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SOURCES OF CLIMATE CHANGE INFORMATION AND FARMERS' ADAPTIVE CAPACITY: AN ADULT EDUCATION PERSPECTIVE FROM RURAL COMMUNITIES OF KANO STATE, NIGERIA

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Abstract

Climate change continues to destabilize agricultural productivity and the livelihoods of rural farming communities in Nigeria. Access to climate change information and the ability of farmers to overcome adaptation constraints are increasingly recognized as essential for building resilience to climate-related challenges. This study examined the major sources of climate change information available to farmers and the constraints affecting their adaptive capacity in Tofa Local Government Area of Kano State, Nigeria, from an adult education perspective. A descriptive survey research design was adopted, and data were collected from 130 farmers using a structured questionnaire. The instrument was validated by experts in adult education and community development, as well as extension education, while its reliability was established through a test–retest method using Pearson Product-Moment Correlation Coefficient (PPMCC), which yielded a reliability index of 0.80. Data were analyzed using descriptive statistics comprising mean and standard deviation. The findings revealed that farmers accessed climate change information primarily through fellow farmers, extension workers, radio broadcasts, community meetings, and non-governmental organizations, with fellow farmers constituting the most prominent source. The study further found that inadequate access to climate-resilient seeds, modern farming equipment, institutional support, and reliable climate information constituted the major constraints

affecting farmers' adaptive capacity to climate-related challenges. The study highlights the importance of integrating adult education with agricultural extension and community development initiatives to strengthen farmers' access to relevant knowledge, practical learning opportunities, and essential adaptation resources. It recommends strengthening extension-based climate education, promoting community learning networks, improving access to climate-resilient agricultural inputs, and enhancing institutional support to improve farmers' resilience and sustainable rural livelihoods.

Keywords: Climate change information, adaptive capacity, adult education, community development, farmers, Kano State, Nigeria

Introduction

Climate change has become one of the most serious environmental challenges affecting agricultural production and rural livelihoods across the world. In Nigeria, changes in rainfall patterns, increasing temperatures, droughts, floods, and pest infestations continue to destabilize agricultural productivity and food security, particularly among smallholder farmers who depend largely on rain-fed agriculture (Bello *et al.,* 2013).

Access to climate change information is increasingly viewed as an important factor in enhancing farmers' capacity to adapt to changing environmental conditions. Information enables farmers to make informed decisions with regard to planting dates, selection of crops, soil management, and other adaptation measures necessary for sustaining agricultural productivity. Studies have shown that access to climate information significantly influences farmers' knowledge of adaptation strategies and their ability to respond effectively to climate-related risks (Akinwalere, 2021; Osuji *et al.,* 2025).

From an adult education perspective, climate change information dissemination constitutes an important form of non-formal learning through which rural farmers acquire knowledge, skills, and competencies required for environmental adaptation. Adult education emphasizes lifelong learning, empowerment, and capacity building, making it a vital tool for enhancing farmers' resilience to climate change. Rural farmers continuously engage in educational processes that strengthen their adaptive capacity through extension services, radio programmes, community meetings, farmer-to-farmer interactions, and other informal learning platforms (Nabara *et al.,* 2023).

Empirical evidence indicates that farmers obtain climate-related information from diverse sources. Mohammed *et al.* (2024) found that personal experience, radio broadcasts, social networks, and institutional channels were major sources of climate change information among maize farmers in Northeastern Nigeria. Similarly, Akinwalere (2021) reported that access to information significantly

influences farmers' climate adaptability, while Bello *et al.* (2013) identified radio and extension services as important channels for climate change awareness and adaptation among farmers in Central Nigeria.

Despite the growing recognition of climate information as a resource for adaptation, many rural farmers still experience inadequate access to reliable climate-related information and advisory services. Consequently, differences in information access continue to affect farmers' awareness, decision-making, and adaptation outcomes. Understanding the sources through which farmers obtain climate change information is therefore essential for designing effective adult education and community development interventions that can strengthen adaptive capacity and promote sustainable rural livelihoods.

