APRI
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LOCAL SOLUTIONS, GLOBAL IMPACT:

CLIMATE ADAPTATION IN WEST AFRICA

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Acronyms and abbreviations

AAAP	Africa Adaptation Acceleration Program
ACASIS	Alert for Heatwaves and Health Impacts in Sahel
ADCOM	Nigeria Adaptation Communication
AF	Adaptation Fund
AfDB	African Development Bank
AFOLU	Agriculture, Forestry, and Other Land Use
ANACIM	National Agency of Civil Aviation and Meteorology
ANAT	National Spatial Planning Agency
ANCAR	National Agency for Agricultural and Rural Advice
APFs	Adaptation Policy Frameworks
APP	Agricultural Promotion Policy
ARD	Regional Development Agency
BOAD	West African Development Bank
CCA	Nigeria Climate Change Act
CCAFs	Platform on Climate Change, Agriculture and Food Security
CEA-AGRISAN	African Centre of Excellence in Agriculture for Food and Nutrition
CECI	Centre for International Studies and Cooperation
CERER	Centre for Studies and Research on Renewable Energies
CFSI	French Committee for International Solidarity
CGIAR	Consultative Group on International Agricultural Research
CHSP	Community Health Strategy Plan
CNAAS	National Agricultural Insurance Company of Senegal
CNCR	National Rural Dialogue Framework
COMNAC	National Committee on Climate Change
COMREC	Councils or Assemblies of Territory Collectives
COP	Conference of the Parties
CORAF	Central African Council for Agricultural Research
CSE	Ecological Monitoring Centre
CSIR	Council for Scientific and Industrial Research
CSO	Civil Society Organisation
CSV	Climate Smart Village

DA	Directorate of Agriculture
DPC	Directorate of Civil Protection
DPP	The Pastoralism and Drylands Pole
DPPD	Multiannual Expenditure Programming Document
DRDR	Regional Directorate for Rural Development
EACC	Economics of Adaptation to Climate Change
EbA	Ecosystem-based Adaptation
EPA	Environmental Protection Agency
ERGP	Economic Recovery and Growth Plan
FAO	Food and Agriculture Organization
FCDO	Foreign, Commonwealth and Development Office
FCT	Federal Capital Territory
FGD	Focus Group Discussion
FONGID	Priority Investments Guarantee Fund
FONSIS	Strategic Investment Fund
FRIN	Forest Research Institute of Nigeria
GARID	Greater Accra Resilient and Integrated Development Project
GBAG	Green Bond Advisory Group
GCA	Global Centre on Adaptation
GCF	Green Climate Fund
GDP	Gross Domestic Product
GEF	Green Environment Facility
GHG	Greenhouse Gas
GIZ	German Agency for International Cooperation
IED	Innovations Development Afrique
IESS	Institute for Environment and Sanitation Studies
INGO	International Non-Governmental Organisation
INP	National Pedological Institute
IPCC	Intergovernmental Panel on Climate Change
IRD	Development Research Institute
ISRA	Senegalese Agricultural Research Institute
ITCP	Integrated Territory Climate Change Plans
LBA	The Agricultural Bank
LDC	Least Developed Country
LDN	Land Degradation Neutrality
LLA	Locally Led Adaptation
LPSD	Sectoral Development Policy Letters
MDAs	Ministries, Departments and Agencies
MDB	Multilateral Development Bank
MEED	Ministry of the Economy Finance and Planning

MESD	Ministry of Environment and Sustainable Development
MESTI	Ministry of Environment, Science, Technology, and Innovation
MoFA	Ministry of Food and Agriculture
MORE	Women Movement for Rural Entrepreneurial Women
NAGGW	National Agency for Great Green Wall
NAP	National Adaptation Plan
NAPF	National Adaptation Policy Framework
NAPGCC	National Action Plan on Gender and Climate Change for Nigeria
NARF	National Agricultural Resilience Framework
NASPA-CCN	National Adaptation Strategy and Plan of Action on Climate Change for Nigeria
NbS	Nature Based Solutions
NBSAP	National Biodiversity Strategies and Action Plans
NCCAS	National Climate Change Adaptation Strategy
NCCP	National Climate Change Policy
NDC	Nationally Determined Contribution
NESP	Nigeria Economic Sustainability Plan
NGO	Non-Governmental Organisation
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
NREEEP	National Renewable Energy and Energy Efficiency Policy
ORGIIS	Organization for Indigenous Initiatives and Sustainability
PDC	Communal Development Plans
PDD	Departmental Development Plans
PLAAC	Local Climate Change Adaptation Plans
PNDL	Local Development Program
PSE	Emerging Senegal Plan
REDD+	Reducing Emissions from Deforestation and Forest Degradation
REVARD	Vulnerability and Improving Resilience of Dionewar's Coastal Communities
SDG	Sustainable Development Goal
SFDRR	Sendai Framework for Disaster Risk Reduction
TACC	Territory Approach for climate Change
UCAD	Cheikh Anta Diop University of Dakar
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development
VSLAs	Village Savings and Loans Associations
WRI	World Resource Institute

Executive summary

Introduction

The 28th United Nations Climate Change Conference (COP28) convened amidst escalating climate challenges, placing strong focus on climate adaptation and resilience. COP28's recognition of the need for adaptation financing and support acknowledges the imperative to bolster resilience in developing countries, where securing funds for climate action is paramount. The outcomes also underscored the importance of technology transfer, capacity-building initiatives and nature-based solutions.

The emphasis on adaptation and resilience is especially relevant for West African nations. Climate change poses an increasingly urgent challenge for countries such as Ghana, Nigeria and Senegal, impacting critical sectors of their economies and overall well-being. The surge in climate-related disasters, encompassing droughts, floods and coastal erosion, poses a severe threat to development progress. In response, nations in the region are actively implementing climate change adaptation policies aligned with their Nationally Determined Contributions (NDCs). However, two significant concerns arise in the implementation of NDCs.

Firstly, as one of the most climate-vulnerable regions globally, West African countries heavily rely on external financing to fulfil their NDCs. The limited fiscal capacity of governments in the sub-region further complicates the implementation process. Secondly, there is a notable lack of attention and recognition for the contributions of local actors in the design and implementation of climate actions.

Shining a spotlight on local actions demonstrates the crucial role played by communities at the forefront of climate adaptation efforts. Meaningful local engagement not only provides a key avenue for achieving multiple societal goals but also serves as a transformative approach to climate action. Recognising and valuing the contributions of local actors are essential steps in fostering effective and inclusive climate resilience in West Africa.

Objective of study

APRI – Africa Policy Research Institute – partnered with organisations in Ghana, Nigeria and Senegal, as well as a range of nationally based policy, research and practice stakeholders to launch the 'Climate adaptation in West Africa: Strategies, practices and initiatives' project. This project investigated, documented and communicated potential gaps, challenges, opportunities and entry points for adaptation to inform the country's NDC implementation. This research project also interrogated the alignment of endogenous adaptation practices with adaptation options of the NDCs and other climate action policies and strategies. It particularly highlighted locally led adaptation (LLA) strategies, practices and lessons to offer guidance for the implementation of the NDCs and climate actions at the local and national levels.

More specifically, the project sought to understand and document:

- status, needs and priorities for climate actions in Ghana, Nigeria and Senegal;
- adaptation priorities and needs of local communities;
- available policies, strategies, practices and initiatives at national and community levels to address adaptation needs;
- challenges and barriers hindering LLA actions in the three countries;
- potential opportunities and entry points to support and encourage effective and sustained adaptation action for at-risk and vulnerable communities;
- recommendations for advancing local adaptation as a key component of NDCs in the sub-region.

The study employed a methodological approach that encompassed mapping the climate policy landscape, implementation strategies and practices at local and national levels in Ghana, Nigeria and Senegal. It began with an extensive literature review and analysis of relevant climate change documents to establish existing knowledge and develop a robust understanding of the policy landscape. The policy landscape mapping included three critical tasks: evaluating policy frameworks for climate action, assessing stakeholders' capacity to incorporate local adaptation strategies, and scrutinising the coherence or inconsistency of local adaptation policies with each country's needs, priorities and international development goals and commitments. This was followed by two stakeholder engagement meetings in each country, convening a diverse group of national, regional and local stakeholders in the climate change field. The aim was to align the research objectives with the context, needs and priorities of policymakers and society in each country. Furthermore, each national team conducted three in-depth case study analyses, concentrating on one of the three priority adaptation sectors outlined in the countries' NDCs.

Key findings

Africa and its people face an urgent need to adapt to the impacts of climate change, given the continent's vulnerability to its effects. Despite being the least responsible for the historical greenhouse gas (GHG) emissions, Africa bears a disproportionate burden of its impacts. Changing weather patterns, increased frequency of extreme weather events and rising temperatures pose significant challenges to agriculture, water resources and overall ecosystem stability. Communities across Africa, many of whom rely heavily on agriculture for their livelihoods, are particularly susceptible to these changes. Adaptation strategies must be prioritised to enhance resilience, protect communities from climate-related risks and ensure sustainable development.

