Research Article

Institutional Interventions and Climate-Smart Practices of Farmers in Nigeria

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Abstract | This research examined the institutional interventions and climate-smart practices of smallholder farmers in southeast Nigeria. The policies, programs, projects, activities of private and public organizations to intervene on climate change-related issues are referred as institutional interventions. The study therefore, identified the institutional interventions and support available for farmers affected by climate change. In addition, identified the climate-smart practices used by the smallholder farmers, analyzed the relationship of the socioeconomic variables, farmers access to institutional support, adaptation of climate-smart practices, and the constraints faced by the farmers in adoption and use of the climate-smart practices. A multistage sampling technique was applied in choosing the 270 smallholder farmers in the studied area. Focused group discussions, interview sessions and surveys were used to obtain the required data. For the data analysis, descriptive statistics and correlation analysis were used to analyze the data. The findings revealed that the socio-economic status of rural farmers, especially income and education are significant factors influencing their access to institutional support and adaptation to climate change. This study suggests that the government take a multi-stakeholder approach to addressing climate change, including the private sector and communities, as well as improving extension services' capacity to educate farmers.

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Introduction

Our food system is broken, and to reverse the trends in hunger and malnutrition, strengthen resilience to minimize the continent's environmental footprints, Africa needs to rethink its food system policy, particularly the sustainability dimension. Some organizations in Nigeria reach out to smallholder farmers affected by the vagaries of climate change through climate change-focused Corporate Social Responsibility (CSR). Equally, the Nigerian government has shown some commitments to fight against the climate change through the ratification of the Paris agreement; in addition to strengthening the capacity of its agencies such National Emergency Management Agency (NEMA), the intervention

programs of the Federal Ministry of Environment and the Federal Ministry of Agriculture and Rural Development to respond to climate change especially in farming communities around Nigeria.

Since it has been established that more than 98 percent of the smallholder farmers depend on the rain to water their crops, this makes the effect of climate change severe (PRCMARINE, 2019). There is a need for farmers to adopt a more strategic approach toward climate change mitigation. The Climate-smart approach towards climate change implies more proactive measures towards limiting climate change's dire consequences on the socio-economic welfare of farmers. Significant climate-smart strategies require technology and policy interventions to minimize vulnerability and increase production capacity, particularly smallholders. Climate-smart agriculture aims to increase agricultural production sustainably to support equitable income increases, food security and growth. Adapting to and strengthening adaptation to climate change from the farm to the national level; and exploring ways to minimize GHG emissions from agriculture compared to past trends (FAO, 2013).

Over 80% of the foods produced and consumed in Nigeria come from smallholder farmer farms, making the smallholder farmer the engine driving Nigeria's agribusiness production (Sabo *et al*., 2017; Mgbenka and Mbah, 2016). More than 570 million farms worldwide are being operated on a tiny scale, with land access of fewer than 2 hectares representing 75 percent of world agricultural land (Lowder *et al*., 2016). Smallholder farmers are well known for the extensive use of family labor, crude implements while relying on a small parcel of land for their livelihood. The smallholder farmers produce chiefly staple crops with a blend of cash crops on the same plot of land. They grow primarily at a subsistent level and a little for the market. Many of the smallholder farmers are impoverished and have limited market access (Rapsomanikis, 2015). Unfortunately, the dynamics of the socio-economic environment in which the farmers operate tend to limit their productivity. The socio-economic status of the smallholder farmers in Africa does not show the level of hard work the farmers put in the farm. The smallholder farmers are highly disadvantaged when some key factors are considered (i.e., landholding, funding, educations, basic amenities, and infrastructure). This sorry state of the socio-economic status of the farmers has limited their access to improved farming technology and awareness of climate change (Wiggins *et al*., 2010).

