

The Role of Government Institutions in Supporting Smallholder Farmers' Adaptation to Climate Change in Gombe State, Nigeria

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ABSTRACT

Climate change is now an everyday reality, with far reaching consequences, especially for poor agricultural communities, who suffer the most diverse effects of climate change. Over past few years, efforts have been diverted from reaction, to pre-emptive, in a bid to ensure that the most vulnerable can adapt to the challenges of climate change. Impacts of climate change are felt more by poor communities who depend on subsistence agriculture for survival. In order to adapt to climate change, there is need for this poor rural communities to be supported in various ways, by both government and non-government entities. This study investigates the role of government institutions in supporting climate change adaptation among smallholder farmers in Gombe State, Nigeria. Primary data was generated using structured questionnaire. This was administered to 240 randomly selected members of the farming communities, local leaders and members of government institutions working on environmental management in the State. Data was analyzed using both descriptive and factor analysis methods. Results show that a number of factors are responsible for determining the government support towards adaptation in both crop and animal production among smallholder farmers. The study findings revealed different challenges encountered by crop farmers, livestock farmers and government institutions in trying to implement mechanisms of adaptation to climate change in Gombe State, Nigeria. The study recommended that government should engage rural smallholder farmers, non-governmental organizations and civil society in this effort, and that it should encourage local mechanisms in order to ensure sustainability of the adaptation efforts.

Keywords: *Agricultural communities, Climate change, Government institutions, Smallholder farmers and subsistence agriculture.*

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Highlights of this paper

- Climate change is now an everyday reality, with far reaching consequences, especially for poor agricultural communities, who suffer the most diverse effects of climate change.
- This study investigates the role of government institutions in supporting climate change adaptation among smallholder farmers in Gombe State, Nigeria.
- The study recommended that government should engage rural smallholder farmers, non-governmental organizations and civil society in this effort, and that it should encourage local mechanisms in order to ensure sustainability of the adaptation efforts.

1. INTRODUCTION

The challenges of climate change which result partly from increases in greenhouse gases are expected to cause increase in global temperatures and shift in pattern of rainfall. This is expected to significantly affect human livelihoods especially in sub Saharan Africa (Intergovernmental Panel on Climate Change (IPCC), 2013). Climate change is known to be a global phenomenon that will affect all countries in in the world in one way or the other (IPCC, 2007). The forecast of the Intergovernmental Panel on Climate Change (IPCC) reveals that sub-Saharan Africa (SSA) is one of the regions that will be worst affected by climate changes despite the fact that it is the least contributor to the problem of global warming. The climate of Sub Saharan Africa is believed to be warming up at an increasing rate than any other place in the world. This is further made worst by the fact that Sub Saharan Africa is known to be among the poorest region socio-economically in the world (IPCC, 2014). The exposure and vulnerability of the African continent to the challenges of climate change is as high as up to 40 per cent of the total population residing in arid and semi-arid areas, while only 25 per cent of the population living in coastal areas, which are regions believed to be most vulnerable to the impact of climate change (IPCC, 2014).

There are so many uncertainties on how climate change is related to and influences extreme events. According to O'Brien *et al.* (2010) these uncertainties make it necessary for increased knowledge of these relations, in order to enhance action that reduces vulnerability. The frequencies, intensities and impacts of natural disasters have in recent times increased unprecedentedly, thereby affecting the poorest in least developed countries of the world (IPCC, 2007). These natural disasters are the result of exposure of vulnerable households, communities and ecosystems, to shocks or stresses that are beyond their capacity to cope or recover from without support of external organizations or institutions (Ireland, 2010). Climate change has therefore become a very important factor in redefining the prospects of economic development and growth of most households and communities, and this will be determined by how they respond to the challenges of climate change. Scholars such as Agrawal (2008) have observed that with the recent obvious likelihood of changes in institutional and social relationships, there is much that needs to be known about the role of governmental organizations and institutions in adaption to climate change. O'Brien *et al.* (2010) opined in their study that the role of local groups and institutions addressing the problem of adaptation to climate change in informal settlements can be adequately understood through ethnographic study in relation to climate adaptation (O'Brien *et al.*, 2010).