African countries have been actively working to put in place adaptation plans, as often reflected in their NDCs. Recognising the urgent need to address climate change impacts, many African nations have outlined comprehensive strategies to enhance the resilience of their most vulnerable communities. These plans often include measures to improve water resource management, promote sustainable agriculture and strengthen early warning systems for extreme weather events. While the specifics vary among countries and local contexts, they share the common goal to build

strong institutions and foster partnerships with a view to mobilise finance, access technologies and strengthen their skills base.

Senegal, Ghana and Nigeria are three of the countries that have undertaken significant steps towards meeting the adaptation needs faced by large numbers of highly vulnerable people. These countries have developed and implemented various strategies, often outlined in their NDCs, to enhance resilience and mitigate the impacts of a changing climate. However, despite these commendable efforts, they continue to face substantial challenges, particularly due to the availability of limited financial resources and their weak institutional and human capacities. Additionally, there are concerns about the integration of climate considerations into broader development policies and the gap between the scientific knowledge produced by the research community and the action taken by practitioners on the ground. Insufficient coordination and collaboration among government agencies and local stakeholders hinders the smooth integration of adaptation measures and diminishes the effectiveness of policies, ultimately impeding the adoption of sustainable adaptation practices.

Integration of climate considerations in development policies is crucial for building local resilience. Historically, climate change adaptation planning has often operated independently from broader sectoral development policies. This is of particular concern in regard to local adaptation efforts which isolate local economies and livelihoods from the broader development planning processes. It becomes crucial to synchronise national, sub-national and sectoral strategies to guarantee a cohesive and coordinated response to minimise duplicated efforts, fragmented initiatives and inefficient resource utilisation.

Experience across Ghana, Nigeria and Senegal demonstrates that communities have been adapting to the impacts of climate change, to varying degrees. However, they lack access to the necessary resources and power for implementation. Despite being well placed to understand their priorities, local actors often find themselves receiving decisions from distant experts rather than taking leadership roles in climate finance planning. The current climate finance model channels funds through numerous intermediaries for short-term projects; local decision-making in climate interventions is frequently deficient, affecting project effectiveness and sustainability.

Expanding locally led adaptation (LLA) strategies by communities in Senegal, Nigeria and Ghana can play a major role in addressing the unique challenges posed by climate change on local communities. Such strategies can leverage the invaluable local knowledge, practices and experiences of communities, ensuring that adaptation efforts are contextually relevant and durable. Local communities are often the first to feel the impacts of climate change, and their active involvement in co-designing and implementing adaptation measures is crucial. LLA fosters a sense of ownership and empowerment, enhancing the opportunities for transformative change in the face of environmental changes and associated disruptions. By tapping into indigenous knowledge and incorporating community perspectives, LLA contributes to more effective, inclusive and culturally sensitive adaptation strategies, aligning with the principles of sustainable development. This bottom-up approach recognises the diversity of challenges across different areas and promotes a collaborative effort to strengthen climate resilience at the grassroots level.

LLA strategies in Senegal, Nigeria and Ghana face a number of stumbling blocks. LLA strategies exhibit distinctive characteristics, including participatory practices, diversified approaches, prioritisation of vulnerable community members, and the utilisation of local knowledge to enhance

resilience. Despite spontaneous adaptation efforts by many segments of society in Ghana, Nigeria and Senegal, planned adaptation processes by key stakeholders often overlook these grassroots initiatives and place insufficient appreciation and emphasis on endogenous knowledge and practices, while failing to integrate them into national and global solutions. The constrained role of women and disadvantaged groups in LLA also poses major shortcomings. Addressing these weaknesses is essential to maximise the potential of LLA in these countries and to ensure that comprehensive and locally tailored climate adaptation practices flourish.

The essential contribution of women to the success and sustainability of climate resilience efforts in locally led adaptation (LLA) practices is evident in the cases examined from Ghana, Nigeria and Senegal. Despite their crucial roles in managing household resources, agriculture and community welfare, women face constraints in participating in decision-making and holding leadership positions within LLA initiatives. Prevailing gender norms and societal expectations often confine women to traditional roles, limiting their active engagement in shaping and executing adaptive strategies. This restriction extends to LLA, where the distinctive perspectives, knowledge and experiences of women are not fully leveraged.

LLA practices among agricultural and fishing communities in Ghana, Nigeria and Senegal encounter a significant funding gap attributed to inadequate domestic resources and unreliable international climate finance. This impedes the execution of locally customised solutions, restricting the transformative potential of scaling up LLA efforts. Addressing this funding deficit is vital to empower communities, foster innovation and guarantee the sustainability of adaptive measures. Mobilising resources across local, national and international domains becomes imperative to unleash the complete potential of LLA and enhance the resilience of communities at the forefront of climate change.

Ensuring the success of LLA practices is contingent upon access to evidence-based knowledge. LLA aims to empower communities to develop context-specific solutions tailored to their distinct vulnerabilities and needs. This necessitates the generation of local data and information to build the knowledge and evidence essential for informing on-the-ground adaptation strategies. The disparity between scientific knowledge and practical implementation frequently results in suboptimal decision-making. Access to evidence-based knowledge stands out as a critical challenge in LLA endeavours across West Africa. To address this, countries must invest in robust climate services, expert training, support for vulnerability assessments and the formulation of adaptation plans for various sectors and territories.

In all three countries, the existing institutional landscape holds untapped potential for fostering resilient communities through LLA practices. Utilising and strengthening existing institutions can provide a strong foundation for sustainable and impactful adaptation efforts. These existing structures often carry valuable insights into the community's needs, priorities, vulnerabilities and adaptive capacities. Strengthening them entails empowering them with the requisite resources, knowledge and capacities to spearhead climate adaptation initiatives. This support may come in the form of capacity-building programmes, financial resources or collaborative partnerships with governmental and non-governmental entities.

Establishing platforms for communities of practice and mutual learning in climate adaptation holds immense potential for collective learning and collaboration. These could serve as incubators that bring together local communities, policymakers, researchers and practitioners to benefit from

each other's insights and expertise and build trust and strong relationships. They provide a space for dialogue, where challenges can be openly discussed and adaptive strategies co-created.

Recommendations

For the national policy community

- **Devolve and develop climate governance and institutions at the local level:** Climate governance stakeholders must recognise the importance and added value of locally led adaptation and encourage the integration of communities' endogenous adaptation practices into the various priority adaptation options of the NDC for greater efficiency, performance and impact in climate action.

- **Devolve and enhance access to climate adaptation financial resources:** Government and policymakers must develop mechanisms to improve access to financial resources for local governments and communities, especially for small-scale farmers, women's groups and community-based organisations involved in climate adaptation initiatives at the local level.

- **Strengthen capacity-building efforts:** The government and policymakers must invest in capacity-building programmes to empower local communities with the knowledge, skills and tools needed to design and implement climate adaptation strategies. This includes providing training on climate-smart agriculture, sustainable land management, ecosystem restoration and disaster risk reduction, among other relevant topics.

- **Integrate traditional knowledge and practices into climate adaptation strategies:** Local communities possess valuable traditional wisdom developed over generations to cope with environmental changes. Incorporating this knowledge and these approaches to support policies can enhance the effectiveness and cultural appropriateness of adaptation actions.

- **Encourage and support collaborations between research institutions, policymakers, civil society organisations and local communities:** This collaboration is critical to ensure that all relevant stakeholders are included in the identification, documentation and communication of relevant local adaptation experiences in order to generate knowledge to inform and support decision-making and implementation processes of the NDCs and other national and local development policies and strategies.

- **Facilitate community engagement and participation:** Federal and central government policymakers and actors currently exhibit a gap in comprehending the significance of social cohesion, inclusion and civic engagement in fostering trust and equity among community members. Increased effort and resources are required to promote community engagement and participation. This entails actively involving local communities in decision-making processes related to climate adaptation, taking into account their knowledge, needs and perspectives.

- **Raise awareness about climate change, its impacts, adaptation measures and associated benefits:** The results of this research show that many communities have been engaging in adaptation actions for decades without an in-depth understanding of climate change.

For the international community

- **Champion the integration of locally led adaptation (LLA) action into the implementation of national and global climate goals:** Considering the alignment of community adaptation strategies with NDCs and other national policies, the international community, led by the UNFCCC, should promote and incentivise countries and partners to prioritise LLA in financial support and implementation.

- **Strengthen capacity building and knowledge sharing:** Support capacity-building programmes and knowledge-sharing platforms that facilitate the exchange of best practices, lessons learned and experiences between local communities, practitioners and policymakers from different countries. This can include funding training programmes, workshops and conferences that focus on enhancing the skills and knowledge of local actors in climate adaptation.