The growth of small-scale farmers' understanding that the mitigation of climate change is dependent on their socio-economic condition and the ability to reap the benefits of institutional support; climate change consequence is extreme weather conditions, which result in flooding and increasing temperature, have affected the livelihood of the farmers, leaving more devastating impacts on the low socio-economic status of the farmers. The continuous and unchecked increase in demographic data leaves considerable pressure on the farmers' socio-economic well-being and fuels the rapid change in the climate (Karfakis, 2012). With the growing threat of climate change and population explosion, food production must increase by 60% to address the global food supply deficit (Karfakis *et al*., 2012). Climate change is caused by the uncontrolled depletion of natural resources, specifically deforestation. Agricultural activities contribute to greenhouse gas emissions and the high rate of emissions growth experienced. Most Nigerian enterprises, including corporate bodies and government agencies have well-designed policies and initiatives to mitigate climate change. Most of these programs and policies are geared towards sustaining the majority of the populace, predominantly farmers. Government and corporate organizations provide information to vulnerable groups, such as farming communities, to help them mitigate and adapt to climate change; protecting and providing public infrastructure is critical to mitigating climate change (Oruonye *et al*., 2019; Adger *et al*., 2009).

The broad objective of the study is to analyze the socio-economic status, institutional support, and climate-smart practices of smallholder farmers in southeast Nigeria. The specific goals include to:

- Study the socioeconomic situation of the area's smallholder farmers and the climate-smart practices they employ.
- Investigate the impact of climate-smart practices and institutional support on smallholder farmers' socio-economic status, and the challenges they face in putting those strategies into practice.

Materials and Methods

This study was carried out in the South-East geo-

political zone of Nigeria. Since small farmers dominate the study area, three states were chosen for investigation includes Abia, Ebonyi and Imo. In order to select farmers for the research, a multistage sampling technique was used. The three agricultural zones in the three states were visited for fact-finding. In Imo state, the Okigwe, Orlu and Owerri agricultural zones were visited; Abia State, the Aba, Ohafia and Umuahia agricultural zones were visited. In contrast, for Ebonyi State, the Ebonyi South, Ebonyi North and Ebony Central agricultural zones were visited. The fact-finding visit was done to elicit the farmers operating on farm size of 2 hectares or less. The fact-finding visits revealed that more than 92% of the farms were 2 hectares or less.

One local government area was chosen randomly from each of the agricultural zones using a random sampling technique. Then is the random selection of one community from the nine selected local government areas. Finally, thirty smallholder farmers were selected at random from each of the nine villages for a total sample size of 270 farmers. Focus group meetings and farmers interviews were used to gather primary data, few farmers were assumed to be educated. Trained enumerators were employed to facilitate the data collection process. Descriptive statistics and Karl Pearson correlation coefficient were used for the data analysis.

Results and Discussion

Socio-economic status of the small holder farmers

The socio-economic status of the smallholder farmers is presented in Table 1 and the results reveal the distribution of the smallholder farmers according to sex, education, income, experience and other variables. The distribution of the smallholder farmers according to their sex shows that 66.67% of the farmers are women. The women mainly spearhead farming in rural areas; most men view small-scale farming as a women's affair and seek alternative sources of income (Enete and Amusa, 2010); since women make up the bulk of the smallholder farmers, efforts to educate the farmers on climate change and climate-smart practices. According to their age, the distribution of the smallholder farmers shows that the majority of the farmers fall within the productive age of 21 to 50 years of age. Here lies the strength of the smallholder farmers, who depend on their youthful strength to carry out the farming activities. Ibitola *et al.* (2019) made a similar observation on the age of the farmers. Climate change and climate-smart programs for farmers should be youth-driven. The problem of illiteracy is evident among the smallholder farmers in the study area; the results revealed that 40.74 percent of the smallholder farmers have no formal education, while 41.48 percent had primary education. The level of education of the farmers may impede a clear perception of the concept of climate change and climate-smart practices. The experience of the smallholder farmers is a great asset to the campaign for climate-smart agriculture. The majority of the farmers have 11 to 40 years; some authors noted that farming is the way of life in most communities in Nigeria.