This study therefore examines the major sources of climate change information available to farmers and the constraints affecting their adaptive capacity to climate-related challenges in Tofa Local Government Area of Kano Sate, Nigeria, from an adult education perspective.

Statement of the Problem

Climate change has become one of the greatest threats to agricultural productivity and food security in Nigeria, particularly among rural farming communities that depend largely on rain-fed agriculture. Increasing temperatures, irregular rainfall patterns, prolonged droughts, floods, and pest infestations have continued to reduce crop yields and threaten farmers' livelihoods. Although various climate change adaptation measures have been promoted, their effectiveness depends largely on farmers' access to relevant climate change information and their capacity to utilize such information in making informed farming decisions.

Previous studies have examined farmers' awareness of climate change, adaptation strategies, and sources of climate change information. Other studies have identified factors such as inadequate finance, poor access to agricultural inputs, limited extension services, and weak institutional support as barriers to climate change adaptation. However, these issues have often been investigated separately, with limited attention given to understanding both the major sources of climate change information available to farmers and the constraints affecting their adaptive capacity within a single study. Furthermore, most existing studies have approached climate change adaptation from agricultural and extension perspectives, with limited emphasis on the role of adult education and community development in strengthening farmers' adaptive capacity. In addition, empirical evidence from rural farming communities in Tofa Local Government Area of Kano State remains limited.

Consequently, there is insufficient evidence on how existing climate change information sources can be effectively utilized within adult education programmes while addressing the major constraints that limit farmers' adaptive capacity. This knowledge gap limits the development of context-specific educational and community-based interventions capable of improving farmers' resilience to climate-related challenges. It is against this background that this study examined the major sources of climate change information available to farmers and the constraints affecting their adaptive capacity in Tofa Local

Government Area, Kano State, Nigeria. The findings are expected to provide empirical evidence for strengthening adult education programmes, agricultural extension services, and community development initiatives aimed at enhancing farmers' resilience and promoting sustainable agricultural livelihoods**.**

Objectives of the Study

1. To identify the major sources of climate change information available to farmers in Tofa Local Government Area, Kano State.

2. To identify the major constraints affecting farmers' adaptive capacity to climate-related challenges in Tofa Local Government Area, Kano State.

Research Questions

1. What are the major sources of climate change information available to farmers in Tofa Local Government Area, Kano State?

2. What are the major constraints affecting farmers' adaptive capacity to climate-related challenges in Tofa Local Government Area, Kano State?

Literature Review

Access to climate change information is essential for helping farmers make informed decisions regarding agricultural production and adaptation. Climate information is disseminated through various formal and informal channels, including extension agents, radio broadcasts, farmer-to-farmer networks, community meetings, and mobile communication platforms. Studies in Nigeria have consistently identified radio and agricultural extension services as major sources of climate-related information among rural farmers. Bello *et al.* (2013) found that radio was the most important source of climate change information among farmers in Central Nigeria, while extension agents played a significant role in disseminating adaptation knowledge. Similarly, Ebenehi *et al.* (2018) reported that farmers in Niger State obtained climate information primarily from radio, extension agents, fellow farmers, and television. Recent evidence from Ebonyi State also revealed that farmer-to-farmer networks, radio, community meetings, and mobile phones constitute important channels for climate information dissemination among smallholder farmers (Osuji *et al.,* 2025). These findings suggest that both formal and informal learning platforms are critical in promoting climate awareness among rural farmers.