- **Increase international climate finance for LLA:** Enhance funding and allocate financial resources exclusively for the support of locally driven climate adaptation initiatives. Achieve this by creating dedicated funds, grant programmes and financial mechanisms that prioritise and direct resources to local communities and organisations.

- **Adapt proactive and innovative ways to finance and ensure access to local-level actors:** Climate facilities such as the Green Climate Fund (GCF), the Adaptation Fund (AF), the Global Environment Facility (GEF) and bilateral development agencies must set up a common fund exclusively reserved for financing local adaptation initiatives directly led by communities to make endogenous practices more sustainable and increase the efficiency and performance of climate action.

- **Allocate resources to support comprehensive climate research and data collection, especially in respect to local and indigenous knowledge, practice and strategies:** The international community should seek partnerships with the governments and local institutions to allocate resources needed to support comprehensive climate research and data collection. This information would provide a solid foundation for evidence-based decision-making, risk assessments and adaptation planning.

1 Introduction

1.1 Overview and context

The outcome of the United Nations Climate Change Conference COP28, convened in late 2023, embraced the findings of the inaugural Global Stocktake under the Paris Agreement. It acknowledged the imperative of reducing global greenhouse gas (GHG) emissions by 43% below 1990 levels by 2030 to constrain global warming to 1.5˚C. Parties committed to expediting actions by 2030, particularly emphasising the necessity to transition toward net-zero emission energy systems and move away from fossil fuels in an equitable and orderly manner.[1] Additionally, parties at COP28 adopted a framework for the global adaptation goal. This goal was initially announced in Paris in 2015, but since then, disagreements prevented the creation of relevant targets and indicators. The COP28 parties consequently set 2030 targets to conduct impact, vulnerability and risk assessments, implement adaptation plans and policy instruments, and establish monitoring, evaluation and learning systems for their national adaptation efforts. The conference highlighted the vital importance of preserving and restoring nature. Recognising the challenges faced by developing countries, the conference emphasised the critical role of increased support and financial assistance as essential elements for enabling effective climate action.

Two years prior, in 2021, the Intergovernmental Panel on Climate Change (IPCC) had issued its 6th Assessment Report, sounding a warning that human activities, primarily through greenhouse gas emissions, indisputably contributed to global warming. The global surface temperature had already surpassed 1.1˚C above the 1850–1900 baseline in the period from 2011 to 2020.[2] The report cautioned that ongoing greenhouse gas emissions would further escalate global warming, projecting a likely attainment of 1.5˚C in the near term based on considered scenarios and modelled pathways. The findings of the Global Stocktake paint a similarly dire picture that the world is falling short of the trajectory needed to limit temperature rise to 1.5˚C by the close of this century. Achieving this target necessitates swift mobilisation of finance, technology, global cooperation and substantial political will.

Importantly, it should be underscored that the impact of an average global temperature increase of 1.5˚C varies across regions. Western Africa and the Sahel, for instance, are projected to experience faster temperature rises, reaching 4 to 6˚C by the end of the 21st century.[3] This elevation in temperatures is causing catastrophic floods in some areas and extreme heat and recurrent droughts in others – the new norm for weather conditions. As a consequence, key development sectors have already borne the brunt, witnessing widespread loss and damage, including biodiversity loss, water shortages, diminished food production, loss of life and reduced economic growth.

The disproportionate reliance on climate-exposed sectors in West Africa such as agriculture and, where cropland is rainfed, the vulnerability of large populations to climate hazards is

increased. This particularly affects marginalised groups, including women, children and the elderly. Consequently, adapting to climate change is not merely a choice for many in the poorest countries; it is a necessity for their survival. It means that countries must invest significant efforts in formulating and implementing national adaptation plans, adaptation communications and Nationally Determined Contributions (NDCs) as an integral part of their development plans.

In practice, adaptation is essential in any warming scenario. This involves making adjustments to accommodate the hotter climate, adapting to wetter and drier conditions and building infrastructure to mitigate damage to property and economies. For example, farmers in West Africa, facing challenges in food production due to shifts in rainfall patterns, can introduce irrigation schemes and adopt new crop varieties to maintain or enhance productivity. Similarly, coastal communities can build sea walls to shield against storm surges or establish mangrove forests to prevent erosion and loss of land.

The essential concept of 'climate justice' must be underscored, considering the varied historical responsibilities that underlie the climate crisis. The principles of justice include the right to a clean, healthy and sustainable environment; the right to health; and the rights of Indigenous peoples, local communities, children, persons with disabilities and people in vulnerable situations. Additionally, the empowerment of women and equity between generations are integral components of these justice principles. However, to actualise these principles, they must be incorporated and codified into policies and strategies, necessitating the development of institutions to integrate them into actual practices.

This calls for a serious reconsideration of how adaptation finance is conceptualised and applied, including a reassessment of the distribution of climate finance between mitigation and adaptation. Currently, financial resources remain markedly insufficient to address the worsening climate change impacts in developing countries. The estimated annual adaptation finance needs of developing countries range from USD 215 to 387 billion until 2030.[4] To meet these needs, both domestic and international finance must be scaled through various means, including grant-based funding, highly concessional finance and non-debt instruments. Additionally, involving the private sector is imperative to rapidly increase the deployment of existing technologies, foster innovation and facilitate the development and transfer of new technologies.

Another important gap lies in technology development and transfer, as well as capacity building for adaptation, particularly for those most vulnerable to the adverse effects of climate change – communities that bear no responsibility for causing the climate crisis. Recognising the crucial role of technology development and transfer, along with endogenous technologies and innovation, in supporting adaptation actions is vital as part of the endeavour to localise technology. However, progress in capacity building necessitates action at individual, institutional and systemic levels, with particular attention paid to participatory and multi-stakeholder engagement to bolster ownership and foster the exchange of knowledge, experience and lessons.

Preserving local ecosystems from the impacts of climate-related risks in West Africa requires the development of adaptive strategies. This ensures that infrastructure and service provisions are guided by traditional knowledge and local knowledge systems. Governments and policymakers at all levels must actively involve local communities in their climate actions and policies. Widening participation should extend beyond mere consultations, allowing local communities to assume leadership roles in projects and interventions that directly affect them.

Local communities in West Africa are already taking action to adapt to the changing climate. Initiatives for locally led adaptation (LLA) demonstrate clear co-benefits for both climate action and sustainable development, benefiting the communities and the country. This report presents findings of research conducted on climate change adaptation policies, strategies and local actions in Ghana, Nigeria and Senegal. It delves deeper into understanding LLA strategies, practices and lessons in each country, employing in-depth case studies to provide insights into policies and the implementation of NDCs and climate actions at both the local and national levels.

1.2 Report approach

The research initiative in Ghana, Nigeria and Senegal was executed by establishing a collaborative framework and fostering dialogue among local scientists, policymakers, practitioners and communities. This co-creation and cooperative effort, involving a diverse range of stakeholders, facilitated the analysis of the climate governance context, identified gaps and challenges and addressed knowledge needs related to adaptation for a more equitable and inclusive approach to climate action. It also enabled an examination of the alignment between local knowledge and indigenous adaptation practices with the adaptation options outlined in the Nationally Determined Contributions (NDCs) and other climate action policies and strategies. The collaborative process provided insights into how national adaptation policies and strategies could benefit from incorporating local knowledge, experiences, practices and strategies, ultimately supporting effective and sustained adaptation at the local, national and global levels.

In each country, the following methods were employed:

- A thorough review and analysis of pertinent documents such as the NDCs, National Adaptation Plan (NAP), adaptation policies, national and local development policy planning, climate governance and local-level adaptation. This was conducted to map out national climate action initiatives, specifically emphasising the design and implementation of NDCs through the perspective of LLA.

- Engagement with stakeholders across different scales and categories, including the organisation of two stakeholder consultation and sharing workshops.

- Deep dives focusing on key priority adaptation sectors to provide contextual understanding of the enablers of and barriers to climate change adaptation actions and their impact on livelihoods.

By combining a literature review, mapping exercises, stakeholder engagement and case studies, the study aimed to generate valuable insights into the implementation of the NDCs through LLA.

1.3 Report structure

This synthesis report is organised into the following sections:

- Section 1 introduces the global discussions on climate change and what they mean for African countries.

- Section 2 presents a framing discussion on adaptation in Africa and the importance of community-based solutions, in particular an exploration of the locally led adaptation concept.

- Sections 3, 4 and 5 present a synthesis of, respectively, Ghana's, Nigeria's and Senegal's scoping reviews of key policy documents on climate adaptation, mapping of the key stakeholders and a summary of the deep-dive case studies.
- Section 6 presents a summary of the general analysis and discussion of the project results.
- Section 7 concludes the synthesis report.