Thus, from the above, it can be seen that the connection between climate change and disasters is often times not always clear. However, the rising level and intensity of extreme weather events such as rising levels of rainfall and heat waves have been pointed out to be some of the main manifestations and likely impacts of climate change in Sub Saharan Africa and have been accepted to the major causes of disasters (IPCC, 2013). Moser *et al.* (2010) reported that environmental refugees affected by climate related stressors are already increasing the intensity of rural-urban migration in many parts of SSA. The IPCC (2013) observed that many places in SSA are already affected by climatic changes such as increasing risk of flooding, landslides, droughts, heat waves and strains on local food production. Natural hazards are believed to be socially constructed and hence strongly affected by

vulnerability and adaptation to climate change. While natural hazards often occur, the change into risk and potential for disaster is based upon human exposure and lack of capacity to cope with its adverse impacts. For people with high vulnerability and low adaptive capacity and resilience, such incidents can be very destructive (Ireland, 2010).

Individuals, government institutions, civil society organizations and businesses operating at the local level often times directly experience on-the-ground effects of climate change. Adaptation to the challenges of climate change requires changes in response to multiple stresses, across multiple scales and by many institutions (Crane, 2013). Thus, the role of government institutions like the local government councils, local organizations such as cooperatives (both formal and informal), women and youth groups, and Non-governmental organization is widely accepted in many studies of climate change adaptation. Two studies, that of Adger (2010) and Agrawal (2008) were very prominent in highlighting the importance of government institutions in enhancing adaptation to climate change at local level and among other things managing and implementing locally driven adaptation initiatives, creating opportunities for collective learning and by mediating interventions suitable to the local context (Moser *et al.*, 2010).

Many scholars such as Adger *et al.* (2009) and Berkhout (2011) have explained the roles of government institutions to include giving protection to vulnerable groups, making information available to plan and stimulate adaptation, and protecting important public goods such as social infrastructure. Few scholars on the other hand, have suggested the role of government in relation to the role of market. For instance, Fankhauser *et al.* (1999) suggested the need for a reserved role for government, arguing that 'the primary duty of government will be to create the right legal, regulatory and socio-economic environment that will support independent adaptation', which takes place through the natural force of the free market.

It has been observed that most of the studies so far carried out were rather prescriptive or normative suggestions on the role of government. There are only few studies that have practically provided empirical assessments on what type of roles governments institution is actually playing. Swart *et al.* (2009) and Biesbroek *et al.* (2010) were among the few studies carried out in this regard. These studies outlined priority sectors that are contained in national adaptation strategies (NAS) among seven European countries. However, such studies pay particular attention to the drivers and processes in which these NASs were developed. Careful search of existing literatures reveals that past studies that provides empirical assessment of types of roles or rationales for government intervention, most importantly at the national level are not available. The explanation of this could be that most adaptation strategies (at national level) have not existed for a long period of time and many of these strategies does not have substantial action plan and specific budget allocation that is required to understand where the priorities lies (Crane, 2013).

The work of Fankhauser *et al.* (1999) is one of such instances, of adaptation work that explains how the role of government as it relates to the role of market has followed the normative theory of government intervention and where market forces are dominant in deciding adaptation actions. Government intervention is accepted when it can enhance the overall efficiency of the market by correcting any market imperfections that exist. At the end of the day, this is the mainstream method for most environmental policies in Western countries (Thampapillai, 2011). However, it remains not clear whether such method that emphasizes efficiency of public intervention can be effectively implemented to adaptation policy in such places where there are so many inherent uncertainties. Scholars such as Stern (2006) has observed that quantitative information on costs and benefits of adaptation are very limited at the moment. These uncertainties have the tendency of making the achievement of efficient adaptation decision-making difficult to achieve.

Two more important theories that are relevant to the study and which provide alternative explanation on how government intervention is determined in adaptation are highlighted. One of this study is based on the budget maximization theory which has taken a critical view of government intervention. The other theory is that based on social contract theory which provide more dynamic perspective on the relationship between the role of the government and the market (Adger *et al.*, 2009; Berkhout, 2011). Government institutions are regarded as the formal and informal organizations, social groups and individuals that are concerned with accountability and legitimacy that is established within the jurisdictions in which they operate in. These government institutions are classified into three major groups and include; public (bureaucratic administrative units, and elected local governments), civic (individuals, households, membership and cooperative groups) and market (service and business organizations) (Agrawal, 2008). Climate on the other hand is regarded as a measure of the average pattern of variation of prevailing weather conditions such as temperature, relative humidity, rainfall and other climatic variables of a given location over a long period of time. IPCC (2007) provide a definition of climate change as the changes in the climate of a place that occur over long period of time as a result of natural variability or human activities. The IPCC also argues that although the climate has always been changing, the current rate and magnitude of change is unprecedented mainly due to human activities.

