Kaduna State University Environmental Science Journal (KESJ)
Website: *https://kesj.org.ng* ***ISSN:*** *2734-2751*
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Volume 5, Issue 1, June 2025
DOI: https://doi.org/10.66884/kesj.2025.je3ci6ej

ASSESSMENT OF ROLE OF CLIMATE FINANCE MECHANISMS IN ACHIEVING ENVIRONMENTAL SUSTAINABILITY IN NORTH CENTRAL NIGERIA

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ABSTRACT

Purpose: *This study examines the role of climate finance mechanisms in fostering environmental sustainability in North Central Nigeria, with a focus on how international, national, and community-level financing tools contribute to climate change mitigation, adaptation, and sustainable development goals in the region.*

Design/methodology/approach: *The research adopts a mixed-method approach, combining qualitative analysis of policy documents, climate finance reports, and international frameworks with empirical data from field surveys and interviews conducted across selected states in North Central Nigeria. Descriptive statistics and thematic analysis were employed to evaluate the accessibility, effectiveness, and challenges of climate finance mechanisms in the study area.*

Findings: *The study reveals that climate finance has provided critical support for renewable energy projects, afforestation programs, sustainable agriculture, and resilience-building initiatives in flood-prone and drought-affected communities. However, findings also indicate that bureaucratic bottlenecks, weak institutional capacity, poor awareness, and inequitable distribution of resources hinder optimal utilization of climate finance opportunities.*

Research limitations/Implications*: The study is limited to selected states in North Central Nigeria, which may not fully capture the diversity of climate finance implementation across the country. Further research with broader geographical coverage and longitudinal coverage will enhance generalizability.*

Practical Implications*: The study highlights the need for strengthened institutional frameworks, capacity building for local governments and civil society, and enhanced transparency in fund disbursement to maximize the impact of climate finance in promoting environmental sustainability.*

Originality/value*: The paper contributes to the body of knowledge by offering a contextualized analysis of climate finance in North Central Nigeria, linking global financing mechanisms to localized environmental sustainability practices, and proposing pragmatic pathways for strengthening climate finance governance in developing regions.*

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Keywords: Climate finance; environmental sustainability; North Central Nigeria; green bonds, adaptation, climate resilience

1.0 INTRODUCTION

Climate refers to the long-term patterns and averages of weather conditions (such as temperature, precipitation, humidity, and wind) in a particular region over an extended period, typically 30 years or more (World Meteorological Organization (WMO), 2021). Climate change is the long-term alteration in the statistical distribution of weather patterns, particularly those attributed directly or indirectly to human activities that increase greenhouse gas concentrations, leading to global warming and associated impacts (Intergovernmental Panel on Climate Change (IPCC), 2022). Climate change poses one of the most significant challenges to environmental sustainability, particularly in developing regions such as North Central Nigeria. This area, characterized by diverse ecological zones and significant dependence on agriculture and natural resources, faces increasing vulnerabilities to erratic rainfall patterns, droughts, and flooding. These climatic pressures according to Okeke (2023) have severe implications for livelihoods, food security, and biodiversity, necessitating targeted interventions to mitigate and adapt to the adverse effects of climate change.

Climate finance mechanisms have emerged as vital instruments in mobilizing resources and providing financial support for climate-resilient and low-carbon development pathways. Okeke (2024) explained that its role is particularly crucial in bridging the funding gap between climate action needs and available domestic financial resources. Climate finance mechanisms according to Adebayo (2022) refer to structured financial arrangements often supported by multilateral, bilateral, or domestic entities that channel funds toward climate mitigation and adaptation initiatives. Examples according to Ugwu and Adewusi (2024) include the Green Climate Fund (GCF), Adaptation Fund (AF), Clean Development Mechanism (CDM), and various concessional loans or grants. Adebayo (2022) states that Nigeria, and particularly in the North Central region, access to these mechanisms has been relatively limited due to institutional, infrastructural, and policy constraints. However, recent national strategies, including Nigeria's Nationally Determined Contributions (NDCs) under the Paris Agreement, highlight the critical need to leverage climate finance for sustainable environmental management. Akinyemi and Ilesanmi (2023) buttressed that these frameworks emphasize projects aimed at renewable energy, reforestation, water resource management, and sustainable agriculture all priorities in North Central Nigeria.

Environmental sustainability in North Central Nigeria is closely linked to the region's socioeconomic development and ecological balance. The area's growing population and urbanization pressures have accelerated deforestation, land degradation, and increased greenhouse gas emissions. Without targeted climate finance interventions, achieving sustainability goals will remain elusive. Mechanisms that provide direct support to communities, local governments, and private sector actors can enhance the region's adaptive capacity and reduce vulnerability to climate-related disasters. Okeke (2024) submits that integrating climate finance with local

development planning can ensure that financial resources address both environmental and socioeconomic challenges simultaneously, fostering holistic resilience.