PART ONE

Adaptation, vulnerability and resilience in Africa

2 Africa and adaptation

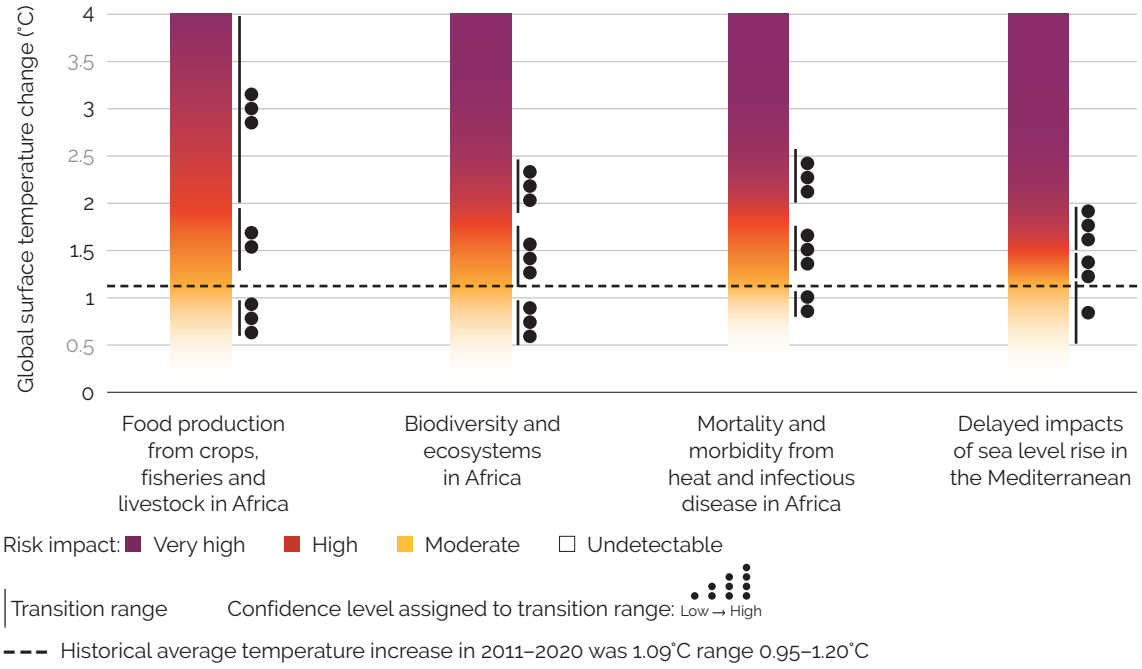
2.1 Africa and climate change

Climate change has caused substantial damage, and increasingly irreversible losses, to ecosystems in various regions. The global surface temperature has now reached 1.1˚C above pre-industrial levels, resulting in extreme weather events such as storms, floods and intense heatwaves and slow-onset events such as sea level rise, ocean acidification, desertification and loss of biodiversity,[5] as well as heavier rainfall and other weather extremes with adverse impacts on human health and ecosystems. All these result in 'loss and damage', referring to the destructive impacts of climate change, both economic and non-economic, that cannot be or have not been avoided through mitigation and adaptation actions.[6] For many communities around the world, this threshold has already been reached, and for some, such as small island states, the impacts present an existential threat. The paradox in this is that while most of these vulnerable communities have contributed the least to climate change, they are disproportionately affected.

Africa's contribution to the build-up of GHG emissions is low, contributing the least to global climate change. Available data from various global organisations indicate that Africa's contribution to global GHGs stood at less than 4% as of 2020.[7] However, Africa is among the regions hit hardest by human-induced climate change, the consequences of which are recurrent heatwaves and droughts, disrupted rainfall patterns, coastal erosion and major changes to continental water bodies. The region's considerable development constraints such as poverty, limited access to basic services and high levels of climate-sensitive livelihoods contribute to high vulnerability to climatic hazards. Global warming above 2˚C will result in yield reductions for staple crops across most of Africa compared to 2005 yields, and over the same period, distribution and seasonal transmission of vector-borne diseases is expected to increase (Figure 1).

Some of the largest impacts caused by climate change are observed in West Africa, where substantial damage and increasingly irreversible losses in terrestrial, freshwater and coastal and open ocean ecosystems are currently experienced.[8] Since the mid-1990s, West Africa has experienced increasing rainfall, resulting in recurrent flood events and droughts. The unpredictability of rainfall patterns significantly impacts the food production of impoverished, primarily rural families, especially in areas reliant on rainfed agriculture. The absence or weakness of domestic and local food distribution systems contributes to elevated levels of food insecurity, creating multidimensional vulnerabilities, intersecting with socio-economic, political and environmental factors. Similarly, climate change in the coastal areas of West Africa leads to rising sea levels, contributing to a complex set of interconnected issues that strain ecosystems and marine resources vital to coastal communities. Unsustainable practices such as overfishing, mangrove deforestation and industrial-scale fishing in open seas, along with mining and on- and offshore exploitation of oil and gas, exacerbate these challenges.

Figure 1 Regional risks for increasing levels of global warming[9]



With each incremental temperature rise in the sub-region, hazards rapidly escalate. This brings about more severe heatwaves, intense rainfall and other extreme weather events, thereby increasing risks for both human health and ecosystems. In various parts of the Sahel, vulnerable groups such as the elderly are succumbing to the impacts of extreme heat.[10] Consequently, adaptation costs are poised to surge with global warming. Achieving transformative adaptation in Africa will require substantial increases in public and private finance flows, totalling billions of dollars annually. This entails improving direct access to multilateral funds, strengthening project pipeline development and reallocating more financial resources toward project implementation.

2.2 Importance and challenge of community solutions

Community climate solutions play a pivotal role in addressing the impacts of climate change, offering localised strategies that engage and empower communities. The importance of community-driven initiatives lies in their ability to respond to the specific needs, vulnerabilities and strengths of local populations. These solutions are often more effective as they incorporate traditional knowledge, practices and a deep understanding of the local context.[11]

One of the key advantages of locally led climate solutions is their inclusivity. Local communities, particularly those most affected by climate change, become active participants in the design, implementation and monitoring of adaptation and mitigation measures. Such an inclusive approach ensures that the strategies adopted resonate with the community's values and priorities, fostering a sense of ownership and commitment. Moreover, community-led solutions are often more sustainable in the long run as they draw on existing social structures, harnessing the strength of community bonds to implement and maintain climate initiatives.[12] By integrating climate resilience into local practices and livelihoods, these solutions are more likely to endure and evolve as conditions change.

Despite their importance, locally led climate solutions face several challenges. One significant hurdle is the limited access to resources, both financial and technical, which hampers the implementation of ambitious projects. Communities may lack the funding, technology or expertise needed to enact large-scale changes, leaving them reliant on external support. Another challenge is the need for effective governance structures. In many cases, communities face institutional barriers that impede their ability to make decisions and access relevant information. Bridging this governance gap is crucial for empowering communities and ensuring that their climate solutions align with broader national and international climate goals.

The issue of power in locally led climate solutions is a critical aspect that shapes the effectiveness, equity and sustainability of adaptation and mitigation efforts.[13] Power dynamics within communities and in the broader context of climate action influence decision-making, resource distribution and the overall success of initiatives. Several key aspects merit consideration in understanding the interplay of power in locally led climate solutions. Firstly, there is often a disparity in power among community members, with certain individuals or groups having more influence, resources or access to decision-making processes. This power imbalance can result in marginalised voices being excluded or underrepresented in the planning and implementation of climate solutions. It is essential to address these inequities to ensure that the most vulnerable and affected groups are actively involved in shaping adaptive strategies. Secondly, power dynamics extend beyond the community level, involving interactions with external actors such as governments, NGOs and businesses. External entities may exert influence over community initiatives, sometimes reinforcing existing power structures or introducing new dynamics. This underscores the importance of recognising and challenging unequal power relations within the broader socio-political context to enable genuinely community-driven solutions.

Moreover, power intersects with concerns related to knowledge and expertise.[14] Communities often possess valuable local knowledge and insights into climate impacts, but their perspectives might be cast aside or marginalised in favour of external, top-down approaches. Empowering communities involves recognising and incorporating their knowledge into the decision-making processes, fostering a more inclusive and effective response to climate challenges. Furthermore, financial resources play a crucial role in determining the success of community climate solutions. The distribution of funds and resources may be influenced by power dynamics, favouring certain groups or initiatives over others. The funder could also influence the direction of the project or activity. Addressing power imbalances requires transparent and equitable resource allocation, ensuring that communities have the financial means to implement and sustain climate initiatives. Empowering communities involves creating spaces for diverse voices, recognising local knowledge and ensuring equitable access to resources, ultimately leading to more impactful and community-driven climate solutions.