Climate change adaptation (CCA) has been defined by IPCC (2007) as the adjustment in human or natural systems to actual or anticipated changes in weather or their impacts, that removes or reduces their harmful impacts or exploits their beneficial opportunities. Climate change therefore, is the taking of action in anticipation or response to the impacts of climate change which cannot be mitigated. CCA action is carried out by institutions in both the public and private sectors using policies, development of infrastructure and technologies and through behavioral change. There are many different classifications of adaptation activities. This include those based on purposefulness of adaptation (spontaneous vs. planned), timing (anticipatory vs. reactive), adapting agent (private vs. public) and scope (short-term vs. long term; localized vs. regional).

In Nigeria, the issue of climate change has two dimensions. The first is the dimension which has been acknowledged by households and communities in different parts of Nigeria and have equally been reported by the Nigerian Meteorological Agency (NIMET) (2008). This dimension is the changes that have already been observed in climate parameters such as temperature, rainfall and extreme weather events. The second dimension has to do with changes that are to be expected in the future. According to NIMET (2008) between 1941 and 1970, only patches of the country, in the northeast, northwest, and southeast experienced late onset of rains. However, from 1971 to 2000 late onset of rains had spread to most parts of Nigeria, leaving only a narrow strip in the middle of the country with normal conditions. From 1941 to 2000 there was evidence of long-term temperature increase in most parts of the country. The main exception was in the Jos area, where a slight cooling was recorded. The most significant increases were recorded in the extreme northeast, extreme northwest and extreme southwest, where average temperatures rose by between 1.4°C and 1.9°C respectively.

Climate change is having adverse effects on the population at all levels of society in Nigeria, causing disasters of immeasurable proportions. In response to this, the government has initiated emergency response and adaptation strategies through various institutions, both at national, state and local levels, such as: the Forestry Research Institute of Nigeria (FRIN), National Oil Spill Detection and Response Agency (NOSDRA), Nigeria National Petroleum Corporation (NNPC), Nigerian Metrological Agency (NIMET), National Environmental Standard Regulation and Enforcement Agency (NESREA), State Emergency Management Agency (SEMA) and Gombe State Environmental Protection Agency (GOSEPA) among others. Over the recent past, government action has been

shifted from reactive emergency response to adaptation mechanisms, on realization based on various environmental studies acknowledging the reality and severity of climate change (Thampapillai, 2011).

The general objective of this study was to make a critical assessment of the role played by government institutions in Nigeria towards the process of adaptation to climate change among smallholder farmers in Gombe State. Specifically, the study sought to: examine the support of government institutions in facilitating smallholder farmer's adaptation to climate change and assess the challenges to the implementation of climate change adaptation strategies in Gombe state, Nigeria.

2. MATERIALS AND METHODS

2.1. Description of Study Area

Gombe State, the study area is found in the Northeastern region of Nigeria Figure 1. The state is located between latitude $9^{\circ}30'N$ to $12^{\circ}30'N$ and longitude $08^{\circ}05'E$ to $11^{\circ}45'E$. The State is bordered by Yobe State to the North, Adamawa and Taraba States to the South, Borno State to the East and Bauchi State to the West. It covers a land area of $20,265\text{km}^2$. It has a population of 2,587,159 people (1,296,166 - 50.1% males and 1,290,993 - 49.9% females) according to the 2006 population census.

