Schemes For Enhancing Climate Change Resilience Among Rice Farmers For Food Security In Ebonyi State, Nigeria

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Abstract.

This study determined schemes for enhancing climate change resilience among rice farmers for food security in Ebonyi State. Three specific purposes guided the study. The study was a survey research design and used questionnaire to elicit information from 162 respondents, made up of 108 registered rice farmers and 54 extension agents. Data collected through the questionnaire were analyzed using mean and standard deviation to answer the research questions, while t-test was used to test the hypotheses. The study identified seven schemes from government, seven schemes from agricultural institutions and six from farm practices for farmers to adopt to manage climate change. It implies that if government could packaged the identified schemes into extension training programme, farmers could be resilient in the face of climate change. It was then recommended that extension agents should train and encourages farmers to adopt the schemes.

Keywords: *Schemes, Climate change, Resilience, Rice farmers and Food security.*

I. INTRODUCTION

Common observations show that Nigerian food system is failing. Today, many families including rural farm families are hungry and not able to get enough food for normal physical and mental growth (Akpata, 2024). All key sectors of the economy with special reference to education, health, peace and security as well as growth derivers of the economy are threatened by the failure of the food systems. Food system is a complex process, encompassing food production, processing, distribution and consumption (Egbe, 2018). Effective food systems have sustainable farming practices to produce adequate food, efficient food processing, efficient transport systems and proper food utilization. But, in Nigeria, food systems suffer institutional problems like insecurity in the form of banditry, terrorism and kidnapping, which badly affect farmers leading to hunger, diseases and poverty. Climate change adds greatly to these problems because most Nigeria farmers depend on rain-fed agriculture, the sector that is heavily affected by changes climate.

The overwhelming consensus of experts is that the climate changes and it affects agricultural activities (Thinda, Ogundeji & Belle, 2020; Mushore, Mhizha, Manjuwe and Mushambi, 2021; and Egbe, Chieme, Esheya and Oku, 2025). According to Mckinely and Pede (2021) climate change is a variation in climate parameters such as cloud, precipitation, temperature and sunshine, which leads to changes in rainfall pattern, heat stress, drought and floods. In the opinion are Feliciano and Recha (2022) climate changes is a change in earth weather patterns or average weather conditions and climate system of a place. These authors stated further that climate change is a reality affecting farm communities in diverse ways such as increase in frequency and intensity of floods, drought and extreme temperature.

The attendant problems to extreme climate events are crop infestations by diseases and pests, increase in weeds, and erosions which are detrimental to crops and animals (Misra, 2020). In the context of this study, climate change is a variation in rainfall patterns, temperature, sunshine and winds which affect rice production practices and put food security at risk.In Ebonyi State, climate change causes occasional floods, droughts and erosion which have some physiological effects on agriculture such as increased weeds, pests and diseases challenges, (Egbe, 2018). He states further that climate change alters growing seasons, decreases yields of crops, especially rice and increases risk in food security. Its impacts is more pronounced

in rural communities dominated by small scale farmers who depend on annual rainfall for cropping activities. In fact, it affect all dimensions of food security.Food security is a situation when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life (Food and Agricultural Organization of United Nations, FAO, 2016). The FAO (2016) document contained the four pillars of food security: availability of food, accessibility, adequacy and stability of food supply. Climate change badly affects these pillars of food security, especially sufficient food production (availability) and food access. Thus, Nwajiuba (2019) lamented that Nigerians are a little away from food crisis; as the four pillars of food security are not quarantined. Today, the rise in prices of food items force great number of people into hunger and poverty. This reinforces the needs for a more strategic forward-looking measures to scale up efforts to build climate change resilience schemes among farmers.