According to their landholding, the distribution of the farmers clearly shows that all of the farmers sampled are smallholder farmers with land access of 2 hectares or less (Deininger *et al.*, 2017); these farmlands are mostly inherited or communal as indicated by 41.8 and 32.9 percent of the farmers respectively. The income distribution shows that 37.78 and 36.3 percent of the farmers are low-income earners. They earn as little as 165 to 330 US dollars a month; This makes adopting most climate-smart agricultural practices highly costly.

Climate smart practices in use by the small holder farmers

Perception of the farmers has a role in laying in their action against climate change, from the response of the smallholder farmers as seen in Figure 1, which shows that 29 percent of the farmers do not believe that the climate is changing.

Olaniyi *et al.* (2013) and Sultan *et al.* (2019) noted that most farmers still assume that climate change is a "white man's" myth. However, in this situation, most farmers are already worried that the climate is changing daily.

The source of information on climate change available for the farmers is presented in Figure 2, which illustrates that 58 percent of the smallholder farmers knew that the climate was changing through their personal experience, 20 percent of the farmers knew that the climate is changing, and agricultural extension contact. In comparison, 14 percent claim that they do not have information on climate change. This result shows that the level of awareness of the farmers on climate change is low.

Table 1: *Socio economic status of the farmers.*

Variable	Frequency	Percentage
Gender		
Female	180	66.67
Male	90	33.33
Total	270	100
Age in years		
21-30	34	12.59
31-40	78	28.89
41-50	89	32.96
51-60	56	20.74
61 – 70	13	4.815
Total	270	100
Marital status		
Single	87	32.22
Married	183	67.78
Total	270	100
Education level		
Primary	112	41.48
Secondary	29	10.74
Bsc/HND	13	4.815
Msc	6	2.222
No formal education	110	40.74
Total	270	100
Location		
Rural	198	73.33
Suburban	72	26.67
Total	270	100
Household size		
2 to 10	80	29.63
10 to 20	190	70.37
Total	**270**	100
Land holding (hectares)		
0.1- 1	177	65.56
1.1 -2	93	34.44
Total	270	100
Nature of land holding		
Communal	89	32.96
Lease	45	16.67
inherited	112	41.48
Purchased	24	8.889
Total	270	100
Experience		
1 to 10	45	16.67
11 to 20	30	11.11
21 to 30	75	27.78
31 to 40	120	44.44
Total	270	100
Income per month (US dollara)		
less than 165	102	37.8
168.3 to 330	98	36.3
333.3 to 660	58	21.48
more 660	12	4.444
Total	270	100