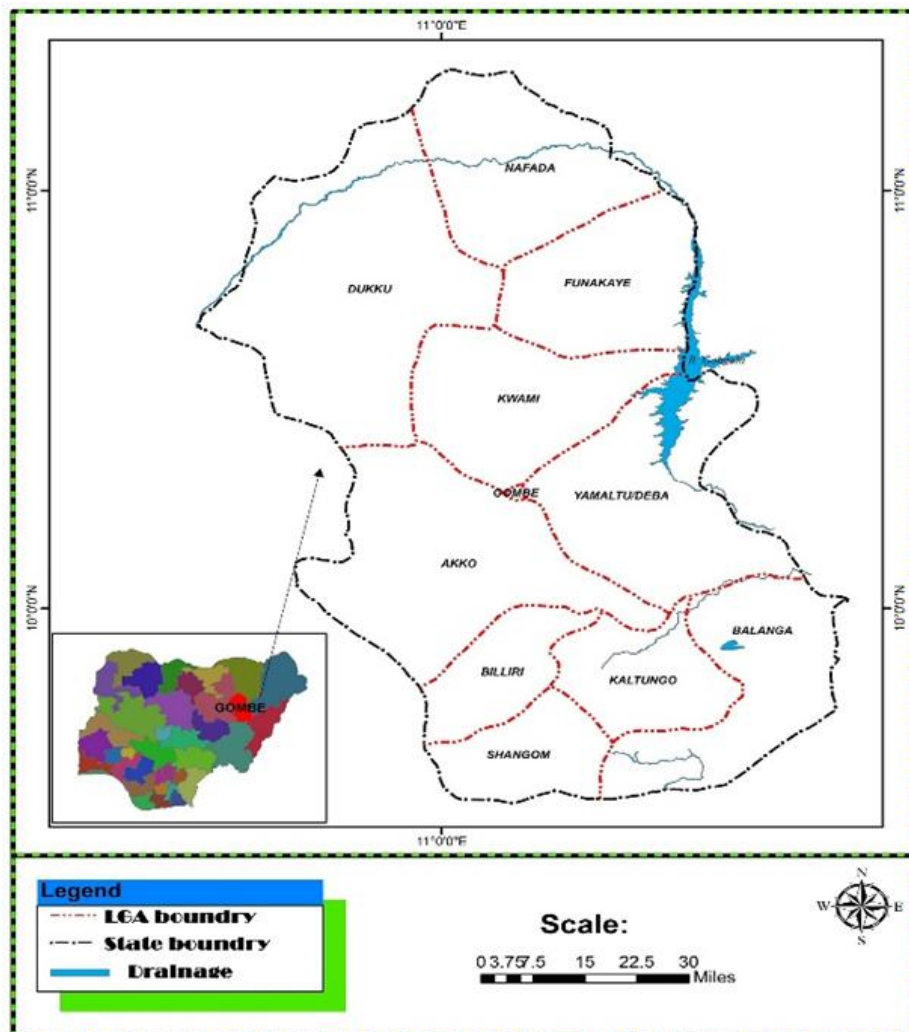


Figure-1. Map showing the study area.

Source: GIS lab, GSU.

The study area has an annual population growth rate of 3.2%. The study area is found in the Sahel Savannah vegetation zone and has tropical continental type of climate characterized by long dry season and a short rainy season. The physical terrain of the State consists of undulating hills rising above 1200m above sea level. The study area is drained by River Gongola, which is a tributary of River Benue (Upper Benue River Basin). The main mineral resources found in the State include silica, gypsum, uranium, limestone, dolomite, talc, and kaolin. The state is a multi-ethnic state, with some ethnic groups such as Tangale, Terawa, Waja, Kumo, Fulani, Kanuri, Bolewa, Jukun, Pero/Shonge, Tula, Cham, Lunguda, Dadiya, Bambuka, Hausa and Kamo/Awak. The people of Gombe state are primarily farmers (about 64%) producing food and cash crops such as cereals, legumes fruits, vegetables and tree crops (Mahmoud, 2016). The service and commercial sector employs an estimated 29% while the industrial sector employs the least with an expected 7% of the area's total work force. The area falls within the Tropical Continental Zone of Nigeria and thus, experiences a long dry season followed by a short rainfall season which begins in April/May and lasts till September/October (NIMET, 2008). High temperatures are experienced most times of the year with the mean monthly temperature ranging between 21°C and 32°C, highest temperatures are recorded just before the onset of the rains with temperatures rising to about 40°C.

2.2. Sampling and Data Collection Procedures

The population of the study comprised of local leaders, members of the local farming communities and staff of the various government institutions working on climate change mitigation in Gombe State. The sample size used in the study comprised of 240 respondents. Purposive sampling was used to select the respondents from among the local farmers and simple random sampling was used to select respondents from among the local leaders and staff of government institutions. The data with similar characteristics were edited, classified, grouped, coded and tabulated into tables and charts before interpretation Table 1. Descriptive statistics were used to analyze the data collected.