Climate change resilience is explained as the ability to prepare for, withstand and recover from the challenges presented by climate change (Thinda, et. al, 2020). It is explained in this study as the ability of rice farmers to withstand stresses from environmental (climate) changes and maintain functioning in the face of the stress. Mushore, *et al* (2021) reported that climate change resilience are both the adaptation and mitigation measures. Intergovernmental panel on climate change, (IPCC, 2023) explained adaptation as the process or action taken to adjust to actual or expected climate change and its effects. The IPCC (2023) document explained mitigation as efforts to reduce or prevent climate change by preventing emission of greenhouse gases. Adaptation and mitigation to climate change entails a range of actions from governments, non-governmental organization, agricultural institutions, communities and farmers (IPCC, 2023). The actions and processes from the stakeholders will enhance farmers socio-economic, natural, physical and financial capabilities to cope with and recover from impacts of climate change. These actions are summarized under schemes.Schemes are explained in the context of this study as operational guideline for action. This explanation is in keeping with the definition given by Egbe and Eze (2016) that a scheme is a strategy, mechanism, measure for actions put in place by government, institutions or individuals to improve a system. Thus, Nelson and Koku (2019) said that various measures or schemes have to be in place for farmers to build and enhance climate resilience. To enhance in this study, means to strengthen efforts and ability of farmers to cope with climate changes. Pike, Dawly and Tomaney (2021) said that farmers need education and better access to farm credits to enhance their ability to adapt to climate change. To Danso-Abbeam and Ogundeji (2021) government collaborations with non-governmental organizations and individuals will provide financial, technical and technological supports to farmers to be resilient in the face of climate change.

This, implies that actions or schemes from different stakeholders will build climate resilient farming, in which farmers will produce greater quantity and quality rice.Rice (oryza sativa) is one of the leading cereals in Nigeria and one of the major staple food in Ebonyi State. Ebonyi is the leading rice producing State in Nigeria, and Ebonyi rice is consumed locally and exported as “Ebonyi rice world” or “Ebonyi Gold”. But the production of Ebonyi rice is challenged by soil degradation and climate change. Onyeneke, Amadi, Njoku and Osuji (2021) reported that climate change and its extreme events such as floods, heat stresses, and drought affect rice production in Ebonyi State. These authors reported further that the extreme weather events lead to pests and diseases infestations on rice farms which in turn cause poor yields. Again, the rice farmers are mostly small holders who lack the capacity to mitigate or adapt to climate change events. This makes them more vulnerable to climate change and its extreme events. It is against this background that this study is designed to scheme out ways of enhancing farmers resilience to cope with climate change for food security.

Purpose of the Study

The main purpose of this study is to determine schemes for enhancing climate change resilience among rice farmers for food security in Ebonyi State. Specifically, the study sought to determine:

1. Government schemes for enhancing climate change resilience.
2. Schemes from agricultural institutions for enhancing climate change resilience
3. Schemes from farmer practice for enhancing climate change resilience among rice farmers.

II. METHODS

The study was carried out in Ebonyi State, Nigeria. Ebonyi was chosen for the study because it is an agrarian state dominated with rice farmers whose activities are affected by climate change. The study was a descriptive survey research design; and multi-stage sampling technique was used to select respondents. The first stage was a random selection of two Local Government Areas from each of the three agricultural zones of the State. In the second stage, three (3) communities were randomly selected from each of the six (6) local government areas, giving 18 communities. The third and last stage involved purposive selection of 6 registered rice farmers and 3 extension agents from each of the 18 communities, giving a total of 162 respondents.Data gathered through questionnaire and direct observations were analyzed using mean and standard deviations to answer the research questions. A cut-off point of 2.50 was established from the four response options of the instrument. The cut off point of 2.50 was used for decision making on items accepted as schemes and those not accepted.

III. RESULTS AND DISCUSSIONS

The results of this study are presented in order of research questions using tables.

Research question 1

What are the government schemes for enhancing climate change resilience among rice farmers in Ebonyi State?