The importance of locally led and owned climate solutions cannot be overstated. However, experiences in adaptation with local actors and indigenous communities show that in most cases local stakeholders lack the financial resources and technical capacity to implement the various components of locally driven adaptation activities.[15] These barriers challenge the coherence between top-down adaptation strategies and local adaptation needs and development plans. For example, the process of planning and implementing priority adaptation options contained in the NDC and NAP does not clearly define a framework for integrating a locally led approach to adaptation, even though the guidance recommends considering local and endogenous knowledge and practices developed by communities adapting to climate change. Indeed, success in planning and implementing adaptation depends on the active participation of local actors.

2.3 Some conceptual narratives on local adaptation

The major challenge facing the delivery of climate change adaptation in Ghana, Nigeria and Senegal is that the topic has yet to feature in the mainstream national discourse. The requisite frameworks critical for providing guidance and systematic support for planning, implementing and administering adaptation practice are only just being developed. The bottleneck is partly due to institutional, financial and capacity-related challenges.

LLA has emerged as an important approach, giving decision-making power to local communities, organisations and governments at the lowest administrative level. LLA involves understanding local needs, co-designing context-specific adaptation measures and building on existing systems. In the context of this report, LLA refers to climate adaptation processes and actions that are led by or include local communities, community-based organisations, citizen groups, local government, and local private sector entities as decision makers.[16] Such an approach is focused on ensuring that local people have individual and collective agency over the adaptation process. It further recognises the resourcefulness and capabilities of local communities and emphasises the importance of funding and support for their adaptive solutions.

LLA emphasises the importance of building on existing social, economic and environmental systems, rather than imposing external solutions that may not be sustainable or effective in the long term. Attention to LLA will be critical to the success of the implementation of climate actions, set out by countries in their NDCs. Thus, research is needed to identify gaps, opportunities and community-specific priorities in climate solutions that align with endogenous adaptation practices and the needs of local communities. The broader aim of the case studies was to generate lessons on the enablers of and barriers to climate change adaptation actions at the local level and provide insights into the ways in which the implementation of the NDCs through LLA can be enhanced to support climate action and livelihoods within the host and surrounding communities. The research was guided by questions such as: What local actions and initiatives are practised in response to climate change? Who is behind such actions? What are the motivations for actions from the communities? And what are the outcomes and co-benefits of such actions?

LLA would often mobilise not only local communities, but also community-based organisations, citizen groups, local government and local private sector entities. Locally led adaptation goes beyond stakeholder engagement as it is often practised today (common with community-based approaches) and occurs when local actors, who are directly accountable to local people, have agency over adaptation and development paths. By bringing decision-making closer to those most affected, this type of action can deliver democratic, equitable and context-specific solutions, which can address multiple risks and achieve multiple benefits.[17]

PART TWO

Country studies

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3 Ghana

Ghana is a lower-middle-income developing country with a land area of 238 000 km^2, and a population of 30.8 million: 51% female, 49% male. Ghana is divided into 16 regions and 261 local authorities or district assemblies.[18] Its economy is dominated by the service sector, which contributes about 46% of GDP, followed by industry with 33% and agriculture with 21% of GDP.[19] The key sectors driving the growth of the economy include mining, petroleum, agriculture and forestry. The agricultural sector, however, is a key source of livelihood for the population.[20] It employs the most people, accounting for at least 40% of the country's active labour force and about 71% of the rural population. Ghana's long-term aspiration is to become a high-income country by 2056, and it plans to double per capita GDP in the medium term.[21] However, climate change has been identified by policymakers as a key risk threatening to constrain these future aspirations.

3.1 Climate change impact and vulnerability

Ghana is highly vulnerable to climate change and variability because it is heavily dependent on climate-sensitive sectors such as agriculture – largely rainfed with a low level of irrigation development – forestry and hydropower. The country has a 565 km long coastline that is inhabited by about a quarter of the population and is the location of significant physical infrastructure. The EACC Ghana country study estimates that climate change will cause a reduction in real household consumption of 5–10% in 2050, with rural households suffering greater reductions, primarily through impacts on agricultural production.[22]

Ghana is ranked 109 out of 181 countries in the 2020 ND-GAIN Index.[23] As such, climate change has been identified by policymakers as a key risk that threatens to constrain future aspirations of the country.[24] Ghana has been experiencing significant changes in weather patterns, resulting in severe climate-related risks such as drought, flooding and erratic rainfall. Rising temperatures, changing rainfall patterns and an increased frequency and intensity of extreme weather events such as floods and droughts are already negatively affecting agriculture and forestry production, which are the mainstay of the economy. This poses significant risks for food insecurity and loss of income.[25] The mean annual temperature is projected to rise by about 4.8˚C on average from 1990 to 2100; the number of days of warm spell in Ghana is projected to increase from 10 days in 1990 to over 280 days on average in 2100.[26] The country's high poverty rates, inadequate infrastructure, weak institutions and governance structures, and limited access to technology and financial resources exacerbate its vulnerability to climate change impacts.

Climate change has had significant impacts on key sectors of the Ghanaian economy. In agriculture, rising temperatures and changing rainfall patterns have led to reduced crop yields, affecting food security and livelihoods.[27] Health has been impacted by increased incidence of malaria and other climate-sensitive diseases. Water resources have been affected by reduced rainfall and increased

evaporation, leading to water scarcity that is affecting hydropower generation.[28] Livelihoods have been affected by droughts, loss of crops and livestock and increased food prices. Forestry has been impacted by deforestation, forest degradation and loss of biodiversity.

Climate change also poses a significant threat to economic growth, with potential impacts on trade, tourism and infrastructure. Climate change has also had significant impacts on coastal communities in Ghana, with sea level rise leading to erosion and flooding.[29] This has impacted the livelihoods of fishers and people in coastal towns and villages. In peri-urban and urban areas, climate change has led to increased urban heat, affecting health and productivity, as well as increased flooding due to inadequate drainage systems.[30] These challenges disproportionately affect the most vulnerable communities, such as women, children and the poor, who are often disadvantaged by traditional, patriarchal decision-making processes as well as by age and type of household.

3.2 National policy and regulatory context

To address the above-mentioned impacts and challenges, the government of Ghana has developed several policies, strategies and actions.[31] Adaptation strategies emphasised in these policy documents include a mix of behavioural, capacity-building, technological, financial and integrated approaches. The key strategies emphasised in these policies include climate information services, integrated landscape planning, improving livelihoods, sea defence walls, resilient community infrastructure, crop insurance and opportunities for improving livelihoods. The Ghanaian government seeks to prioritise early warning and disaster risk management as well as integrated water resource management as part of its investment into adaptation activities.

These strategies focus on building the adaptive capacity of vulnerable communities, enhancing the resilience of key sectors such as agriculture, and promoting low-carbon development pathways. Ghana's updated NDC emphasises 13 specific adaptation measures out of a total of 47 programmes of action.[32] Key priority areas for adaptation include the development of resilient infrastructure, the promotion of livelihoods, strengthening of agricultural landscapes and food systems, urban planning, early warning systems, enhancing the climate resilience of women and vulnerable groups and promoting social inclusion.

The current approach to climate adaptation planning in Ghana encourages cross-sectoral and inter-agency collaborative actions that integrate adaptation imperatives into policies, programmes and plans.

In addition to the NDC, there are several policies and strategies that support Ghana's climate change agenda. These include the National Climate Change Policy (NCCP), the 2012 National Climate Change Adaptation Strategy (NCCAS), the 2015 NDCs, the 2015–2020 National Climate Change Master Plan Action Programs for Implementation and the 2018 National Adaptation Policy Framework, all of which guide climate actions and initiatives. Key government ministries such as Energy, Forestry, Agriculture, Health and Gender have also created Climate Change Units, which serve as channels for managing specific climate change issues in government ministries, departments and agencies (MDAs). In addition to the government's efforts, various private firms, NGOs and civil society groups are working on climate change adaptation and mitigation initiatives at different levels.

The role of key stakeholders and financing for climate adaptation actions

Ghana's commitment to climate action is evident through the diverse range of stakeholders engaged in addressing climate change impacts at various levels.[33] These stakeholders, including technical agencies, directorates, NGOs, the private sector, academic institutions, international organisations, local authorities and communities, play pivotal roles in advancing climate resilience. Some of these institutions implement specific climate change initiatives at the local level, while some also engage in climate change policy advocacy at the national level. A summary list of the stakeholders includes:

- Government agencies: Government agencies play a central role in climate change policy and implementation. The Ministry of Environment, Science, Technology and Innovation (MESTI) is responsible for coordinating climate change activities, developing policies and implementing mitigation and adaptation measures. The Environmental Protection Agency (EPA) is the central agency under MESTI that monitors, regulates, coordinates and provides updates and communication on climate change and environmental issues. The Ministry of Food and Agriculture (MoFA) focuses on climate-smart agriculture and rural development. Various ministries, departments and agencies (MDAs) such as the Ministry of Local Government and Rural Development and the Forestry Commission also implement projects with climate change components.