Adaptive capacity refers to the ability of individuals or communities to adjust to climate variability, reduce vulnerability, and respond effectively to climate-related risks. However, farmers' ability to adapt is often influenced by the availability of climate information, financial resources, agricultural technologies, farm inputs, and institutional support. Evidence from Nigeria indicates that inadequate access to these resources constitutes a major constraint to climate change adaptation. Ige *et al.* (2021) identified inadequate access to climate information, inadequate finance, scarcity of labour, inadequate

farm input supplies, poor agricultural extension services, non-availability of resistant crop varieties, and inaccurate agro-meteorological information as major constraints limiting farmers' choice of climate change adaptation strategies in Ondo State. The authors concluded that these constraints reduce farmers' capacity to cope effectively with the adverse effects of climate change and recommended strengthening extension services and improving farmers' access to reliable weather information. Similarly, Akinwalere (2021) found that although farmers obtained climate change information from different sources, they continued to face constraints that limited climate adaptability. The study identified barriers related to access and utilization of climate information and emphasized the need to improve information dissemination systems to enhance farmers' adaptive capacity. Earlier findings by Bello et al. (2013) also showed that although farmers were aware of climate change and adopted various adaptation strategies, their adaptation efforts were constrained by inadequate financial resources, limited access to relevant technologies, and weak institutional support. The study emphasized that improving access to agricultural information and support services is essential for strengthening farmers' resilience to climate-related challenges.

The reviewed literature demonstrates that climate change information obtained through extension services, radio broadcasts, fellow farmers, community meetings, and other communication channels plays a significant role in improving farmers' awareness of climate change and supporting adaptation efforts. Similarly, previous studies have identified major constraints to adaptive capacity, including inadequate access to climate information, financial resources, improved farm inputs, agricultural technologies, and institutional support (Bello et al., 2013; Akinwalere, 2021; Ige *et al.,* 2021). Despite these contributions, important gaps remain in the literature. Empirically, most studies have examined either sources of climate change information or constraints to adaptive capacity as separate issues, with limited attention to how both dimensions can be investigated within a single study. Geographically, much of the available evidence comes from states such as Ondo, Niger, Ebonyi, and parts of Central Nigeria, while empirical evidence from rural farming communities in Kano State, particularly Tofa Local Government Area, remains limited. Methodologically, many previous studies have focused on climate change awareness, adaptation strategies, or farmers' perceptions, with relatively few employing a descriptive survey design to simultaneously assess sources of climate change information and constraints affecting adaptive capacity using structured quantitative measures. From an adult education perspective, existing studies have predominantly approached climate change adaptation from agricultural and extension viewpoints, giving limited consideration to the role of adult learning and community development in strengthening farmers' adaptive capacity. This study addresses these empirical, geographical, methodological, and contextual gaps by examining the major sources of climate change information and the constraints affecting farmers' adaptive capacity from an adult education and community development perspective among rural farmers in Tofa Local Government Area, Kano State, Nigeria.

Theoretical Framework

Andragogy Theory

This study is anchored on Andragogy Theory developed by Malcolm Knowles (1980). The theory explains how adults learn and emphasizes that adult learners are self-directed individuals who draw upon their life experiences to acquire new knowledge and solve practical problems. According to Knowles, adults are motivated to learn when the knowledge acquired is relevant to their immediate needs and daily activities. The theory is based on six major assumptions: the need to know, self-concept, prior experience, readiness to learn, orientation to learning, and motivation to learn. Adults learn best when learning activities address real-life challenges and provide practical solutions to problems they encounter in their environment.

The relevance of Andragogy Theory to this study lies in its explanation of how rural farmers acquire and utilize climate change information. Farmers are adult learners who obtain climate-related knowledge through extension services, radio programmes, community meetings, farmer associations, and interactions with fellow farmers. These learning opportunities enable them to understand climate change and adopt appropriate adaptation strategies to cope with environmental challenges.

The theory further suggests that farmers are more likely to utilize climate information when it is presented in a practical, accessible, and problem-centred manner. As adult learners, they apply acquired knowledge directly to agricultural activities such as adjusting planting dates, adopting improved farming practices, selecting climate-resilient crop varieties, and managing climate-related risks. Therefore, Andragogy Theory provides a suitable framework for understanding how sources of climate change information contribute to farmers' understanding of climate change and enhance their adaptive capacity in Tofa Local Government Area of Kano State, Nigeria.

