
Perceived Resilience Capacity of Rice Farmers to Climate Change in Ebonyi State, Nigeria

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Abstract

The study determined rice farmers' perceived resilience capacity to climate change in Ebonyi State, Nigeria. Multistage sampling procedure was employed in selecting 104 respondents for the study. Data were collected using semi-structured interview schedule. Percentage, mean and standard deviation were used in presentation of results. Results showed that areas of rice farmers' resilience capacity to climate change were: planting improved varieties of seed (\bar{x} =4.76), utilisation of soil that retains water longer (\bar{x} =3.33), access to very fertile soil for rice production (\bar{x} =3.28) and good amount of solar radiation (\bar{x} =3.21). However, areas in which respondents' did not perceive as sources of resilience capacity were: favourable government policies (\bar{x} =2.37), good marketing policies (\bar{x} =2.57), and access to insurance (\bar{x} =2.84). Policies such as crop insurance, appropriate marketing and infrastructural policies that help rice farmers cope with negative effects of climate change be enacted and implemented. Such policies should address issues of marketing and insurance of rice farms against disasters such as flood, drought, diseases and pests' infestation.

Key words: Resilience capacity, climate change, adaptation strategies, rice

Introduction

Climate change is affecting rice production systems in an unprecedented scale. According to the World Economic Forum (2019), climate change may decrease rice yields by up to 40% by 2100. The concern on the impact of climate change on rice production lies on the strategic role of rice as both a food security staple and as an economic crop. Sinnarong, Chen, McCarl, and Bao-Linh (2019) estimates a reduction in mean rice production and an increase in production variance as a result of fluctuations in temperature and precipitation due to climate change. Drastic rainfall patterns and rising temperature will introduce unfavourable growing conditions into the cropping calendars. The World Economic Forum (2019) had predicted that future soil changes due to higher temperatures combined with flooded conditions as a result of climate change will cause rice plants to take up arsenic at higher levels and using irrigation water with high arsenic exacerbates the problem. The detrimental effects of climate change can reduce soil organic carbon (SOC) which is a critical element that affect soil health (Adityarup, 2017). The SOC has significant effect on the chemical, physical, and biological properties of soil. Thus, fluctuations in the SOC due to climate change effect will affect soil fertility, impact rice yield and consequently affect farmers' income from rice production. In other to continue and succeed in their livelihood activities and to ensure food security of populations, rice farmers would need to have means to cope with the effects of climate change. Ray (2017) asserts that as climate shifts, rice farmers need support to adapt to their agricultural methods so that they can be more productive and resilient.

Resilience is the capacity of hazard affected bodies to resist loss during disaster and to regenerate and reorganize after disaster in a specific area in a given period (Zhuo Wang and Wang, 2016). It is the process of adaptation and developing a set of skills, capacities, behaviours and actions necessary when dealing with adversity (Food and Agriculture Organization FAO, 2016). The International Food Policy Research Institute (IFPRI, 2014) asserts that agricultural resilience is all about equipping farmers to absorb and recover from shocks and stresses to their agricultural production and livelihood. Resilience building is very important in rice production. It helps rice farmers to adapt quickly to climate change. Building resilience on rice production systems involves looking at ways to adapt to climate change with intention of providing long term food, nutrition and income security (Bhawan and Cohen, 2014). Farmers that grow only rice are vulnerable to both climate change and market shock. Because of this, rice farmers have developed some adaptation measures to tackle the effects of climate change. For instance, Yakubu, Akpoko, Akinola, and Abdulsalem, (2020), found that rice farmers adapted to climate change through the use of improved varieties in terms of better yield, early maturing, drought tolerant and resistance to pests and diseases; intercropping. However, how best these measures are able to help rice farmers withstand, recover from and bounce back after extreme weather events remains unanswered. It therefore becomes

imperative to study how rice farmers perceive their areas of resilience capacity as they try to cope with the adverse effects of climate change on their livelihood activity.

Purpose of study

The study ascertained the perceived resilience capacity of rice farmers to climate change. Specifically, the study :

1. ascertained farmers' perception about climate change;
2. ascertained areas of climate change impact on rice farmers' livelihood; and
3. determined the areas of rice farmers perceived resilience capacity to climate change.