Source: *Field data, 2019.*

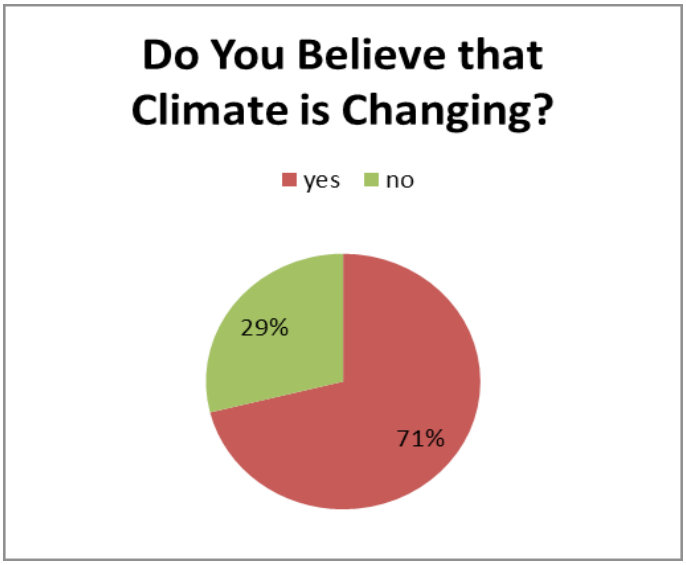

Figure 1: *Farmers believe on climate change.*
Source: *Field data, 2019.*

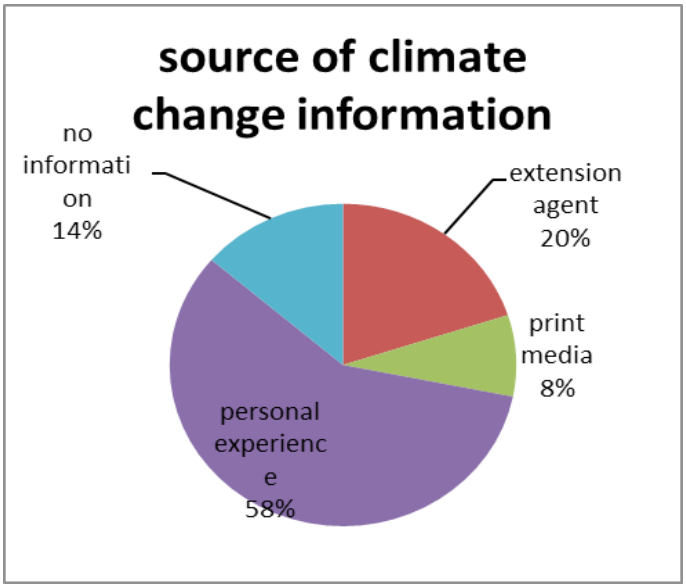

Figure 2: *Sources of climate change information.*
Source: *field data, 2019.*

Figure 3 presents the farmers' perception of climate change, 31 percent perceived that the climate change is evident with the increasing level of rainfall, 12 percent noted that climate change is apparent through the increase in the number of flood cases and the drying of rivers and lakes respectively. Some of the farmers perceived that the heat waves are increasing as well as their varying perceptions point to one fact that the climate is changing.

Climate smart practices identified by the smallholder farmers

The climate-smart practices identified by the smallholder farmers include the Adoption of Improve crop Varieties (AICV), Crop Rotation (CR) mulching, Crops and Livestock Diversification (CLD), Use of

Organic Manure (UOM), Mixed Cropping (MC) and Planting of Wind Break Trees (PWBT). These climate-smart practices identified by the farmers were divided into crop-smart components, smart risk components and smart environment components. The crop-smart component includes Adoption of Improve crop Varieties (AICV), Mixed Cropping (MC) and Crop Rotation (CR); the risk-smart component is the Crop and Livestock Diversification (CLD). In contrast, the smart environment components include use of Organic Manure (UOM) and the Planting of Wind Break Trees (PWBT).

From Table 2, the most common climate-smart practice by the smallholder farmers is mixed cropping with a mean score of 3.315. The farmer ensures the right blend of nitrogen-fixing crops (legumes) with other crops to ensure the good health of the soil.

Forms of institutional support accessed by the farmers

The forms of institutional support accessed by the farmers to mitigate and adapt to climate change as shown in Figure 4 are corporate social responsibility (CSR) of private organizations, representing 32 percent, the aids from government institutions like NEMA and FMARD account for 16 percent. In contrast, grants from non-government organizations (NGOs) account for the largest at 52 percent.

Correlation analysis between socio-economic status of the smallholder farmers and the climate smart practices

Table 3 depicts the relationship between small farmers' socio-economic characteristics and smart climate techniques. With a 5% significance level and a positive sign, the coefficient of correlation between farmers education and adoption of improved crop varieties suggests that educating farmers may be related to their ability to be climate-smart in terms of adopting improved varieties. Literacy has the potential to positively impact climate-smart practice adoption by training farmers to adopt improved crop varieties and discuss the information involved in mitigating the effects of climate change. This result is consistent with the findings of Onyebinama and Onyejelem (2010).