Methodology

This study adopted a descriptive survey research design to examine the major sources of climate change information available to farmers and the constraints affecting their adaptive capacity to climate-related challenges in Tofa Local Government Area of Kano State, Nigeria. The study was conducted among rural farmers in Tofa Local Government Area, where agriculture constitutes the primary source of livelihood.

The population of the study comprised all crop farmers in Tofa Local Government Area. A sample of 130 respondents was selected using purposive and snowball sampling techniques. The purposive sampling technique was used to select farmers who had at least five years of farming experience and were actively engaged in crop production, as they were considered to possess adequate experience and practical knowledge of climate change and its effects on agricultural productivity. Thereafter, the snowball sampling technique was employed to identify other eligible farmers through referrals from the initially selected respondents.

Data were collected using a structured questionnaire designed to obtain information on the sources of climate change information available to farmers and the constraints affecting their adaptive capacity to climate-related challenges. The questionnaire was designed using a 4-Point Likert Scale of Strongly Agreed (SA) = 4, Agreed (A) = 3, Disagreed (D) = 2, and Strongly Disagreed (SD) = 1. The criterion mean of 2.50 was calculated as [4+3+2+1]/4=2.50.. Accordingly, any item with a mean score of 2.50 or above was accepted, while any item with a mean score below 2.50 was rejected.

The instrument was validated by experts in Adult Education and Community Develoment, as well as Extension Education to ensure its content validity and suitability for measuring the variables under investigation. The reliability of the instrument was established using a test-retest method. The reliability coefficient was determined using Pearson Product-Moment Correlation Coefficient (PPMCC), which yielded a reliability index of 0.80, indicating that the instrument was reliable for data collection.

The questionnaire was administered personally by the researchers with the assistance of trained research assistants, and all administered copies were successfully retrieved for analysis. The data collected were analyzed using descriptive statistics, specifically mean and standard deviation, to answer the research questions. The results were presented in tables and interpreted in line with the objectives of the study.

Results

Research Question 1: What are the major sources of climate change information available to farmers in Tofa Local Government Area, Kano State?

Table 1: *Mean Ratings and Standard Deviations on Sources of Climate Change Information among Farmers (N 130)*

S/N	Item Statement	N	Mean	Standard Deviation	Decision
1.	I receive information about climate change from radio	130	2.98	0.93	Accepted
2.	Extension workers educate me about climate change issues	130	3.10	0.98	Accepted
3.	I discuss climate issues with fellow farmers	130	3.25	0.87	Accepted
4.	I attend community meetings that discuss climate issues	130	2.62	1.10	Accepted
5.	NGOs have provided me with information about climate change	130	2.87	1.02	Accepted

Cluster Mean	130	2.96	0.98	Accepted

Source: Field Survey (2026)

The findings in Table 1 indicate that farmers access climate change information through a variety of formal and informal channels. The cluster mean of 2.96, which is above the criterion mean of 2.50, suggests that the identified information sources are widely utilized by the respondents. Among the sources, discussions with fellow farmers recorded the highest mean score (M = 3.25), indicating that peer learning and social interaction constitute important mechanisms for information dissemination within farming communities. Extension workers (M = 3.10), radio broadcasts (M = 2.98), and NGOs (M = 2.87) were also identified as major sources of climate-related information, highlighting the significance of agricultural extension services, mass media, and NGOs in promoting climate change awareness. Although community meetings recorded the lowest mean score (M = 2.62), respondents still acknowledged their relevance in climate information dissemination. Overall, the findings demonstrate that farmers rely on a combination of interpersonal communication, extension services, and media platforms to obtain information about climate change.

Research Question 2: What are the major constraints affecting farmers' adaptive capacity to climate-related challenges in Tofa Local Government Area, Kano State?