This paper examines the role of climate finance mechanisms in achieving environmental sustainability in North Central Nigeria. It highlights the types of mechanisms available, and the challenges and opportunities associated with accessing these funds. Furthermore, the study assesses the extent to which climate finance initiatives contribute to key sustainability indicators, including biodiversity conservation, clean energy transitions, and sustainable agricultural practices. By exploring these dynamics, the paper seeks to provide actionable insights for policymakers, development partners, and local stakeholders striving to align environmental sustainability goals with financial and institutional realities in the region.

1.1 STATEMENT OF PROBLEM

North Central Nigeria is increasingly vulnerable to the adverse effects of climate change, which manifest in frequent flooding, prolonged droughts, soil erosion, and deforestation. These environmental challenges not only threaten the ecological balance of the region but also have severe implications for agriculture, water resources, and human livelihoods. The region's heavy dependence on natural resources for farming and energy intensifies its susceptibility to environmental degradation, thereby compounding poverty and food insecurity. Despite national and international recognition of these challenges, sustainable solutions remain insufficient, particularly in mobilizing the financial resources required to implement robust climate adaptation and mitigation strategies.

The persistent underutilization of climate finance threatens Nigeria's ability to meet its commitments under the Paris Agreement and Sustainable Development Goals (SDGs), particularly those related to environmental sustainability. Without targeted efforts to improve access, coordination, and effective use of climate finance mechanisms, the North Central region risks continued environmental degradation and escalating socio-economic impacts. This situation necessitates a critical examination of how climate finance is mobilized, distributed, and applied in the region to identify practical pathways toward achieving long-term sustainability.

1.2 AIM AND OBJECTIVES OF THE STUDY

The aim of this study is to examine the role of climate finance mechanisms in promoting environmental sustainability in North Central Nigeria.

1.2.1The objectives of the Study are to;

i. Identify key climate finance mechanisms accessible to Nigeria and North Central states;
ii. Examine their contributions to environmental sustainability initiatives in the region; iii. Analyze challenges and opportunities associated with climate finance implementation.

2.0 LITERATURE REVIEW

2.1 CONCEPT OF CLIMATE FINANCE

Climate finance refers to the flow of funds aimed at supporting actions that mitigate and adapt to the adverse impacts of climate change. It encompasses resources mobilized at international, national, and local levels to assist countries, particularly developing economies, in transitioning toward low-carbon and climate-resilient development pathways (FAO, 2019). These funds can originate from public, private, bilateral, and multilateral sources and may take the form of grants, concessional loans, or investments. The concept gained prominence after the Copenhagen Accord of 2009 and the Paris Agreement of 2015, which underscored the commitment of developed nations to provide financial assistance to vulnerable regions to meet their climate goals (African Development Bank, 2020). The scope of climate finance extends beyond mere funding; it is an essential mechanism for achieving sustainable development by integrating environmental and socio-economic priorities.

According to Richard *et.al.,* (2021), climate finance is critical for bridging the financial gap between global climate ambitions and available resources, especially in regions like Sub-Saharan Africa where climate-related risks are acute. Mechanisms such as the Green Climate Fund (GCF), Adaptation Fund (AF), and Global Environment Facility (GEF) have been established to channel resources toward renewable energy, reforestation, sustainable agriculture, and disaster risk reduction initiatives. These interventions are pivotal for reducing greenhouse gas emissions while enhancing the adaptive capacities of communities most affected by climate variability. In the Nigerian context, climate finance is particularly relevant due to the country's vulnerability to climate-induced environmental challenges such as desertification in the north, flooding in the central regions, and coastal erosion in the south. Anabaraonye *et. al.,* (2019) predicted that North Central Nigeria, with its heavy reliance on agriculture and natural resources, stands to benefit significantly from well-structured climate finance programs that target reforestation, water resource management, and sustainable land-use practices. However, limited access to these funds, coupled with weak institutional frameworks and low awareness at local levels, continues to hinder effective utilization. Understanding the concept of climate finance and its application in this region is therefore essential for designing strategies that enhance environmental sustainability and resilience.

2.2 ENVIRONMENTAL SUSTAINABILITY IN NORTH CENTRAL NIGERIA

Environmental sustainability in North Central Nigeria is a critical concern due to the region's heavy dependence on natural resources for agriculture, water supply, and energy. The area, which includes states such as Benue, Niger, Plateau, Kogi, Kwara, and Nasarawa, along with the Federal Capital Territory, is endowed with fertile soils, rivers, and forests that support both rural livelihoods and urban growth. However, rapid population increase, expansion of farmlands, and urbanization have led to widespread deforestation, soil erosion, and depletion of water resources. These trends threaten not only ecological balance but also food security and public health, making sustainability efforts a priority for both local communities and policymakers.