- Non-governmental organisations: NGOs play a vital role in advocating for climate change mitigation and adaptation measures. Organisations such as Arocha Ghana and Strategic Youth Network for Development engage in raising awareness, capacity building, project implementation and promoting sustainable development practices.

- Research institutions: Research institutions, including universities and think tanks, contribute to the climate change policy arena through research, data analysis and scientific evidence. Institutions such as the Council for Scientific and Industrial Research (CSIR), the Bureau of Integrated Rural Development and the Institute for Environment and Sanitation Studies (IESS) offer expertise and knowledge on climate change impacts and mitigation strategies.

- Private sector: The private sector plays a critical role in climate change action, particularly in areas such as renewable energy, sustainable agriculture and green technologies. Companies involved in renewable energy development, sustainable manufacturing and carbon offset projects have a vested interest in climate change policies that create a favourable business environment.

- International organisations: International organisations, including the United Nations Development Programme (UNDP), the United Nations Environment Programme (UNEP) and the World Bank, provide technical and financial support to Ghana's climate change efforts. They collaborate with the government, NGOs and other stakeholders to implement projects, provide funding and build capacity.

- Community-based organisations: Local community-based organisations and traditional leaders play an important role in implementing climate change initiatives at the grassroots level. They have a deep understanding of local contexts, traditional knowledge and practices that can contribute to climate change adaptation and resilience-building efforts.

Ghana faces obstacles in adequately financing climate change adaptation measures, particularly those aligned with the NDCs. First, of the total inflows of climate finance committed between 2010 and 2019, climate finance allocated to mitigation activities accounted for 87.4%, while adaptation activities received only 3.4%.[34] This distribution highlights a significant disparity between mitigation and adaptation funding in Ghana. Findings further reveal that there is a significant gap between the finance required for climate adaptation and the actual funds available. Thus, the implication of Ghana's updated NDC funding requirements is that substantial financial resources are needed to effectively implement climate action measures in the country. The estimated investment of USD 9.3–15.5 billion over the period of 2020 to 2030 highlights the scale of the financial commitment required to address climate change challenges and meet the goals outlined in the NDC.[35] To mobilise this funding, Ghana will need to engage a diverse range of stakeholders, including public institutions, international organisations, private sector entities and carbon markets.

Awareness of and access to various financing models as well as a concerted effort are necessary to secure the financial resources and effectively allocate them to implement both unconditional and conditional programmes of action. Meeting these funding requirements will enable Ghana to enhance its climate resilience and achieve its climate targets as outlined in its NDC. It will also contribute to sustainable development, job creation and the overall well-being of communities and ecosystems in the face of climate change impacts. However, the mobilisation of such a significant amount of funding can present challenges, including the need for effective coordination, transparent financial mechanisms and accountability to ensure that the funds are utilised efficiently and effectively. Collaboration between different stakeholders and innovative financing approaches will be crucial in meeting the funding needs and driving successful climate action implementation in Ghana.

3.3 Local actions, strategies and practices

In addition to the national adaptation policies, communities have been implementing several strategies, initiatives and practices to adapt to the impacts of climate change. Work on these strategies has been self-initiated and/or supported by government services, CSOs and NGOs. These local actions and strategies include efforts to intensify sustainable forest resource management, climate-smart agriculture, crop insurance, community-based conservation actions and early warning mechanisms to minimise the impacts of floods and disaster risk management.

Other local adaptation actions include: the promotion of livelihood opportunities for the youth and women in climate-vulnerable agriculture landscapes and food systems, especially in Northern Ghana; integrated water resources management; and reduction and recycling of waste. Some of these local efforts are being promoted through initiatives such as the Greater Accra Resilient and Integrated Development Project (GARID), the main objective of which is to develop sustainable capacity for flood risk management; construction of sea defence walls via coastal protection projects; a sustainable land and water management project; and early warning and disaster risk management initiatives at various sub-national levels. The main sectors of interest for adaptation are agriculture, education, environment, development planning, health and interior.

3.4 Lessons from case studies

Case 1: Kpiri and Sor No. 1 – organic shea processing

This case study focuses on two communities, Kpiri and Sor No. 1, in the West Gonja district of the Savannah Region in Ghana. The main livelihood activity in these communities is agriculture, specifically shea nut picking and food crop production. The northern part of Ghana, which includes the five northern regions of North East, Northern, Savannah, Upper East and Upper West, is generally considered to be a climate-vulnerable landscape and dryland area. This results in drier conditions and lower levels of vegetation, which make it challenging for agriculture and other livelihood activities that rely on rainfall. A local NGO, Movement of Rural Entrepreneurial Women (MORE Women), is leading an adaptation action in response to the communities' vulnerability to climate change impacts through the establishment of Village Savings and Loans Associations (VSLAs) and organic shea processing. The main adaptation strategies include VSLAs for group-based organic shea processing, energy-saving stoves, local by-laws against logging and charcoal burning and tree planting initiatives.

Motivations: One of the most significant impacts of climate change on farmers is the increasing frequency and intensity of droughts, which has led to reduced crop yields. As such, participants are motivated by the need to reduce the negative impact of climate change in the region. The specific motivations include: (i) generation of a reliable source of income for women, which allows them to build resilience against the impacts and vulnerabilities of climate change; (ii) promotion of sustainable land use practices that prioritise the conservation of shea resources and promote the use of alternative sources of energy, such as improved energy-saving cookstoves and biogas (pilot phase); (iii) make charcoal and firewood less attractive to rural communities.

Practices and strategies: The Kpiri and Sor community have implemented a number of integrated practices and strategies: (i) provision of a VSLA toolbox with seed capital to MORE Women, to promote group-based organic shea processing; (ii) promotion and use of energy-saving stoves in parboiling shea nuts, which optimises the combustion process, resulting in higher energy efficiency compared to traditional stoves; (iii) formulation of local by-laws against logging and charcoal burning to promote conservation, which would provide ideal conditions for farming and other livelihood activities; (iv) provision of credit to the women's groups through the weekly VSLA meetings, which also fosters relationship-building and enhances cohesion; (v) promotion of tree planting.

Outcome: The VSLAs, organic shea processing, energy-saving stoves and local by-laws against logging and charcoal burning have empowered communities economically, environmentally and socially. They are better equipped to adapt to climate change impacts, protect natural resources and build resilient and sustainable livelihoods for a more secure future. The VSLAs have provided communities with financial tools to save and increased women's access to credit, enabling them to invest in income-generating activities, climate-smart agriculture, tree planting and organic shea processing. Moreover, the initiative has helped to provide a safety net for members of the various groups, especially during times of economic stress caused by climate change impacts such as droughts and crop failures. In addition to improved soil fertility through the promotion of sustainable land use practices, the establishment of community by-laws has played a particularly critical role in regulating land use practices and protecting natural resources and the environment.

Co-benefits: A number of co-benefits have been derived from the project such as financial literacy and bookkeeping/record-keeping skills, improved social cohesion amongst rural women, promotion

and use of the energy-saving cooking stoves leading to health benefits and enhanced access to credit. Moreover, new skills have been acquired in the use of natural and sustainable methods to process shea nuts, without the use of chemicals or artificial additives. This collective benefit has facilitated the establishment of a network of support among the women for sharing knowledge and resources and collaboration on projects that benefit their communities. The economic empowerment of women has had a generally positive impact on community well-being.

Alignment with NDCs: The local adaptation actions observed in this case study align well with a number of national policies, strategies and action plans that have been developed to address climate change impacts. These include the updated NDCs, the National Adaptation Policy Framework, the NCCP, the National REDD+ Strategy and the National Climate Smart Agriculture Food Security Action Plan.

Lessons: There is considerable potential for locally led interventions to build resilience and reduce vulnerability to climate change impacts. Three important lessons can be drawn from the Kpiri and Sor No. 1 case. Firstly, the case highlights that successful responses to LLA practices depend on the active engagement and ownership of local communities. Secondly, the use of multiple and diverse livelihood strategies, such as VSLAs, organic shea processing and tree planting, promotes complementarity that helps communities build resilience to climate change impacts and reduce their vulnerability to shocks. Thirdly, LLA practices that focus on women's empowerment and leadership can have a significant impact on improving livelihoods, reducing poverty and enhancing social cohesion.