Table 2*: Mean Ratings and Standard Deviation on Constraints Affecting Farmers' Adaptive Capacity to Climate-Related Challenges (N130)*

S/N	Item Statement	N	Mean	Standard Deviation	Decision
1.	Lack of information about climate change affects my farming activities	130	2.81	1.09	Accepted
2.	Climate change has led to increase in pests and diseases	130	3.04	0.95	Accepted
3.	I don't have access to modern farming equipment	130	3.35	0.89	Accepted
4.	Inadequate support from government or NGOs affects my farming activities	130	3.15	1.00	Accepted
5.	Poor access to climate-resistant seeds limits my productivity	130	3.41	0.91	Accepted

Cluster Mean	130	3.15	0.97	Accepted

Source: Field Survey (2026)

The findings in Table 2 indicate that farmers experience several constraints that affect their adaptive capacity to climate-related challenges. The cluster mean of 3.15, which is above the criterion mean of 2.50, shows that respondents generally agreed that the identified factors constitute major constraints to their ability to adapt effectively to climate change. Poor access to climate-resistant seeds recorded the highest mean score (M = 3.41), indicating that the unavailability of improved seed varieties is the most significant constraint. This was followed by lack of access to modern farming equipment (M = 3.35), inadequate support from government and non-governmental organizations (M = 3.15), increased incidence of pests and diseases resulting from climate change (M = 3.04), and inadequate access to climate change information (M = 2.81). These findings suggest that farmers' adaptive capacity is constrained by a combination of informational, technological, institutional, and environmental factors. Therefore, improving access to climate information, agricultural technologies, quality farm inputs, and institutional support is essential for strengthening farmers' resilience to climate-related challenges.

Discussion of Findings

The findings revealed that farmers obtained climate change information from diverse sources, including fellow farmers, extension workers, radio broadcasts, community meetings, and non-governmental organizations. Discussions with fellow farmers emerged as the most utilized source of climate change information, followed by extension workers and radio broadcasts. This finding is generally consistent with Bello *et al.* (2013), who reported that radio and agricultural extension services were important sources of climate change information among farmers in Central Nigeria. Likewise, Mohammed et al. (2024) found that maize farmers in Northeastern Nigeria relied on radio broadcasts, extension agents, personal experience, and social networks to obtain climate-related information. However, unlike Bello *et al.* (2013), where radio was among the dominant information channels, the present study found that fellow farmers constituted the primary source of climate change information. This difference may be attributed to variations in local communication networks, access to mass media, the availability of extension services, and the strong culture of peer learning among rural farming communities in Tofa Local Government Area. The prominence of fellow farmers as a source of information underscores the importance of informal learning and knowledge sharing in promoting climate change awareness.

The findings also support Knowles' (1980) Andragogy Theory. First, the high reliance on fellow farmers reflects the experience assumption, which posits that adults bring a rich reservoir of life experiences that serves as an important resource for learning. Farmers draw on their own experiences and those of their peers to acquire practical knowledge about climate change and appropriate adaptation practices. Second, the use of extension workers demonstrates the readiness to learn assumption, as farmers actively seek

knowledge that enables them to respond to immediate farming challenges associated with climate variability. Third, the continued use of radio broadcasts and other communication channels reflects the orientation to learning assumption because adults prefer learning that is problem-centred and directly applicable to real-life situations. Climate change information obtained through these channels equips farmers with practical knowledge for making informed decisions on agricultural production and adaptation. These findings therefore suggest that integrating formal and informal learning opportunities is essential for strengthening farmers' climate change awareness and adaptive capacity from an adult education perspective.