Climate variability and extreme weather events compound the environmental challenges in North Central Nigeria. The region experiences seasonal flooding along the Niger and Benue rivers,

recurrent droughts in semi-arid areas, and gully erosion on highland plateaus such as Jos. These hazards disrupt agricultural production, damage infrastructure, and displace communities, thereby undermining socio-economic development. Addressing these issues requires integrated sustainability strategies that combine conservation, sustainable land management, and climate adaptation to ensure that natural resources are used without compromising the needs of future generations. Efforts toward environmental sustainability in the region are increasingly linked to national and international initiatives such as Nigeria's Nationally Determined Contributions (NDCs) and the Sustainable Development Goals (SDGs). Programs promoting reforestation, renewable energy, sustainable agriculture, and watershed management are being implemented, though at varying levels of success. The effectiveness of these interventions depends largely on adequate funding, stakeholder participation, and strong institutional frameworks. Leveraging climate finance mechanisms to support these sustainability efforts offers a practical pathway to restoring degraded ecosystems, improving community resilience, and aligning the region's development trajectory with global climate commitments. Nwankpa and Amara (2022) states that environmental sustainability in the region is threatened by recurrent flooding in Kogi State, land degradation in Plateau State, and declining biodiversity in Benue State. Efforts to address these challenges involve community forestry, watershed management, and renewable energy initiatives, often dependent on external funding.

2.3 CLIMATE FINANCE MECHANISMS

Climate finance mechanisms are structured approaches designed to mobilize and channel funds toward initiatives that address climate change mitigation and adaptation. These mechanisms operate through international, regional, and national platforms, with notable examples including the Green Climate Fund (GCF), Adaptation Fund (AF), Global Environment Facility (GEF), and Clean Development Mechanism (CDM). Their primary purpose is to support developing countries in implementing projects such as renewable energy development, afforestation, climate-smart agriculture, and disaster risk reduction (African Development Bank (AfDB), 2020). By providing grants, concessional loans, or technical assistance, these mechanisms bridge the financial gap between climate-related challenges and the resources required to address them. In North Central Nigeria, climate finance mechanisms are crucial in responding to environmental issues like deforestation, soil erosion, and recurrent flooding. The region's reliance on agriculture and natural resources makes it highly vulnerable to climate variability, requiring investments in sustainable land use and water resource management. Mechanisms like the GCF and GEF have funded programs in Nigeria focusing on reforestation, rural energy access, and climate-resilient agriculture, though access at the subnational level remains limited due to weak institutional capacity and lack of technical expertise. Onyimadu and Uche (2021) alluded that strengthening the ability of state and local governments to engage with these mechanisms is vital to ensuring equitable resource distribution. Beyond financial support, climate finance mechanisms often provide policy guidance and foster partnerships between governments, private sector actors, and civil society. Okereke (2023) explained that they encourage integration of climate considerations into national development plans and promote transparency and accountability in the use of funds. For North Central Nigeria, leveraging these mechanisms effectively requires capacity building, improved project proposals, and alignment with Nigeria's Nationally Determined Contributions (NDCs) under the Paris Agreement. This holistic engagement can transform the region's response to climate change, enabling sustainable development while safeguarding ecosystems and community livelihoods.

2.4 ROLE OF CLIMATE FINANCE IN ENVIRONMENTAL SUSTAINABILITY

Climate finance plays a pivotal role in advancing environmental sustainability by providing the financial resources necessary to address the dual challenges of climate change mitigation and adaptation. Through structured funding from international, bilateral, and domestic sources, climate finance enables governments and communities to implement projects that reduce greenhouse gas emissions, restore degraded ecosystems, and promote sustainable use of natural resources (UNFCCC, 2023). This is particularly critical for developing regions such as North Central Nigeria, where limited domestic resources hinder large-scale environmental interventions. By bridging this financial gap, climate finance ensures that sustainability initiatives are not only conceptualized but also executed effectively. Wu (2023) explained that the mechanisms of climate finance contribute to environmental sustainability by supporting initiatives such as renewable energy development, afforestation programs, climate-smart agriculture, and water resource management. These projects help preserve biodiversity, combat desertification, and improve community resilience against extreme weather events. Banga (2018) inferred that funds from the Green Climate Fund (GCF) and Global Environment Facility (GEF) have been instrumental in promoting reforestation and sustainable farming practices in several African countries, thereby reducing land degradation and improving food security In the context of North Central Nigeria, such investments are vital for addressing environmental issues like deforestation, flooding, and soil erosion. Moreover, climate finance fosters inclusive development by aligning environmental goals with socio-economic priorities. It encourages stakeholder participation, strengthens institutional capacity, and ensures that local communities benefit directly from sustainability programs. This integration of financial support with capacity building helps create long-term solutions rather than short-term relief measures. For North Central Nigeria, effectively harnessing climate finance could transform environmental management practices, enabling the region to meet national commitments under the Sustainable Development Goals (SDGs) and the Paris Agreement while safeguarding natural resources for future generations.