Limitations and challenges: Despite the value and importance of this initiative, it faces several challenges and barriers. The lack of access to financial resources makes it difficult for women to invest in and expand the organic shea processing business. This is compounded by the fact that financial institutions in the area do not prioritise funding for small-scale farmers and women's groups. Moreover, the limited availability of equipment and tools to support the organic shea processing business makes it difficult for women to produce the quantity needed to meet market demands. This is made more difficult by the lack of or limited supportive policies and regulations that address the needs and concerns of small-scale farmers and women's groups. Existing policies and regulations do not provide adequate support or incentives for LLA practices, leading to limited adoption and impact. The unpredictable and extreme weather patterns associated with climate change also pose significant challenges, making it difficult for farmers to predict planting and harvesting seasons.

Entry points and opportunities: This case study presents several opportunities and entry points for policymakers, practitioners and even international entrepreneurs and investors to support the communities to better adapt to climate change. Policymakers and practitioners can provide targeted capacity-building and technical assistance programmes to support communities engaged in organic shea processing and VSLAs. This would need to be supported by national and local policies, regulations and incentives where policymakers, practitioners and international entrepreneurs can cooperate to allow market development and value chain integration for organic shea products. These entry points draw attention to several issues that provide opportunities to adequately integrate LLA into the implementation of its NDCs. They include the genuine involvement of women, and community-based approaches that enable communities to take ownership of the adaptation process and foster a sense of collective responsibility for natural resources.

Case 2: Pindaa and Kuliya communities – climate-smart agriculture

The case study conducted in Pindaa and Kuliya communities in Ghana's Upper East region highlights an initiative led by the Organisation for Indigenous Initiatives and Sustainability (ORGIIS-Ghana) to restore degraded savannah forests and strengthen livelihoods through climate-smart agricultural practices. The initiative works with communities to employ climate-smart agricultural practices to help improve soil fertility and conservation of natural resources, as part of the locally led responses to the impacts of climate change such as increased temperatures, erratic rainfall and prolonged droughts.

Motivation: The findings from the deep dive case study revealed that the main motivations for this initiative include increasing food security and improving household income by increasing crop yields and diversifying income sources; and improving soil health, restoring degraded ecosystems and enhancing the biodiversity of the landscape.

Practices and strategies: The Pindaa and Kuliya communities are implementing a number of adaptation strategies promoting and adopting climate-smart agriculture. Some of these include: (i) adoption of integrated pest management techniques and the use of agroecological practices, including intercropping, crop rotation and the use of organic manure and pest control methods, aimed to improve soil fertility and crop productivity; (ii) promotion of tree planting through supply of seedlings (e.g. shea, mango, acacia) to farmers by ORGIIS, in collaboration with the Forestry Commission and other relevant state agencies, and encouraging them to plant and nurture them till maturity; (iii) the use of a community-based solar-powered irrigation scheme which is managed through training from ORGIIS and involves the use of solar-powered pumps to collect water used for irrigation, especially during the dry season.

Outcomes: The Pindaa and Kuliya communities' case points to a number of outcomes, demonstrating the value of the co-creation of strategies, capacity building and monitoring and evaluation of the initiative. Some of these outcomes include: (i) increased and alternative sources of income generation to support households through the cultivation of crops such as tomatoes and peppers; (ii) improved food security by increasing the availability of food, and reducing the vulnerability of farmers to crop failures due to drought or erratic rainfall; (iii) positive responses of community members to the adoption of climate-smart agriculture and agroecological principles; (iv) increased crop productivity and yield as farmers diversify the traditional varieties of crops like sorghum, millet and cowpea to drought-resistant varieties better suited to the changing climate conditions; (v) improved soil health and fertility; (vi) improved water availability and access during the dry season, leading to increased crop yield and income.

Co-benefits: The project activities and strategies provide additional co-benefits that go beyond the main objectives of the initiative. These include: soil erosion control; shade and shelter for livestock; potential enhanced carbon sequestration, which contributes to climate change mitigation efforts and supports the overall goal of achieving carbon neutrality; social benefits such as community cohesion and empowerment through the establishment of community-based organisations and the sharing of knowledge and resources.

Alignment with NDC: These LLA practices align with the national policies, strategies and actions in several ways. The main policies and strategies are the updated NDCs, the National Adaptation Policy Framework, the NCCP, the National REDD+ Strategy and the National Climate Smart Agriculture Food Security Action Plan.

Lessons: The case study demonstrated that projects with active involvement and support from community leaders can enable communities to better adapt to climate change. Bringing community members together in a project setting facilitates the sharing of ideas and resources, fostering a sense of ownership and collective responsibility and leading to more effective implementation and better outcomes for everyone involved. Moreover, LLA practices can help build community resilience to climate change impacts given that climate-smart agriculture practices are tailored to their specific needs and contexts. Climate-smart agriculture, when locally led, can improve agricultural productivity, optimise resource use, reduce risks and improve overall livelihoods.

Limitations and challenges: Communities' limited access to resources such as credit/finance, technology and infrastructure hinders their ability to adopt these practices effectively. The Pindaa and Kuliya communities' case was also constrained by inadequate institutional support from government agencies, local authorities and extension services as well as weak value chains and inadequate infrastructure such as inadequate storage facilities, transportation networks and market linkages. Specific to social groups, cultural norms and power dynamics hindered women's participation and decision-making in agricultural activities.

Entry points and opportunities: There are several entry points and opportunities for policymakers, investors and funding agencies to strengthen the grassroots communities in employing climate-smart agricultural practices. For example: (i) policymakers can integrate LLA into climate decisions and create an enabling policy environment that promotes and supports climate-smart agriculture; (ii) investors and funding agencies can provide financial resources to support climate-smart agriculture initiatives at the grassroots level. This can involve funding for training and capacity building, access to climate-resilient inputs and technologies and investment in infrastructure; (iii) investors and funding agencies can support knowledge transfer and technical assistance programmes to build the capacity of grassroots communities; (iv) collaborative efforts between policymakers, investors, funding agencies and grassroots communities are crucial. By forging partnerships with local organisations, farmer cooperatives and community-based groups, stakeholders can jointly design and implement climate-smart agricultural projects.

Case 3: Keta-Ada stretch – community-based disaster risk reduction to respond to coastal erosion

The Keta Municipality and Anloga districts are particularly exposed to climate change impacts such as sea level rise and erosion of coastal lands. Coastal erosion, which is worsened by climate change, is a particular threat to their livelihoods. Both artisanal and industrial fishing are practised in the areas. Agriculture is also an important economic activity here, with crops such as cassava, maize and vegetables being cultivated. There is also a small-scale mining sector that mainly focuses on salt and sand. This study was carried out across seven communities in the Keta and Anloga districts to understand the nature of practices, initiatives and strategies that communities are employing to adapt to the climatic impacts of coastal erosion. The communities engaged were: Fuveme, Dzita, Anyanui, Salakope, Adina, Agavedzi and Blekusu. The study highlights the locally led initiatives undertaken by these communities to reduce their vulnerability to the impacts of climate change and enhance their resilience.

Motivation: The Keta-Ada stretch case shows that local communities recognise the significant threat posed by rising sea levels and coastal erosion to their homes, livelihoods and infrastructure, and are motivated to act by a mix of economic, social and behavioural factors. The community aims to assert

agency and control over their own futures by working together to build resilience and adapt to ongoing climate change impacts. LLA practices were also seen as a way to enhance the resilience of the community in the face of climate change impacts for which government inaction on the issue of coastal erosion has been problematic.

Practices and strategies: The Keta-Ada community has taken several measures and empowered themselves with knowledge of adaptive practices that will enable them to reduce their vulnerability and enhance their resilience to coastal erosion. These initiatives involve strategies such as: community engagement and general awareness programmes; creation of water passages (dual canals) which limit the vulnerability that often accompanies sea erosion; and application of community-led monitoring of the sea and traditional ecological knowledge. In addition, community-based early warning systems are established to alert residents about impending coastal hazards. Nature-based solutions such as mangrove restoration and beach nourishment have also been set up as part of the adaptation practices.

Co-benefits: There are two main co-benefits that can be associated with the adaptation practices in the area. First, the use of nature-based solutions, such as the planting of mangroves and the restoration of wetlands, has helped to enhance biodiversity and ecosystem services in the Keta-Ada coastal stretch area. The mangroves also help to protect homes from erosion and storm surges. Second, the LLA practices have contributed to increased social cohesion and community empowerment. By working together to implement adaptation measures, communities have strengthened their social networks and built a sense of collective ownership and responsibility.

Alignment to NDCs: These LLA practices are well aligned with the national policies, strategies and actions in several ways. The key policies and strategies that support these practices include the NCCP, the NCCAS of 2012, the NDCs of 2015, the National Climate Change Master Plan Action Programs for Implementation (2015–2020) and the National Adaptation Policy Framework of 2018. These policy frameworks provide a comprehensive and coordinated approach to climate change adaptation, ensuring that local initiatives align with national priorities and objectives.

