income, poor extension services; and economic constraints such as poor social network, no access to weather forecast and high cost of farm labour. These however, represent the principal critical constraints that limit the smallholder rice farmers' capability to adapt strategies to mitigate the effects of climate change on rice production in Ebonyi State. This implies lack of information and insufficient fund hinders farmers from getting the necessary resources and technologies which assist to mitigate climate change.This is in

agreement with the findings of Deressa (2019) who identified five major constraints to farmers' adaptation to climate change in Nile basin region of Ethiopia as lack of information pertaining climate change, lack of money, shortage of labour and land and poor facilities for irrigation. Furthermore, the findings of the study are in tandemwith the work of Nzeadibe *et al*., (2011) who reported that inadequate information, low awareness level, poor government attention to environmental issues, lack of access to improved crop varieties, ineffectiveness of indigenous methods, limited knowledge on adaptation measures, low institutional capacity and absence of government policy on climate change were the major constraints to climate change adaptation.

4. CONCLUSION AND RECOMMENDATIONS

Based on the findings of this study, it was concluded that rice production in Ebonyi State was dominated by married, literate males with mean age of 41 years, mean household size of 6 persons, average farming experience of 15 years and average income of ₦740,011.42k. Furthermore, level of education, farming experience, membership of cooperative society, farm size, and annual income were socioeconomic variables that positively influenced the rice farmers response to climate change.In the course of mitigating effects of climate, the farmers were faced with the following constraints; infrastructural, institutional and economic constraints.

- Farmers should organize themselves into cooperative organization so as to access credit from financial institutions and pool their resources together for establishing small-scale irrigation scheme. This will enhance access to all year water for farming activities.
- Government should increase investment on social and physical infrastructures particularly on those institutions dealing with climate related issues to strengthen farmers' capacity to adapt climate change.
- Government should reconsider providing subsidy on farm inputs, in addition to ensuring effective distribution to enable farmers access them on record time so as to be ahead of varying climate.
- Regular training should be organized for the farmers to enhance their capacity to harness and utilize indigenous adaptive strategies for combating climate change.
- The government should establish mini meteorological stations in local communities to serve the weather needs of farmers in the rural communities. This will enhance farmers' access to timely and accurate weather information for timely farm planting.

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