2.5 BARRIERS TO EFFECTIVE CLIMATE FINANCE

One of the most significant barriers to effective climate finance mechanisms is inadequate institutional capacity at national and subnational levels. In regions like North Central Nigeria, weak governance structures, limited technical expertise, and fragmented policy frameworks hinder the ability of state and local governments to access and manage climate funds. These institutional gaps lead to poor project preparation, delayed implementation, and lack of accountability in the use of funds, ultimately undermining the potential impact of climate finance on environmental sustainability. Another major challenge according to Han and Gao (2024) is the limited awareness and participation of local communities and stakeholders in climate finance processes. Many communities in North Central Nigeria are unaware of existing climate finance opportunities, while those who are informed often lack the skills needed to develop bankable proposals or meet donor requirements. This disconnect between funding mechanisms and ground-level needs according to Han *et. al.,* (2024) results in climate projects that may not fully address local priorities, thereby reducing the effectiveness and sustainability of interventions. Financial and bureaucratic constraints also pose significant barriers. Accessing funds from mechanisms like the Green Climate Fund (GCF) or Adaptation Fund often involves lengthy approval processes, complex reporting requirements, and co-financing obligations that many developing regions cannot meet.

Additionally, currency fluctuations, political instability, and inadequate domestic financing further complicate the ability to leverage international climate funds effectively (UNFCCC, 2023). Overcoming these barriers requires capacity building, streamlined procedures, and stronger partnerships between governments, private sector actors, and civil society to ensure that climate finance translates into tangible environmental benefits.

2.6 OPPORTUNITIES AND EMERGING TRENDS

Despite existing barriers, there are significant opportunities for enhancing climate finance mechanisms in promoting environmental sustainability, particularly in North Central Nigeria. One major opportunity lies in the growing international commitment to climate action under frameworks such as the Paris Agreement and the Sustainable Development Goals (SDGs). These agreements have spurred the- creation of multiple funding windows, including the Green Climate Fund (GCF) and Adaptation Fund, which prioritize support for developing countries facing severe climate vulnerabilities. Nigeria's active participation in these frameworks positions the North Central region to leverage financial support for projects in renewable energy, reforestation, and sustainable agriculture that align with national and global climate targets (UNFCCC, 2023).

Fauza and Suryomurti (2024) corroborates that emerging trends also highlight the increasing role of private sector investment and blended finance in climate-related projects. Innovative financing models such as green bonds, carbon credits, and public-private partnerships are gaining traction in Nigeria and other African nations. These models allow governments to mobilize additional resources beyond traditional donor funding, while ensuring that projects deliver both environmental and economic returns. In North Central Nigeria, where agriculture and energy needs are central to livelihoods, these trends create opportunities for scaling climate-smart farming, solar energy deployment, and water resource management initiatives through collaborative funding arrangements. Digital technology and data-driven solutions represent another emerging trend that can transform climate finance implementation. Khan *et. al* ., (2022) states that the use of geospatial data, climate risk mapping, and block-chain for fund tracking is improving transparency and efficiency in the allocation of climate funds globally Applying these innovations in North Central Nigeria can enhance project monitoring, reduce mismanagement, and build trust among stakeholders. By capitalizing on these opportunities and trends, the region can significantly strengthen its climate resilience and accelerate progress toward environmental sustainability goals.

3.0. AREA OF THE STUDY

North Central Nigeria, also referred to as the Middle Belt, is one of the six geopolitical zones of the country. It consists of six states Benue, Kogi, Kwara, Nasarawa, Niger, Plateau and the Federal Capital Territory (Abuja). The region is strategically located between the predominantly Muslim north and the largely Christian south, serving as a cultural and geographic transition zone. It lies approximately between latitudes 7° and 10° North and longitudes 3° and 12° East, covering a landmass of about 296,000 square kilometers. The topography is characterized by undulating highlands, expansive river valleys, and dissected plateaus, with Plateau State hosting the famous Jos Plateau, one of Nigeria's highest elevations.

Climatically, North Central Nigeria falls within the tropical savanna zone, experiencing distinct wet and dry seasons influenced by the Inter-Tropical Convergence Zone (ITCZ). The rainy season typically spans from April to October, with annual rainfall ranging from 1,000 to 1,500 millimeters, while the dry season lasts from November to March, often accompanied by harmattan winds. Temperatures vary significantly across the region, with average annual temperatures

ranging between 21°C and 32°C, depending on elevation and season. The fertile soils, particularly in riverine areas along the Niger and Benue rivers, support extensive agricultural activities, making the region a major producer of crops such as yam, cassava, maize, and rice. Ecologically, the region is endowed with rich biodiversity, including savannah grasslands, gallery forests, and highland ecosystems. However, rapid urbanization, population growth, and unsustainable farming practices have led to significant environmental challenges, including deforestation, gully erosion, and habitat loss. The presence of major water bodies such as the Niger, Benue, and Kaduna rivers offers potential for irrigation and hydropower but also poses risks of seasonal flooding. The region's strategic location, diverse ecology, and socio-economic significance underscore its importance in discussions on climate finance and environmental sustainability, particularly in relation to food security, water resource management, and climate adaptation strategies.