The findings revealed that farmers face several constraints affecting their adaptive capacity to climate-related challenges. Poor access to climate-resistant seeds emerged as the most significant constraint, followed by inadequate access to modern farming equipment, insufficient support from government and non-governmental organizations, increased incidence of pests and diseases, and limited access to climate change information. These findings indicate that although farmers are aware of climate change, their ability to implement effective adaptation measures is constrained by inadequate resources, technologies, information, and institutional support. The findings are consistent with Ige *et al.* (2021), who identified inadequate access to climate information, financial resources, agricultural inputs, improved crop varieties, extension services, and reliable agro-meteorological information as major constraints limiting farmers' climate change adaptation strategies in Ondo State, Nigeria. Similarly, Bello *et al.* (2013) reported that inadequate finance, limited access to appropriate technologies, and weak institutional support constrained farmers' adaptation efforts despite their awareness of climate change.

The findings also support Knowles' (1980) Andragogy Theory. First, the identified constraints reflect the need to know assumption, which suggests that adults seek knowledge when they recognize its relevance to solving immediate problems. The respondents acknowledged that inadequate access to climate information limits their ability to make informed farming decisions, demonstrating the importance of timely and relevant climate education. Second, the findings align with the readiness to learn assumption, as the challenges posed by climate variability create an immediate need for farmers to acquire practical knowledge and skills that enhance adaptation. However, inadequate institutional support and limited access to learning resources reduce opportunities for effective learning and the application of adaptation practices. Third, the findings are consistent with the orientation to learning assumption because adult learners value education that provides practical solutions to real-life problems. Access to climate-resilient seeds, modern farming equipment, and reliable support services enables farmers to apply acquired knowledge directly to their farming activities. Therefore, strengthening climate education, extension services, and institutional support is essential for enhancing farmers' adaptive capacity and promoting sustainable agricultural livelihoods from an adult education perspective.

Conclusion

This study examined the major sources of climate change information available to farmers and the constraints affecting their adaptive capacity to climate-related challenges in Tofa Local Government Area of Kano State, Nigeria, from an adult education perspective. The findings revealed that farmers relied on a combination of formal and informal information sources, particularly fellow farmers, extension workers, radio broadcasts, community meetings, and non-governmental organizations, to acquire climate-related knowledge. The study further established that farmers' adaptive capacity is constrained by inadequate access to climate-resilient seeds, modern farming equipment, reliable climate information, and institutional support, thereby limiting their ability to respond effectively to climate-related challenges.

The study contributes to the growing body of knowledge on climate change adaptation by demonstrating that effective adaptation depends not only on access to climate change information but also on the availability of the resources and support systems required to translate knowledge into practice. From an adult education perspective, the findings underscore the importance of promoting continuous learning through extension services, community-based learning platforms, and other non-formal educational programmes that enhance farmers' knowledge, skills, and resilience. By providing empirical evidence from rural communities in Tofa Local Government Area, Kano State, this study also fills an important geographical and contextual gap in the literature and offers evidence that can inform adult education programmes, agricultural extension services, and community development interventions aimed at strengthening farmers' adaptive capacity and promoting sustainable rural livelihoods.

Recommendations

Based on the findings of this study, the following recommendations are made:

1. Agricultural extension agencies should strengthen climate change education by increasing the frequency of extension visits and providing regular, practical training on climate-smart agricultural practices. Extension programmes should also promote farmer-to-farmer learning to enhance the dissemination of climate change information through existing community knowledge networks.

2. Government agencies, agricultural research institutes, and non-governmental organizations should improve farmers' access to climate-resilient seed varieties and appropriate modern farming equipment through targeted input support programmes, subsidized distribution schemes, and community-based demonstration farms to strengthen farmers' adaptive capacity.

3. The Federal and Kano State Ministries of Agriculture, in collaboration with relevant agencies, should strengthen institutional support by providing timely climate information, weather advisories, and

technical advisory services through extension workers, radio programmes, and community learning platforms to enable farmers to make informed adaptation decisions.

4. Adult education providers and community development practitioners should integrate climate change education into community-based adult learning programmes to improve farmers' knowledge, problem-solving skills, and capacity to adopt appropriate adaptation measures. Such programmes should emphasize practical, participatory, and locally relevant learning approaches that address the immediate climate-related challenges faced by rural farmers.

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