Methodology

The study was carried out in Ebonyi State, Nigeria. The State lies within latitude 7°31'N and 8°30'N of the Equator and Longitude of 5°40'E and 6°45'E of Greenwich meridian (Anorue et. al., 2017). The population for the study consisted of all rice farmers in Ebonyi State. Multistage sampling procedure was employed in selecting respondents. At the first stage, two agricultural zones (Ebonyi South and Ebonyi North) out of the three agricultural zones of Ebonyi were purposively selected based on dominance of rice production. At stage two, two (2) blocks were purposively selected from each zone based on level of rice production giving a total number of four (4) blocks. The selected blocks were: Ikwo, Ezza North (Ebonyi South), Akakaliki and Izzi (Ebonyi North). At the third stage, two (2) circles were randomly selected from each selected block giving a total of eight (8) circles. The circles include: Eleke, Ndufu-Echara, Umuogbara, Umuorizor, Agbaja, Nkeleke, Igbeagu and Ndi-eze. At stage four, there was random selection of thirteen (13) farmers from each selected circle giving a total of one hundred and four (104) respondents that were used for the study.

Data for the study were obtained from primary source. This was achieved using a semi-structured interview schedule. Data on socio economic characteristics of respondents that were obtained by asking respondents to indicate their sex (male or female), their actual age in years, educational level, farming experience (in years), monthly household income (in naira), quantity of rice harvested in the previous farming season (in bags), access to rice subsidies (yes or no), access to rice processing subsidies (yes or no), number of times of extension contact in the last one year, access and source of credit, and to indicate if they belonged to any social organization. Respondents were also asked to indicate if they had access to weather information (yes or no) and sources (friends and neighbour, radio, television internet). In order to obtain information on farmers' perception of climate change, respondents were asked to give their observed changes in weather parameter in the past ten years as follows: increased = 3, remain the same = 2, decreased = 1, and don't know = 0 with a mean of 2.5. Any response option with a mean of greater than or equal to 2.5 shows an increase in the parameter while a response option with a mean less than 1.5 indicates a decrease in the respective parameter. In order to determine the extent to which climate change is perceived to have impacted on rice farmers' livelihood activities, respondents were requested to rate the extent of climate change impacts on their livelihood activities on a 4 point Likert-type scale of

very serious = 4, serious = 3, undecided = 2, not serious = 1 and no impact = 0 with a mean of 2.0.

To obtain information on areas of resilience capacity of rice farmers to climate change, respondents were asked to rate the extent to which different resilient indicators had helped them cope with the adverse effects of climate change on their livelihood activities. This was obtained on a five-point Liker-type scale of great extent = 5, moderate extent = 4, undecided=3, little extent = 2, and no extent =1 with a mean of 3.0. Objective 1 was analysed using frequency, percentage and mean scores. Objectives 2 and 3 were analysed using mean and standard deviation.

Results and Discussion

Perception of Climate Change

Results in Table 1 show respondents' perception of climate change. From the result, respondents indicated that temperature had increased ($\bar{x} = 2.95$). This shows that respondents had noticed increase in temperature over the past ten years. The implication is that farmers can form important stakeholders in climate change issues since they are already aware of the changes. This result agrees with the findings of Oselebe, Nnamani, Efiuse, Onu, Eze, and Ogunji (2017) who reported that local farmers perceive climate change as increase in temperature. However, it contradicts a finding from the same work that farmers also perceive increase in rainfall regime as climate change. A study by Ratnasiri Walisinghe Rohde and Guest (2019) found that increasing temperatures will adversely affect rice production much more than varying rainfall. High temperature results in detriment phenological effects on rice plants which reduces yield. Also, high temperatures increase sea level which causes flooding and destruction of rice fields.