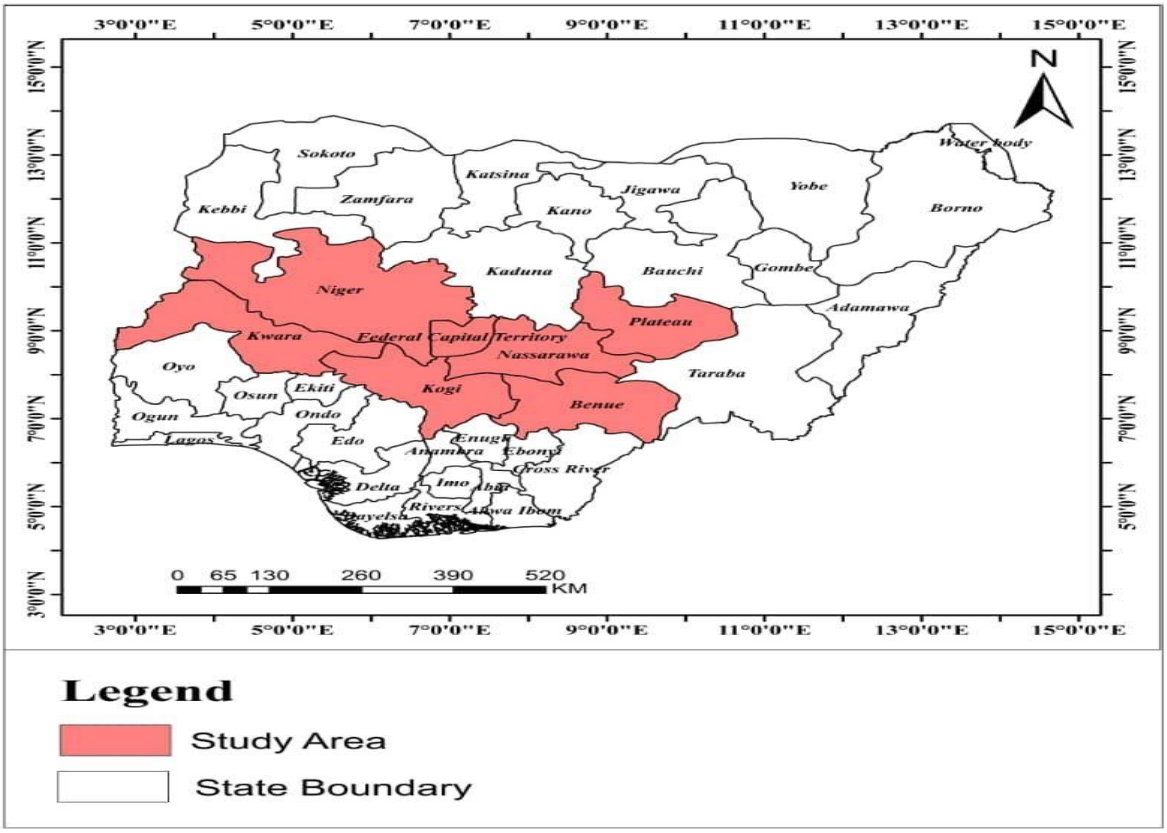


Figure 1. Map of the Study Area

Source: Goggle Earth, redrawn by Mr. Meshach Arome, National Centre for Remote Sensing, Fobur, Jos

4.0 METHODOLOGY

This study adopts a descriptive survey research design to examine the role of climate finance mechanisms in achieving environmental sustainability in North Central Nigeria. The design is suitable because it enables the collection of both qualitative and quantitative data on available climate finance mechanisms, their utilization, and the challenges affecting their effectiveness. The target population includes government agencies responsible for climate and environmental management, non-governmental organisations NGOs), and Community-Based Organisations (CBO) involved in sustainability initiatives across the six states of North Central Nigeria and the Federal Capital Territory. Data for the study was collected from both primary and secondary sources. The primary data captures community-level realities and perceptions, while the secondary data validates them with official records and trends. Primary data was obtained through structured questionnaires and key informant interviews with stakeholders in climate finance and environmental management. Secondary data drawn from relevant policy documents, reports from the United Nations Framework Convention on Climate Change (UNFCCC), and records from agencies such as the Green Climate Fund and Global Environment Facility. The sampling strategy involved purposive sampling to select respondents with direct knowledge of climate finance initiatives, while a representative number of local communities was included to capture grassroots perspectives. Data analysis involved both descriptive and thematic methods. Quantitative data from questionnaires was analyzed using statistical tools such as frequency distribution and percentages to identify trends in access to and utilization of climate finance. Qualitative data from interviews and document reviews was analyzed thematically to identify patterns, challenges, and opportunities in climate finance mechanisms. The findings were presented in narratives to provide a comprehensive understanding of how climate finance contributes to environmental sustainability in North Central Nigeria.