Table-1. Interpretation guides.

S/No	Mean range	Respond mode	Interpretation
1	4.20 – 5.00	Strongly agree	Very satisfactory
2	3.40 – 4.20	Agree	Satisfactory
3	2.60 – 3.40	Undecided	Fairly satisfactory
4	1.80 – 2.60	Disagree	Not satisfactory
5	1.00 – 1.80	Strongly disagree	Poor satisfactory

Source: Field survey, 2017.

Table 1 show how the result was interpreted with the mean ranges of 4.20 -5.00 as strongly agree and interpreted very satisfactory, 3.40-4.20 as agree and interpreted as satisfactory, 2.60-3.40 response as undecided and interpreted as fairly satisfactory, 1.80-2.60 response as disagree and interpreted as not satisfactory and the last Likert scale with a mean range of 1.00-1.80 with a response mode as strongly disagree and interpreted as poor satisfactory.

3. RESULTS OF THE FINDINGS

3.1. Government Support for Crop Production

The results on the support provided by government institutions to farmers towards crop production are presented in Table 1. The table shows that on whether the government provides improved seeds to crop producers, 75% of the respondents agreed, while 25% of the respondents disagreed with the mean of 3.88 and interpreted as satisfactory. On whether government institutions provide training to crop producers about composting, mulching and crop rotation, 84% of the respondents agree, while 16% of them disagree with the mean of 4.07 and interpreted

as satisfactory. On whether the government institutions provide funding for irrigation schemes, 84% of the respondents agreed, 5% of them were undecided, while 11% of them disagreed, with mean of 4.02 and interpreted as satisfactory. On whether government institutions provide reliable pesticides for treating crop pests and diseases, 79% of the respondents agreed, 16% of them were undecided, while 5% of them disagreed with mean of 4.12 and interpreted as satisfactory. When the respondents were asked whether government institutions provide tree seedlings to promote on-farm tree planting, 77% of the respondents agreed, 16% of them were undecided, while 7% of them disagreed, with mean of 4.02 and interpreted as satisfactory. This implied that government institutions provide support to crop producers in various ways in a bid to adapt to climate change in Gombe State, Nigeria with an overall average mean of 4.022 and interpreted as satisfactory [Table 2](#).

Table-2. Ggovernment support to crop farmers in the study area.

Support of government institutions towards adaptation in crop production	Percentage responses (%)					Mean	Interpretation
	SA	A	U	D	SD		
Provision of improved seeds	33	42	0	9	16	3.88	Satisfactory
Training on composting, mulching and crop rotation	26	58	0	14	2	4.07	Satisfactory
Funding irrigation schemes	37	47	5	5	6	4.02	Satisfactory
Provision of crop pesticides	42	37	0	16	5	4.12	Satisfactory
Provision of tree seedlings to promote on-farm tree planting	35	42	16	5	2	4.02	Satisfactory
Average mean	35	45	4	10	6	4.022	Satisfactory

Source: Field data, 2017.

Key: SA - Strongly agree, A - Agree, U - Undecided, D - Disagree, SD - Strongly disagree.

3.2. Government Support to Livestock Farmers

The result on the support provided by government institutions to livestock farmers is presented in [Table 3](#). From the table, it can be seen that on whether government institutions provide pesticides to treat animal pests and diseases, 84% of the respondents agreed, 7% of them were undecided, while 9% of them disagreed, with the mean of 4.12 and interpreted as satisfactory. On whether government institutions provide rain water harvesting equipment to help livestock farmers conserve water for animals to drink, 86% of the respondents agreed, while 14% of them disagreed with the mean of 4.23 and interpreted as satisfactory.

Table-3. Government support to livestock farmers in the study area.

Support of government institutions towards adaptation in livestock production	Percentage responses (%)					Mean	Interpretation
	SA	A	U	D	SD		
Provision of animal pesticides	39	45	7	7	2	4.12	Satisfactory
Provision of rain water harvesting equipment	39	47	0	12	2	4.23	Very satisfactory
Training on feed/pasture conservation	32	49	15	2	2	4.07	Satisfactory
Funding irrigation schemes for all year feed/pasture growth	39	32	12	12	5	3.91	Satisfactory
Average mean	37	43	9	8	3	4.083	Satisfactory

Source: Field data, 2017

Key: SA - Strongly agree, A - Agree, U - Undecided, D - Disagree, SD - Strongly disagree.