Data for answering this research question are presented in table 1

Table 1. Mean responses and t-test Analysis of Farmers and Extension Agents on Government's Schemes for Enhancing Climate Change Resilience Among Rice Farmers

S/N	Item Statement	x_1	SD_1	x_2	SD_2	xg	t-tab	t-cal	Decision
1	Climate change management policies are schemes for enhancing resilience	3.38	0.70	3.37	0.72	3.38	1.96	0.63	NS
2	Government Agricultural funding is a scheme for enhancing climate change	3.13	0.74	3.11	0.72	3.12	1.96	0.93	NS
3	Training of farmers on climate change is a scheme for enhancing resilience	3.02	0.70	3.01	0.73	3.02	1.96	0.62	NS
4	Provision of irrigation system is a scheme for enhancing climate resilience	2.98	0.77	2.97	0.73	2.98	1.96	1.66	NS
5	Provision of agricultural insurance is a scheme for enhancing resilience against climate risks	2.84	0.80	2.83	0.82	2.84	1.96	0.55	NS
6	Establishment of weather stations in villages is a scheme for enhancing climate resilience	2.65	0.84	2.63	0.86	2.64	1.96	0.39	NS
7	Water harvesting is a scheme for enhancing farmers' resilience for climate change	2.54	0.83	2.53	0.89	2.53	1.96	0.59	NS

$\bar{x}_1$, $\bar{x}_2$ = mean responses of farmers and extension agents respectively

SD_1, SD_2 = Standard deviation of farmers and extension agents

$\bar{X}g$ = Grand mean

Data presented in table 1 revealed that the grand mean (xg) of all the seven items are each above the cut off point of 2.50, signifying that the respondents accepted each to be a scheme for enhancing farmers' resilience to cope with climate change. These findings as climate change management, policies, training of farmers and funding agricultural activities enhance farmers resilience to cope with climate change. These agree with the reports of Amoba and Onyishi (2015) and Danson- Abbeam et al (2021) that effective policies, training of farmers and agricultural funding are schemes to farmers' resilience to manage climate change.This study also identified that provision of insurance irrigation systems, weather stations at villages and water harvesting as schemes for making farmers resilient in the force of climate change. These findings are in consonance with the reports of Onyeneke et al (2021) that provision of irrigation system, insurance

cover and drought resistant crop varieties are climate smart agriculture in rice production. The findings are further supported by Marganada and Cafarina (2022) who reported that provision of irrigation systems help farmers to manage climate change risks, avert drought and grow all seasons' crops.

Research Question 2

What are the schemes from agricultural institutions for enhancing climate change resilience among rice farmers?

Data for answering this research question are presented in table 2.

Table 2. Mean Response and t-test Analysis of Farmers and Extension Agents on Schemes from Agricultural Institutions for Enhancing Climate Change Resilience.

S/N	Item Statement	x_1	SD_1	x_2	SD_2	xg	t-cal	t-tab	Decision
1	Development of rice varieties tolerant to climate change events	3.53	0.59	3.32	0.60	3.33	1.96	0.31	NS
2	Equipping farmers with climate knowledge and coping skills is a scheme for climate resilience	2.90	0.61	2.88	0.70	2.89	1.96	0.42	NS
3	Dissemination of information on climate adaptive measures is a scheme for farmers resilience	2.73	0.72	2.72	0.75	2.73	1.96	0.44	NS
4	Assistance to farmers affected by climate change is a scheme for farmers' resilience	2.55	0.85	2.54	0.87	2.54	1.96	0.66	NS
5	Provision of physical resources and technology support is a scheme to make farmers resilience	3.12	0.59	3.11	0.62	3.12	1.96	0.43	NS
6	Provision of access to credits is a scheme for farmers' resilience	2.91	0.65	2.89	0.67	2.90	1.96	0.68	NS
7	Coordination and collaborations between different stakeholder in climate risk management make farmers resilience	2.82	0.69	2.80	0.70	2.81	1.96	0.65	NS