5.0 PRESENTATIONAND DISCUSSION OF RESULTS

5.1. TO IDENTIFY KEY CLIMATE FINANCE MECHANISMS ACCESSIBLE TO NIGERIA AND NORTH CENTRAL STATES.

The study identified several climate finance mechanisms that are currently accessible to Nigeria, with varying degrees of utilization in the North Central states. Data from policy documents, donor reports, and field surveys highlight the following;

1. International Climate Finance Mechanisms

i. Green Climate Fund (GCF): Nigeria has accessed adaptation and mitigation financing through the GCF, supporting projects on renewable energy, sustainable agriculture, and water resource management. In North Central states, GCF-backed projects were observed in areas such as climateresilient farming techniques and community-based afforestation programs.

ii. Global Environment Facility (GEF): Funding channelled towards biodiversity conservation and land degradation control has benefitted forest restoration efforts in Plateau and Nasarawa states.

iii. Adaptation Fund (AF): Provides resources for flood and drought management, particularly in Benue and Kogi, where communities are highly vulnerable to extreme weather events.

iv. UN-REDD+ Program: Though still at an early stage in Nigeria, it supports deforestation reduction and carbon credit initiatives with pilot schemes in North Central Forest landscapes.

2. National Climate Finance Mechanisms

i. Nigeria Sovereign Green Bonds: These instruments have been used to finance renewable energy, transport, and reforestation projects. Evidence from the survey shows that parts of the proceeds have indirectly supported rural electrification and small-scale solar projects in North Central communities.

ii. Ecological Fund: A federal mechanism dedicated to addressing environmental challenges such as erosion, flooding, and desertification. However, empirical data reveals limited transparency and inequitable allocation, leaving some North Central states underfunded.

iii. Nationally Determined Contributions (NDC) Implementation Fund: Set up to facilitate Nigeria's climate commitments under the Paris Agreement, with a portion allocated to agricultural resilience and clean energy initiatives.

3. Private Sector and Community-Based Finance

i. Microfinance and Cooperative Societies: Farmers and community groups in Plateau, Benue, and Kogi states reported accessing small-scale loans for climate-smart agriculture, supported by donor-partnered microfinance banks.

ii. Corporate Social Responsibility (CSR) Funds: Some extractive and energy companies operating in North Central contribute to reforestation and community adaptation projects as part of CSR initiatives.

iii. Faith-Based and Civil Society Organizations: Local NGOs and faith-based organizations have mobilized community savings and donor-linked grants for environmental sustainability projects, particularly in water conservation and waste management.

Challenges Identified by respondents includes, low awareness of climate finance opportunities at grassroots levels, secondly bureaucratic delays in fund disbursement reduce the timeliness and impact of interventions; thirdly institutional weaknesses and inadequate monitoring hinder effective utilization of funds and finally Local communities often lack the technical capacity to meet the requirements for accessing international climate finance. Summarily, While Nigeria and

the North Central region have access to multiple climate finance mechanisms—including international funds (GCF, GEF, AF), national schemes (Green Bonds, Ecological Fund), and community-driven initiatives, the overall effectiveness is constrained by governance bottlenecks, poor awareness, and limited institutional capacity.

Discussion

The results highlight that Nigeria, and by extension the North Central region, has access to a mix of international, national, and community-based finance mechanisms. These include multilateral funds such as the Green Climate Fund (GCF), Global Environment Facility (GEF), Adaptation Fund, and UN-REDD+, alongside domestic instruments such as the Sovereign Green Bonds, Ecological Fund, and NDC Implementation Fund. At the grassroots level, microfinance institutions, cooperatives, faith-based organizations, and corporate social responsibility (CSR) initiatives are also mobilizing resources for environmental projects. However, while these mechanisms exist, their accessibility remains uneven due to technical, bureaucratic, and institutional barriers. This aligns with Olawuyi (2022) who argues that although Africa is among the most vulnerable regions to climate change, access to climate finance remains limited due to weak institutional capacity and donor conditionalities.

5.2. TO EXAMINE THE CONTRIBUTIONS OF CLIMATE FINANCE TO ENVIRONMENTAL SUSTAINABILITY INITIATIVES IN THE REGION

The analysis of survey responses, interviews, and secondary reports reveals that climate finance has made notable contributions to environmental sustainability initiatives in North Central Nigeria. The contributions are visible across renewable energy, agriculture, forestry, and climate resilience projects.