On whether government institutions provide training to local livestock farmers about conservation of feeds/pasture, 81% of the respondents agreed, 15% of them were undecided, while 4% of them disagreed with the mean of 4.07 interpreted as satisfactory. And on whether government institutions provide funding for irrigation schemes to enable all-year growth of pasture/feeds, 71% of the respondents agreed, 12% of them were undecided,

while 17% of them disagreed with mean of 3.91 and interpreted as satisfactory. This implied that government institutions had various ways of supporting local livestock farming communities in adapting to climate change in Gombe State, Nigeria with the average mean of 4.083 and interpreted as satisfactory.

3.3. Adaptation Strategies Adopted by Local Farmers to Cope with the Effects of Climate Change

The findings of the study on the adaptation strategies adopted by local farmers in crop production are presented in [Table 4](#). The result show that some of the adaptation strategies adopted by farmers in the area include planting of crop species that are more drought resistant in order to ensure higher crop yields, practice of local irrigation techniques to help farmers deal with climate change, crop rotation and application of local fertilizers in their gardens to counter the loss of soil fertility.

The findings of the study show that some of the adaptation strategies adopted by local farmers in livestock production include paddocking to minimize spread of animal pests and diseases, increase use of pesticides to control animal pests and diseases, tree planting to prevent further effects of climate change, rain water harvesting to conserve drinking water for animals during dry season and conservation of animal feed (dry grass) for use in the dry season. The results on the effectiveness the various adaptation mechanisms adopted by farmers in the local communities show that majority of the respondents believe that the adaptation mechanisms adopted by farmers are largely effective in combating the effects of climate change in their communities.

These findings are supported by the [IPCC \(2014\)](#) which stated that adaptation is important in order to reduce these effects of climate change. This is not just because of the inevitability of changes in climate, but also because of the need to increase the stock of knowledge about future impacts of climate change, mitigates against potential greater future costs of adaptation especially for poor populations. It is also important to mitigate against potentially larger negative social economic and ecological effects of unplanned adaptation. [Kusakari et al. \(2014\)](#) also posits that, farmers in southern Nigeria tend to practice more ecologically sustaining practices such as, intercropping, agroforestry and the use (and) or maintenance of local food crop genotypes to ensure their adaptability to climate change.

3.4. Challenges of Climate Change Adaptations on Crop Production

The results on the challenges faced by local farmers' in the implementation of climate change adaptation to crop production in Gombe State are presented in [Table 4](#). The result show that on whether massive poverty is a challenge to climate change adaptation among crop producers, where most farmers cannot afford to finance adaptation techniques, 84% of the respondents agreed, 5% of them were undecided, while 11% of them disagree with mean of 4.02 and interpreted as satisfactory. On whether there is a challenge of lack of knowledge among crop farmers of the new farming techniques, 79% of the respondents agreed, while 21% of them disagreed with mean of 4.12 and interpreted as satisfactory.

On whether there is a challenge of lack of information about availability and access to government support, 86% of the respondents agreed, while 14% of them disagreed with mean of 4.23 and interpreted as very satisfactory. And on whether there is a challenge of unavailability of improved seeds for farmers, 81% of the respondents agreed, 15% of them were undecided, while 4% of them disagreed with mean of 4.07 and interpreted as satisfactory. This implied that there are various challenges faced by crop producers in implementing government institutional support to climate change adaptation in Gombe State, Nigeria with an average mean of 4.11 and interpreted as satisfactory.

Table-4. Challenges of climate change adaptation in crop production.

Challenges of climate change adaptation strategies in crop production	Percentage responses (%)					Mean	Interpretation
	SA	A	U	D	SD		
Massive poverty where most farmers cannot afford to finance adaptation techniques	37	47	5	5	6	4.02	Satisfactory
Lack of knowledge among crop farmers of the new farming techniques	40	34	1	16	9	4.12	Satisfactory
Lack of information about availability and access to government support	39	47	0	4	7	4.23	Very satisfactory
Unavailability of improved seeds	32	49	15	2	1	4.07	Satisfactory
Average mean	37	45	5	7	6	4.11	Satisfactory

Source: Field data, 2017

Key: SA - Strongly agree, A - Agree, U - Undecided, D - Disagree, SD - Strongly disagree.