Data presented in table 2 revealed that each of the 7 scheme items has a grand mean above the cut off point of 2.50. This implies that all the items are accepted as schemes to make farmers resilience in climate change management. Again. In each item, the t-calculated is less than the table t-value, signifying that there is no significance difference in the mean responses of farmers and extension agents.The study identified that provision of rice variety tolerant to climate change, training of farmers on climate issues, provision of information and technology support, access to credits and stakeholders collaborations are schemes to make farmers resilience in face of climate change. These findings are in keeping with the reports of Macus (2014) and that of Brown and Sonwa (2015) that research institutes, school, financial and insurance institutions develop crop tolerant to climate events, train farmers, give loans to farmers and provide insurance covers to climate risks respectively. These findings also agree with Pike, Dawley and Tomancy (2021) who reported that agricultural institutions actions are measures to educate, create awareness, provide assistance and resources for farmers to cope with climate change.The results of t-test analysis indicated that there is no significance difference in the mean responses of farmers and extension agents. These findings confirm the relevance of the schemes identified by this study from agricultural institutions for farmers to adopt as climate change coping strategies.

Research Question 3

What are farm practices as schemes for enhancing climate change resilience among rice farmers?

Data for answering this research question are presented in table 3.

Table 3. Mean Responses and t-test Analysis of Farmers and Extension Agents on Farm Practices as Schemes for Enhancing Climate Change Resilience

S/N	Item Statement	x_1	SD_1	x_2	SD_2	xg	t-cal	t-tab	Decision
1	Growing of flood and drought tolerant rice varieties make farmers resilience to climate change	3.52	0.55	3.51	0.58	3.52	1.96	0.29	NS

2	Insuring rice farms against weather risks enhances farmers resilience to climate change	2.95	0.66	2.94	0.69	2.95	1.96	0.39	NS
3	Growing of rice through irrigation enhances farmers' resilience to climate change	3.03	0.59	3.02	0.61	3.03	1.96	0.41	NS
4	Timely planting of rice is a scheme to enhance farmers' resilience	2.81	0.71	2.80	0.74	2.81	1.96	0.36	NS
5	Diversification of rice farming to include low and up land cropping enhances farmers' resilience to climate change	2.98	0.66	2.96	0.67	2.97	1.96	0.72	NS
6	Use of mulch and cover cropping in rice farms is a scheme to make farmers resilience to climate change	2.44	0.91	2.42	0.94	2.43	1.96	0.97	NS
7	Farmers' practice of zero or minimum tillage is a scheme for climate change resilience	2.69	0.80	2.68	0.85	2.69	1.96	0.52	NS

Data presented in table 3 show that six (6) scheme items have each a grand mean above 2.50, which is the cut off point. This indicates that the six items are accepted as schemes for climate change resilience. These findings of growing climate tolerant rice varieties, (cultivars) insuring rice farms, use of irrigation, timely planting diversifications of rice farming and zero tillage as schemes agree with the report of Idu, Fadiji and Chimdi (2023), that farmers' practices and actions are greatly needed in climate risk management. The findings are further supported by Mushore et al (2021) that timely planting, diversification of crop farming, and minimum tillage are actions that help farmers cope with climate change. But the finding that use of mulch and cover cropping is not a scheme to make farmers resilience does not agree with the purpose of the use of mulch materials. The respondents might have believed that it is difficult to mulch or grow cover crops together with rice in a field.The result of the t- test of null hypothesis indicates that there is no significance difference in the mean ratings of farmers and extension agents on schemes from farm practices. This findings stresses the need for farmers to engage on identified schemes and other good farm practice to avert risks from climate change.

IV. CONCLUSION

Climate change has serious consequences on rice production and in turn food security. This study identified schemes for enhancing climate change resilience among rice farmers for food security. It implies that if the climate change risks must be averted rice farmers must adopt the identified schemes in rice farming.

V. RECOMMENDATIONS

Based on the findings of this study, it was recommended as follows:

1. Government of Ebonyi State should educate rice farmers on identified schemes to enhance their climate change resilience
2. Agricultural research institutions should develop rice varieties that are tolerant to climate change
3. Farmers should accept and adopt the schemes identified to enhance their resilience to climate change.

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