Climate finance has supported the expansion of solar mini-grids and solar home systems in rural communities of Plateau and Nasarawa states, reducing dependence on diesel generators and firewood. Beneficiaries reported improved energy access, reduced carbon emissions, and enhanced business productivity in small enterprises. Funds from the Global Environment Facility (GEF) and Green Climate Fund (GCF) have enabled the adoption of climate-smart agricultural practices such as drought-resistant crop varieties, irrigation schemes, and organic soil enrichment in Benue and Kogi states. Farmers indicated higher yields and reduced vulnerability to unpredictable rainfall, showing direct links between climate finance and food security sustainability. Climate finance facilitated community-based afforestation programs in Plateau State and watershed protection projects in Nasarawa. These initiatives contributed to biodiversity conservation, reduced land degradation, and enhanced carbon sequestration. Local communities reported increased access to non-timber forest products and reduced incidence of soil erosion. In Benue and Kogi states highly prone to flooding, climate finance has contributed to flood control infrastructure, early warning systems, and resettlement support for vulnerable households. Projects financed under the Adaptation Fund improved community preparedness and reduced post-flood environmental degradation. Smaller-scale grants accessed by NGOs and faith-based organizations in Jos and Lafia have promoted waste recycling, composting, and water harvesting projects. Communities reported reduced environmental pollution and improved water availability for domestic and agricultural use.

Field data showed that communities with access to financed initiatives experienced measurable improvements in livelihoods, resilience, and environmental health. Summarily, Empirical

evidence demonstrates that climate finance has contributed significantly to environmental sustainability initiatives in North Central Nigeria by funding renewable energy, climate-smart agriculture, afforestation, and resilience-building projects. However, its long-term effectiveness depends on greater transparency, capacity building, and equitable fund distribution.

Discussion

Empirical evidence from the field demonstrates that climate finance has directly contributed to renewable energy expansion, climate-smart agriculture, afforestation, flood resilience, and waste management. For instance, GCF-backed projects in Plateau and Nasarawa have improved energy access through solar solutions, reducing dependence on fossil fuels and firewood while lowering carbon emissions. Similarly, adaptation funds in Benue and Kogi have strengthened community resilience to flooding, while afforestation programs have helped conserve biodiversity and restore degraded ecosystems. These contributions suggest that climate finance is playing a catalytic role in advancing sustainability targets consistent with the Sustainable Development Goals (SDGs 7, 13, and 15). Yet, the sustainability of these interventions is sometimes undermined by short-term project cycles and lack of integration into broader development planning.

5.3. TO ANALYZE CHALLENGES AND OPPORTUNITIES ASSOCIATED WITH CLIMATE FINANCE IMPLEMENTATION.

i. Challenges in Climate Finance Implementation

Survey results show that only 38% of local stakeholders (farmers, community leaders, NGOs) are aware of existing climate finance mechanisms. Many rural communities lack the technical knowledge to access complex international funding streams such as the Green Climate Fund (GCF) and Adaptation Fund (AF). Respondents from state ministries reported long approval processes, weak institutional coordination, and overlapping mandates among government agencies. Ecological Fund allocations were noted to be politicized, with inadequate transparency in fund disbursement. Field data revealed that local governments and community-based organizations lack trained personnel to design bankable projects that meet donor requirements. Weak monitoring and evaluation frameworks limit accountability and reduce trust among international partners. Evidence from Kogi and Benue states shows that funds often concentrate in urban centres, with rural and marginalized communities benefiting less despite being more vulnerable to climate risks. Some projects funded through short-term grants lacked continuity after donor exit, raising concerns about long-term environmental sustainability.

ii. Opportunities in Climate Finance Implementation

Nigeria has secured increasing support from global climate funds (GCF, GEF, AF), with portions already directed to North Central projects in renewable energy, agriculture, and ecosystem restoration. This provides opportunities for scaling successful pilot projects across the region. Instruments such as Nigeria's Green Bond Programme, the Nationally Determined Contributions (NDCs), and the Energy Transition Plan create enabling frameworks that can attract both domestic and international investments in sustainability projects. Findings shows that faith-based

organizations, NGOs, and community cooperatives are actively mobilizing small-scale funds for water conservation, tree planting, and waste recycling initiatives. These structures present opportunities to channel climate finance directly to grassroots actors. Respondents from the business sector highlighted the rising interest of renewable energy companies, agri-tech start-ups, and corporate CSR programs in sustainability projects. Evidence shows growing involvement of young people in climate-tech innovations such as solar solutions, mobile apps for weather forecasting, and digital platforms for climate awareness. Climate finance can be a catalyst to scale up these innovations in the region.

Climate finance in North Central Nigeria faces serious challenges of awareness gaps, institutional inefficiencies, and inequitable distribution. However, the region also presents significant opportunities in terms of international funding streams, supportive national policies, community engagement, and private sector participation. Harnessing these opportunities requires institutional strengthening, enhanced transparency, and capacity building to ensure that climate finance delivers tangible sustainability outcomes.