3.5. Challenges of Climate Change Adaptation on Livestock Production

The results on the challenges faced in the implementation of farmers' climate change adaptation in livestock production in Gombe state is presented in Table 5. The result show that on the assertion that there is a challenge of unavailability of reliable pesticides, 75% of the respondents agreed, and 25% of them disagreed with the mean of 3.88 and interpreted as satisfactory. On the assertion that there is challenge of limited affordability of adaptation techniques by livestock farmers, 84% of the respondents agreed, while 16% disagreed with mean of 4.07 and interpreted as satisfactory. And on the assertion that there is a challenge of lack of proper training on rain water harvesting and feed conservation, 70% of the respondents agreed, while 30% of them disagreed with the mean of 4.02 interpreted as satisfactory. This implied that there are various challenges faced by livestock producers in implementing climate change adaptation in Gombe state, Nigeria with an average mean of 3.99 and interpreted as satisfactory.

Table-5. Showing responses on the challenges of climate change adaptation in livestock production.

Challenges of climate change adaptation strategies in livestock production	Percentage responses (%)					Mean	Interpretation
	SA	A	U	D	SD		
Unavailability of reliable pesticides	33	42	0	9	16	3.88	Satisfactory
Limited affordability of adaptation techniques	26	58	0	14	2	4.07	Satisfactory
Lack of proper training on rain water harvesting and feed conservation	37	43	5	7	6	4.02	Satisfactory
Average mean	32	48	2	10	8	3.99	Satisfactory

Source: Field data, 2017.

Key: SA - Strongly agree, A - Agree, U - Undecided, D - Disagree, SD - Strongly disagree.

3.6. Challenges of Climate Change Adaptation Implementation by Government Institutions.

The results on the challenges faced by government institutions in the implementation of farmers' climate change adaptation measures in Gombe State are presented in Table 6. The result show that on whether there is lack of clear mandate that leads to competition and duplication of duties, 79% of the respondents agreed, while 21% of them disagree, with mean of 4.12 and interpreted as satisfactory. On the assertion that there is a challenge of massive corruption and misappropriation of climate change adaptation funds, 76% of the respondents agreed, 14% of them were undecided, while 10% of them disagree, with mean of 4.02 and interpreted as satisfactory. On the assertion that there is a challenge of lack of inadequate skilled manpower (extension workers, coordinators, veterinary specialists etc.), 81% of the respondents agreed, 9% of them were undecided, while 10% of them disagreed, with mean of 4.12 and interpreted as satisfactory. And on whether there is a challenge of political influence peddling among the government institutions, 86% of the respondents agreed, while 14% of them

disagreed, with mean of 4.23 and interpreted as satisfactory. This implied that government institutions also face various challenges in implementing adaptation support to farmers on climate change in Gombe State, Nigeria with an average mean of 4.12 and interpreted as satisfactory.

Table-6. Challenges faced by government institutions in climate change adaptation.

Challenges of government institutions in climate change adaptation	Percentage responses (%)					Mean	Interpretation
	SA	A	U	D	SD		
Lack of clear mandate leads to competition and duplication of duties	42	37	0	16	5	4.12	Satisfactory
Massive corruption and misappropriation of adaptation funds	35	39	16	6	4	4.02	Satisfactory
Lack of enough skilled manpower (extension workers, coordinators, veterinary specialists etc.)	31	45	7	7	2	4.12	Satisfactory
Political influence peddling among the government institutions	39	47	0	12	2	4.23	Satisfactory
Average mean	37	42	6	11	4	4.12	Satisfactory

Source: Field data, 2017

Key: SA - Strongly agree, A - Agree, U - Undecided, D - Disagree, SD - Strongly disagree.

3.7. Challenges of Implementation of Climate Change Adaptation Strategies

The results on the challenges faced in the implementation of farmers' climate change adaptation strategies in crop production show that some of the challenges include; massive poverty, resulting in most farmers not being able to afford the financing of climate change adaptation techniques. Other challenges include lack of knowledge among crop farmers of the new farming techniques, lack of adequate information about availability and access to government support and unavailability of improved seeds for farmers.