Table 1: Perception of climate change

Variables	Mean	Standard deviation
Temperatures	2.84*	0.84
Rainfall	2.07	0.10
Heat waves	1.96	0.16
Cold weather	1.66	0.16
Drought	2.31	0.81
Uncertainty in inception of planting seasons	2.03	0.53
Uncertainty in duration of planting seasons	2.16	0.66
Uncertainty in intensity of seasons	2.05	0.55

- * \geq 2.5; Source: Field survey 2018

Areas of Climate Change Impact on Rice Farmers' Livelihood Activities

Findings in the Table 2 reveal areas of climate change impact on rice farmers' livelihood activities to include: reduction in income ($\bar{x}=3.61$), uncertainties in planting date ($\bar{x}=3.56$), change in planting pattern ($\bar{x}=3.51$), increase in poverty among rice farmers ($\bar{x}=3.19$), change in harvesting date ($\bar{x}=3.18$). These findings show that rice farmers in the area are experiencing the impact of climate change in their livelihood activities. The implication is that the negative effects of climate change would constitute a major challenge to the farmers in the area. The negative effect of climate change can reduce rice yield which will definitely reduce income from production. These leads to poverty among rice farmers. According to van Oort and Zwart (2017) high temperatures due to climate change will reduce rice yield in West Africa by -21% for wet season irrigated rice and by -45% for dry season irrigated rice. Once there is a substantial decrease in rice yield, farmers will incur huge losses which may push them into poverty due to loss of income.

Also, findings show that other impacts of climate change on rice production were: destruction of transportation network by flood ($\bar{x}=3.11$), loss of rice farm to flood ($\bar{x}=3.09$), uncertainties in price of rice ($\bar{x}=3.04$), increase in prices of rice seed ($\bar{x}=2.69$), loss of farm land ($\bar{x}=2.47$). The catastrophic effects of climate change especially heavy flood events can result in serious destruction of rice fields. The CGIAR (2018) had reported that flooding, salinity, increased pest, diseases and weed build up in rice farms as a result of climate change. Other impacts were: risks to health of rice farmers due to disease outbreak ($\bar{x}=2.36$), increase in cost of labour ($\bar{x}=2.28$), increase in fertilizer requirement ($\bar{x}=2.26$), reduction in labour availability for rice production ($\bar{x}=2.07$), migration of rural rice farmer to urban areas, loss of family members ($\bar{x}=2.02$).

These findings imply that rice production is highly vulnerable climate change. In line with these, Ray (2017) noted that climate change poses a serious threat to the stability of the food system. The impact of climate covers not only farmer's livelihood activities but also causes destruction of lives and property especially by flood. The implication is that rice farmers will need to build resilience in order to survive the menace of climate change on their lives and livelihood.

Table 2: Climate change impact on rice farmers' livelihood activities

Impact of climate change	Mean	Standard deviation
Changing in planting pattern	3.51*	0.82
Reduction in income	3.61*	0.73
Uncertainties in planting date	3.56*	0.69
Increase in rice price	3.31*	0.79
Increase in poverty among rice farmers	3.19*	0.95
Uncertainties in price of rice	3.04*	0.98
Migration of rural rice farmer to urban areas	1.88	1.16
Reduces health of rice farmers due to disease outbreak	2.36*	1.19
Change in harvesting date	3.18*	0.90
Loss of farmland	2.47*	1.17
Loss of lives of family members	2.02*	1.37
Reduction in labour availability for rice production	2.07*	1.32
Increase in prices of rice seed	2.69*	1.18
Increase in cost of labour	2.28*	1.23
Increase in fertilizer requirement	2.26*	1.44
Loss of rice farm to flood	3.09*	1.08
Destruction of transportation network by flood	3.11*	1.12