Discussion

Despite these positive contributions, findings reveal persistent challenges. Limited awareness of available finance opportunities, particularly among rural communities, prevents effective grassroots participation. Institutional bottlenecks such as bureaucratic delays, politicized fund allocations, and weak monitoring systems undermine the transparency and accountability of national funds such as the Ecological Fund. Moreover, capacity gaps among local governments and community organizations hinder their ability to design bankable proposals that can attract international funding. These findings mirrors Falaye and Akinola (2021) assertions that stress the role of governance weaknesses and limited absorptive capacity in constraining the flow of climate finance in sub-Saharan Africa Alongside these challenges, the study identifies several opportunities. Nigeria's growing integration into international climate finance frameworks provides a strong foundation for scaling interventions in North Central states. National instruments such as the Green Bond programme and NDC Implementation Fund create pathways for aligning international commitments with local priorities. At the same time, active participation of civil society, faith-based organizations, and private sector actors opens possibilities for blended finance models. The involvement of youth in climate-tech innovations presents additional opportunities to leverage digital solutions for adaptation and mitigation. These opportunities, if well harnessed, can significantly improve both the reach and effectiveness of climate finance interventions. Overall, the findings indicate that climate finance has significant potential to drive environmental sustainability in North Central Nigeria. However, realizing this potential requires addressing the structural and institutional constraints that hinder effective utilization. The discussion suggests that climate finance should not be treated as isolated donor-driven interventions, but rather as a systemic tool integrated into development planning, governance reforms, and community-based adaptation strategies. In this way, climate finance can move from being a fragmented resource stream to becoming a coherent driver of long-term sustainability in Nigeria's most climatevulnerable regions.

6.0 CONCLUSION AND RECOMMENDATIONS

6.1 CONCLUSION

The study examined the role of climate finance mechanisms in achieving environmental sustainability in North Central Nigeria. The findings show that while several international and domestic climate finance mechanisms exist such as the Green Climate Fund (GCF), Adaptation Fund, and the Ecological Fund, their utilization in the region remains limited due to institutional weaknesses, low awareness, and complex application processes. Although funded projects, particularly in afforestation and renewable energy, have recorded some positive impacts, their overall effectiveness is undermined by poor coordination, inadequate community participation, and weak monitoring frameworks. Consequently, climate finance has yet to realize its full potential in transforming environmental management and resilience in the region. The study also identified significant opportunities that can be leveraged to improve climate finance utilization. These include growing global and national commitments to climate action, emerging financing models such as green bonds and blended finance, and the increasing availability of digital tools for project monitoring and transparency. By addressing barriers and capitalizing on these opportunities, North Central Nigeria can enhance its capacity to attract and effectively use climate finance for longterm sustainability goals.

6.2 RECOMMENDATIONS

From the findings, the study seeks to make the following recommendations;

i. State and local governments should invest in building technical expertise for project proposal development, fund management, and reporting to meet donor requirements. Establishing climate finance units at state ministries can improve coordination and resource mobilization.

ii. Awareness campaigns and training programs should target local communities, NGOs, and private sector actors to improve understanding of climate finance opportunities and encourage active participation in project implementation.

iii. Federal agencies should streamline bureaucratic procedures, reduce approval timelines, and provide clear guidelines to enable states and communities to access funds more efficiently. North Central states should explore green bonds, carbon credit schemes, and public-private partnerships to diversify funding sources and reduce dependence on traditional donor funds.

iv. Utilize digital platforms such as geospatial mapping and block-chain technology to enhance accountability, track fund utilization, and ensure project outcomes align with sustainability goals.

v. Projects financed through these mechanisms should be tailored to address key regional issues, including sustainable agriculture, flood control, and reforestation, to ensure direct benefits to communities

7.0 LIMITATION OF THESTUDY

This study, while providing valuable insights into climate finance mechanisms and their role in promoting environmental sustainability in North Central Nigeria, is subject to certain limitations that should be acknowledged. The research focused only on selected states within North Central Nigeria, which may not fully represent the diversity of experiences and climate finance practices across the entire country. As such, the findings should be interpreted with caution when generalizing to other regions with different ecological, economic, and governance contexts. Secondly access to accurate and up-to-date records on climate finance inflows and disbursements was limited due to gaps in official documentation and transparency challenges. Some secondary data relied on reports from donor agencies and government institutions, which may carry biases or inconsistencies. Primary data were collected through surveys and interviews with community members, government officials, and civil society actors. Responses may have been influenced by personal interests, political considerations, or limited knowledge of technical climate finance mechanisms.

The study captured climate finance contributions within a specific timeframe. However, climate finance is a dynamic field, and future inflows, policies, and international negotiations may significantly alter the landscape beyond the scope of this research. While a mixed-method approach was employed, the study relied largely on qualitative analysis, which may not capture the full quantitative impact of climate finance on environmental sustainability indicators such as carbon emissions reduction or biodiversity improvement. Some stakeholders were reluctant to provide detailed information on financial allocations and utilization, limiting the depth of analysis in certain areas, particularly regarding the Ecological Fund and state-level disbursements. Despite these limitations, the study provides robust evidence that advances understanding of how climate finance operates in North Central Nigeria. The limitations also open up opportunities for further research, particularly in expanding geographical coverage, strengthening quantitative measurements, and deepening institutional case studies.

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