The results on the challenges faced in the implementation of farmers' climate change adaptation in livestock production show that some of the challenges include; unavailability of reliable pesticides, limited affordability of adaptation techniques by livestock farmers and lack of proper training on rain water harvesting and feed conservation methods.

The results on the challenges faced by government institutions in the implementation of farmers' climate change adaptation include; lack of clear mandate which leads to competition and duplication of duties, massive corruption and misappropriation of adaptation funds, inadequate of skilled manpower (extension workers, coordinators, veterinary specialists etc.) and political influence peddling among the government institutions.

These findings are supported by [Rahman \(2008\)](#) who stated that there is sometimes a disconnection between institutions and the farmers. Studies reviewed around this topic shows that, in most cases farmers lacked the necessary information to help them cope with the changes that are being experienced within the sector and especially climate change. [Yaro \(2010\)](#) also pointed out other factors which are less frequently cited in literature. Such other factors which include weak farm management which is expressed in lack of book keeping and land tenure security, inadequate finance, limited spacio-temporal reach, lack of human resources and poor information are issues that challenged the effectiveness of institutional support amongst farmers.

[Hall et al. \(2013\)](#) also acknowledged that another factor that may result in challenges for farmers accessing climate change adaptation support especially from financial institutions is the lack of book keeping (record) by small farmers. This especially creates problems for smallholder farmers when they seek support to adapt from institutions which require collateral agreements as they usually have nothing to show as evidence for their ability to pay back the loans. [Agrawal \(2008\)](#) also argued that the security of the land tenure system being practiced in an area has been identified as another factor which may affect smallholder farmers' decision to access institutional support.

4. CONCLUSION

This study has examined the role of government institutions in supporting smallholder farmers' adaptation to climate change in Gombe State, Nigeria. The findings show that climate change adaptation support provided by government institutions to crop farmers include improved seeds, training to crop farmers about composting, mulching and crop rotation, provision of financial assistance for irrigation schemes, pesticides for treating crop pests and diseases and tree seedlings to promote on-farm tree planting. For livestock farmers, government institutions provide pesticides to treat animal pests and diseases, rain water harvesting equipment, training of livestock farmers about the conservation of feeds/pasture and financial assistance for purchase of irrigation equipment. The findings of the study reveals that some of the factors determining adaptation support provided by government institutions in crop production include; the number of people affected, the severity of drought among the affected people, availability of resources to support farmers, and the government policy on emergency support. The results also show that the factors determining adaptation support provided by government institutions in livestock production include the number of animals affected, the percentage contribution of livestock production to farmers' livelihoods, the availability and number of extension and the severity of floods and/or droughts in the area. The study concludes that climate change has had significant and far reaching impacts on small famers in the study area. Hence, government institutions have been identified to play important roles in adaptation as they shape the response and strategies households adopt to reduce the impacts of climate change.

5. RECOMMENDATIONS

From the findings of the study the following recommendations were made:

- i. Institutions involved in adaptation support should develop innovative ways of meeting with smallholder farmers in remote parts of the state. This could be done through outreach services on specific days that would be convenient to the people such as market days when people from the remote areas come to trade. Again, institutions involved in the adaptation process must employ more local people so as to enhance effective communication between the institutions and the farmers.
- ii. Government institutions, non-governmental organizations and opinion leaders must work together to educate the people on the importance of paying for certain services to ensure that their productivity increases in this period of climatic changes. This call comes as a result of the study observing that, farmers generally understood institutional support to mean those which come freely from institutions.
- iii. Lastly, there is the need for policy by government and institutions to ensure sustainability of interventions towards climate change adaptation. Institutions which offer adaptation support to farmers must ensure the sustainability of interventions they introduce to farmers as opposed to what happens in most cases where when a particular project run by an institution is ended, the institutional surveillance for the intervention also comes to an end. This creates difficulties for farmers to continue with the particular interventions. This is especially true in the case of NGOs and public organizations. If they could charge beneficiaries of such interventions a token to ensure project sustainability, it would go a long way to increase the productivity of farmers. Again, institutions could budget for sustainability content in adaptation projects which can be used to ensure the durability of projects they introduce to farmers.

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