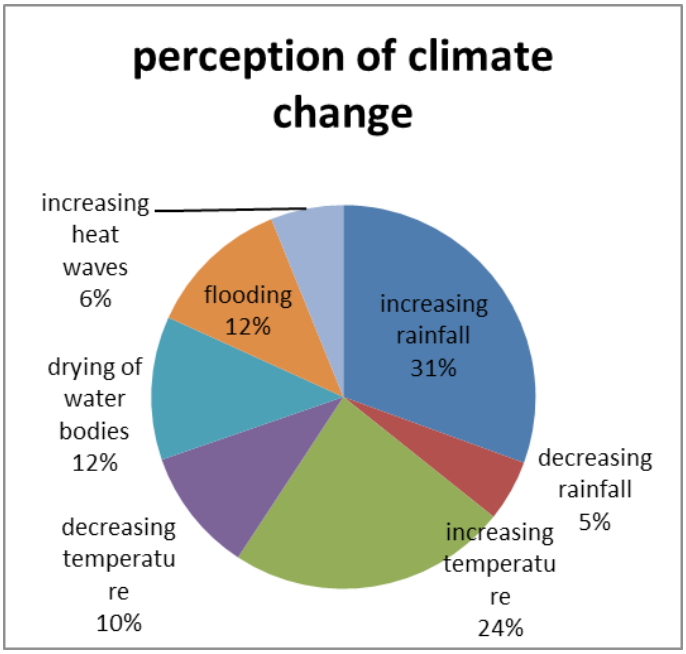

Figure 3: *Farmers perception on climate change.*
Source: *survey data, 2019.*

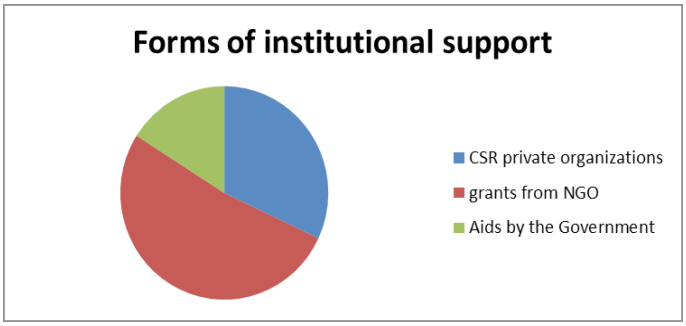

Figure 4: *Forms of institutional support accessed by the farmers.*
Source: *Survey data, 2019.*

Table 2: *Climate smart practices identified by the smallholder farmers.*

	AICV	CR	Mulching	CLD	UOM	MC	PWBT
Mean	3.2	3.196296	3.159259	3.248148	3.166667	3.314815	3.137037
Standard error	0.078116	0.073709	0.077493	0.078396	0.0769	0.074604	0.078532
Median	3	3	3	3	3	3	3
Mode	4	3	3	4	3	4	4
Standard deviation	1.283582	1.211157	1.273335	1.28817	1.263588	1.225869	1.290413
Sample variance	1.647584	1.466901	1.621382	1.659383	1.596654	1.502754	1.665166
Range	4	4	4	4	4	4	4
Minimum	1	1	1	1	1	1	1
Maximum	5	5	5	5	5	5	5
Sum	864	863	853	877	855	895	847
Count	270	270	270	270	270	270	270

Source: *Field data, 2019.*

Table 3: *Correlation coefficient.*

	AIC	CR	mulching	CLD	UOM	MC	PWBT
AIC	1.00						
CR	0.11	1.00					
Mulching	0.09	-0.02	1.00				
CLD	0.10	-0.03	0.02	1.00			
UOM	-0.11	0.03	-0.14	0.08	1.00		
MC	0.02	0.02	0.08	0.07	0.04	1.00	
PWBT	-0.13	-0.11	-0.06	0.02	0.04	0.21	1.00
Experience	-0.18	0.18	0.04	-0.02	-0.07	0.10	-0.08
Education	0.67**	0.07	0.13	0.17	0.12	0.01	0.01
Income	0.50**	0.14	0.17	0.00	0.97***	0.11	0.09
Labour	0.05	-0.03	0.01	-0.03	0.04	-0.11	-0.01
Land	0.62**	0.76***	0.43*	0.51**	0.90***	0.81***	-0.49*
Institutional support	0.55**	0.65**	0.73**	0.53**	0.87***	0.69**	0.75**

Source: *Field data, 2019. ***, ** and * statistically significant at 1%, 5% and 10%, respectively.*