- ≥ 2.0 . Source: Field survey 2018

Perceived Areas of Resilience Capacity of Rice Farmers to Climate Change

Findings in Table 3 show rice farmers areas of perceived resilience capacity to impacts of climate change to include: availability of improved varieties of seed (\bar{x} =4.76), personal savings (\bar{x} =4.63), use of improved varieties of rice (\bar{x} =3.73), access to good storage facilities (\bar{x} =3.56). Yadav et. al., (2015) reported that direct seeding of improved rice seed improved the resilience of rice farmers. This implies that rice farmers in the area will be able to cope with and recover from the effects of climate change when they use improved varieties of rice. Other areas of perceived resilience include: access to natural soil water (\bar{x} =3.37), utilization of inorganic fertilizer (\bar{x} =3.36), utilization of soil that retains water longer (\bar{x} =3.33), access to very fertile soil for rice production (\bar{x} =3.28). According to FAO (2018), proper management of rice production landscapes such as good soil water management can improve the resilience capacity of rice farmers. Since the farmers have access to good soil with sufficient water for rice production, they can be able to cope with the effects of climate change. Availability of ready market for rice (\bar{x} =3.22), good amount of solar radiation (\bar{x} =3.21), adequate access to extension (\bar{x} =3.13), availability of land for rice production (\bar{x} =3.08), utilization of organic fertilizer/manure (\bar{x} =3.07), changing growing season to make up for shortened growing cycle (\bar{x} =3.01), access

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to loan ($\bar{x}=3.00$) were also found to be areas of perceived reliance of rice farmers to climate change. According to Ray (2017), farmers can build resilience to climate change through access to information, credit and insurance. Extension is a very good source of information for farmers. Adequate access to extension will help rice farmers learn the best practices needed to build resilience to whether related disasters. Also, access to loan will help rice farmers adopt improved technologies improved rice varieties. This can help them cope to adverse effects of climate change including

These results show that rice farmers have some safety nets that help them build resilience to the impact of climate change. As climate shifts, rice farmers need support to adapt their agricultural methods so that they can be more productive and resilient.

Table 3: Rice farmers' perceived resilience capacity to climate change

Areas of resilience capacity	Mean	Standard deviation
Access to improved varieties of rice seed	4.76*	0.59
Access to good storage facilities for rice	3.56*	1.03
Access to loan	3.00*	0.83
Access road for distribution of rice	2.83	1.15
Favourable government policies for rice producers	2.37	0.99
Good marketing policy	2.56	1.05
Using good irrigation system in time of drought	2.72	1.09
Changing growing season to make up for shortened growing cycle	3.01*	1.23
Natural soil water availability	3.37*	1.22
Utilization of soil that retains water longer	3.33*	1.13
Access to very fertile soil for rice production	3.28*	1.21
Utilization of inorganic fertilizer	3.36*	1.21
Affordability of inorganic fertilizer	2.84	1.16
Utilization of organic fertilizer/manure	3.07*	1.28
Access to good irrigation facilities	2.61	1.24
Good amount of solar radiation	3.21*	1.18
Availability of ready market for rice	3.22*	1.21
Access to good pricing system for rice	2.86	1.11
Access to market information	2.89	0.98
Adequate access to extension	3.13*	1.04
Utilization of good storage facilities	2.88	1.23
Access to weather/meteorological information	2.84	1.35
Use of improved varieties of rice	3.73*	1.18
Access to insurance	2.84	1.05
Low cost of fertilizer	2.38	1.18
Low cost of labour for rice production	2.55	1.11
Low cost of rice seeds	2.70	1.11
Low cost of transportation of rice	2.61	1.17
Access to of land for rice production	3.08*	1.27
Personal savings	4.63*	0.83
Access to subsidized fertilizers	2.39	1.01

Areas of resilience capacity	Mean	Standard deviation
Access to subsidized seeds	2.57	0.99

- *≥ 3.0; Source: Source: Field survey 2018

Conclusion and Recommendations

Rice farmers had built resilience towards planting of improved seed varieties, personal savings, use of improved rice varieties, natural soil water availability, presence of soil that retains water longer, access to very fertile soil for rice production, access to extension, access to loan/credit. Rice farmers should be encouraged to uphold and improve on their areas of resilience capacity through trainings and farmer-to-farmer extension. Governments and development agencies should provide more loan to rice farmers to enable them cover labour cost. Extension should also train rice farmers on how to conserve the natural environment including water retaining soils and nutrient rich soils which they have identified as major areas of their strength against the adverse effects of climate change on their livelihood activities. Favourable policies such as crop insurance, appropriate marketing and infrastructural policies that help rice farmers cope with negative effects of climate change be enacted and implemented.

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