Farmers' income had a significant positive correlation coefficient with climate smart practices such as adoption of improved varieties and the use of compost (organic manure). Increasing farmers' incomes may lead to the adoption of climate-smart practices to adopt improved varieties and the use of compost, which is not far from the fact that income gives farmers the purchasing power to purchase improved varieties and compost. The coefficient of correlation between land and the climate-smart practices of the smallholder farmers reveals that land is a significant determinant in the climate-smart agricultural practice. The coefficient is significant and positive for adopting improved varieties, crop rotation, mulching, crop and livestock diversification, organic fertilizer and mixed cultivation. Land available to the smallholder farmers are negatively associated with the climate-smart practice of planting winding breaking trees; this may be because of the small nature of the land, the farmers are battling to raise crops on the land and may not deem it necessary to plant wind-breaking plant except were extremely necessary.

The coefficient of correlation between the institutional support accessed by the farmers and the climate adaptation practices reveals a strong positive relationship which means that institutional sponsorship is critical for farmers to adopt each of the identified climate-smart practices.

Challenges identified in the adoption of the climate-smart practices

Table 4 presents the distribution of farmers based on the challenges in implementing climate-smart practices. The percentage represents the responses to the identified constraints to climate-smart practices adoption.

Table 4: *Constraints identified in the adoption of the climate smart practices.*

Constraints to climate smart agriculture	Frequency	Percentage
Superstitious beliefs to farming	76	28.14815
Costs of climate smart agriculture	80	29.62963
Lack of adequate climate information	55	20.37037
Lack of adequate plan and action by stakeholder	59	21.85185
Total	270	100

Source: *Field data, 2019.*

The results reveal that 28.2 percent of the smallholder farmers have some superstitious beliefs about changing climatic conditions. Some of the farmers interviewed believe that changing climate condition is how the divine expresses his anger on man for his sins. Some of the farmers (29.63 percent) insisted that climate-smart practices are costly, making it difficult for them to implement the climate-smart practices in their farms fully.

About 20 percent of the farmers lack adequate climate change information. In comparison, approximately 21% of the farmers are affected by the lack of a concrete intervention or plan on climate change by the government and other community stakeholders (Rohila *et al.*, 2018).

Conclusions and Recommendations

The socio-economic status of the smallholder farmers affects their belief and perception of climate change and climate-smart practices. The farmers believe that the climate is changing so fast and these beliefs result from the previous farming experience. The majority of the farmers have 10 to 30 years; this wealth of experience gives them the required sense of judgment to determine if there have been changes in the climate. The climate-smart practices adopted by the farmers include the Adoption of Improved Crop Varieties (AICV), Crop Rotation (CR), mulching, Crop, and Livestock Diversification (CLD), Use of Organic Manure (UOM), Mixed Cropping (MC) and Planting of Wind Break Trees (PWBT)., the characteristics of the farmers socio economic status such as education and farmland and access to institutional resources, have a direct relationship with climate-smart practices embraced by the farmers.

As a result, we suggest that more efforts be made to educate smallholder farmers about climate change and climate-smart agricultural practices that can benefit them. The significant stakeholders such as government and community leaders should improve the socio-economic welfare of the rural dwellers through the provision of farming aids to enable them to cushion the effects of climate change.

Novelty Statement

This research indicated that institution interventions by the government, non-government organizations, and private organizations have a relationship with the climate-smart strategies and socio-economic status of the smallholder farmers in the study area.

Author's Contribution

Onwusiribe Ndubuisi Chigozirim: Contributed to the writing of the entire manuscript, prepared the survey instrument, and analyzed the data.
Okpokiri Chibuzo Ikechukwu: Interpreted the results and contributing to the development of the materials and methods.
Agu-Aguiyi Fortune Nneka: Contributed the development of the materials and methods, the conclusion and assisted in the interpretation of data in contrast.
Oteh Ogbonnaya Ukeh: Contributed to writing the abstract, introduction and proofread the manuscript.

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Conflict of interest
The authors have declared no conflict of interests.

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