Lessons: The various lessons learned and best practices drawn from this case study include: (i) community ownership and participation are critical to the success of LLA strategies; (ii) holistic approaches that integrate ecological, social and economic dimensions of coastal erosion and adaptation are necessary to ensure the sustainability of local adaptation measures; (iii) effective stakeholder engagement and collaboration can promote the development of locally appropriate and effective adaptation strategies; (iv) incorporating indigenous knowledge and traditional practices can enhance the effectiveness of coastal erosion response efforts; (v) promoting sustainable livelihood diversification initiatives can reduce the dependency of coastal communities on vulnerable sectors. Encouraging alternative income-generating activities and providing support for entrepreneurship and skills development can enhance community resilience and reduce vulnerability to coastal erosion.

Limitations and challenges: The various challenges are as follows: limited access to financial resources needed to implement effective adaptation measures; limited institutional support, especially from the local authorities and the central government; uncertainty and unpredictability of coastal erosion and sea level rise, which makes it difficult for households to plan and implement effective adaptation measures; limited livelihood options available to the residents beyond fishing given the negative impacts on fishing stocks; and non-adherence to by-laws developed and

implemented by the community against sand mining and other practices that exacerbate the impact of coastal erosion on the people.

Entry points and opportunities: There are several entry points and opportunities for policymakers, investors, funding agencies and local governments to strengthen the adaptation actions of coastal communities in responding to coastal erosion. These range from development of policy and regulatory frameworks, to financial support, community engagement and participation, technical expertise and knowledge exchange, implementing integrated coastal management and collaboration between various stakeholders.

Table 1 Case studies results summary – Ghana

Kpiri and Sor	
Motivation	Generation of a reliable source of income for women. Seeking to improve soil fertility to support sustainable land use practices. Need to move away from charcoal.
Actions and strategies	Women were provided with a VSLA toolbox with seed capital. Promotion and use of energy-saving stoves. Formulation of local by-laws against logging and charcoal burning to promote conservation. Regular meetings to foster relationship-building and enhance cohesion. Promotion of tree planting.
Outcome	Community is better equipped to protect natural resources and build resilient and sustainable livelihoods. Provision of financial tools to save and increase women's access to credit. Establishment of community by-laws to regulate land use practices and protecting natural resources.
Co-benefits	Several co-benefits: financial literacy and bookkeeping/record-keeping skills, improved social cohesion amongst rural women, promotion and use of the energy-saving cooking stoves leading to health benefits and enhanced access to credit.
Alignment with NDC	Aligns well with the updated NDCs, the National Adaptation Policy Framework, the NCCP, the National REDD+ Strategy and the National Climate Smart Agriculture Food Security Action Plan.
Lessons	Successful responses to LLA practices depend on the active engagement and ownership of local communities. Use of multiple and diverse livelihood strategies promotes complementarity. LLA practices that focus on women's empowerment and leadership can have a direct impact on improving livelihoods, reducing poverty and enhancing social cohesion.
Limitations and challenges	Lack of access to financial resources. Financial institutions in the area do not prioritise funding for small-scale farmers and women's groups. Limited availability of equipment and tools to support the organic shea processing business. Lack of or limited supportive policies and regulations that address the needs and concerns of small-scale farmers and women's groups.
Entry points and opportunities	Policymakers and practitioners can provide targeted capacity-building and technical assistance programmes to support communities.

Pindaa and Kuliya	
Motivation	Increasing food security and improving household income by increasing crop yields and diversifying income sources. Improving soil health, restoring degraded ecosystems and enhancing the biodiversity of the landscape.
Actions and strategies	Adoption of integrated pest management techniques and the use of agroecological practices. Promotion of tree planting through supply of seedlings (e.g. shea, mango, acacia) to farmers by ORGIIS, in collaboration with the Forestry Commission and other relevant state agencies. Use of a community-based solar-powered irrigation scheme.
Outcome	Increased and alternative sources of income generation. Improved food security by increasing the availability of food and reducing the vulnerability of farmers to crop failures. Positive responses of community members to the adoption of climate-smart agriculture and agroecological principles. Improved soil health and fertility. Water availability and access during the dry season, leading to increased crop yield and income.

Co-benefits	Co-benefits include: Soil erosion control, shade and shelter for livestock, enhanced carbon sequestration, establishment of community-based organisations and the sharing of knowledge and resources.
Alignment with NDC	LLA practices align with the national policies, strategies and actions in several ways. The main policies and strategies are the updated NDCs, the National Adaptation Policy Framework, the NCCP, the National REDD+ Strategy and the National Climate Smart Agriculture Food Security Action Plan.
Lessons	Bringing community members together in a project setting facilitates the sharing of ideas and resources. LLA practice can help build community resilience to climate change impacts. Climate-smart agriculture, when locally led, can improve agricultural productivity, optimise resource use, reduce risks and improve overall livelihoods.
Limitations and challenges	Inadequate institutional support from government agencies, local authorities and extension services. Weak value chains and inadequate infrastructure such as inadequate storage facilities, transportation networks and market linkages. Cultural norms and power dynamics hindered women's participation and decision-making in agricultural activities.
Entry points and opportunities	Policy support. Financial investment designed to support climate-smart agriculture. Knowledge institutions can enable knowledge transfer and sharing. Partnership and collaboration with national and international actors.

Keta-Ada stretch	
Motivation	Local communities recognise the significant threat posed by rising sea levels and coastal erosion to their homes, livelihoods and infrastructure. Communities motivated to act by a mix of economic, social and behavioural factors.
Actions and strategies	The initiatives involve strategies such as: community engagement and general awareness programmes; creation of water passages (dual canals) which limit the extent of vulnerability that often accompanies sea erosion; and application of community-led monitoring of the sea and traditional ecological knowledge. Community-based early warning systems are established to alert residents about impending coastal hazards. Nature-based solutions such as mangrove restoration and beach nourishment are also set up as part of the adaptation practices.
Outcome	Improved accessibility of farm roads, thereby increasing productivity and the shelf life of perishable foods. Improved livelihoods in addition to a reduction of poverty and food insecurity. Inclusion of people with disabilities, women and youth, thereby fostering social integration.
Co-benefits	Enhanced biodiversity and ecosystem services. Mangroves protecting homes from erosion and storm surges. Increased social cohesion and collective ownership.
Alignment with NDC	LLA practices are well aligned with the national policies, strategies and actions in several ways. The key policies and strategies that support these practices include the NCCP, the NCCAS of 2012, the NDCs of 2015, the National Climate Change Master Plan Action Programs for Implementation (2015–2020) and the National Adaptation Policy Framework of 2018.
Lessons	Community ownership and participation are critical to the success of LLA strategies. Holistic approaches of coastal erosion and adaptation are necessary to ensure the sustainability of local adaptation measures. Effective stakeholder engagement and collaboration is central for locally appropriate and effective adaptation strategies. Incorporating indigenous knowledge and traditional practices can enhance the effectiveness of coastal erosion response efforts. Promoting sustainable livelihood diversification initiatives can build resilience.
Limitations and challenges	Limited access to financial resources. Limited institutional support, especially from the local authorities and the central government. Uncertainty and unpredictability of coastal erosion and sea level rise. Limited livelihood options available to the residents beyond fishing given the negative impacts on fishing stocks. Non-adherence to by-laws developed and implemented by the community.
Entry points and opportunities	Adaptive management of liveable spaces builds trust and helps to reduce the vulnerability of communities. Education and awareness-raising campaigns for increased public understanding of the potential hazards and disasters associated with land degradation.

3.5 Policy recommendations for locally led adaptation in Ghana

The following policy recommendations are made for Ghanaian policymakers for deepening adaptation and resilience through LLA.

- **Devolve and enhance access to climate adaptation financial resources:** Government and policymakers in Ghana should develop mechanisms to improve access to financial resources for local governments and communities, especially for small-scale farmers, women's groups and community-based organisations involved in climate adaptation initiatives at the local level.

- **Strengthen capacity-building efforts:** The government and policymakers should also invest in capacity-building programmes to empower local communities with the knowledge, skills and tools needed to design and implement climate adaptation strategies. This includes providing training on climate-smart agriculture, sustainable land management, ecosystem restoration and disaster risk reduction, among other relevant topics.

- **Integrate traditional knowledge and practices into climate adaptation strategies:** Local communities possess valuable traditional wisdom developed over generations to cope with environmental changes. Incorporating this valuable knowledge and these approaches to support policies can enhance the effectiveness and cultural appropriateness of adaptation actions and limit maladaptation.

- **Enhance climate governance for effective implementation of LLA:** Facilitating inclusive and participatory platforms that bring together a range of stakeholders encourages dialogue, knowledge exchange and collaboration to co-create adaptation strategies that reflect local needs and aspirations. This strengthens coherence between national policies and locally led adaptation efforts, as well as inclusion of women and marginalised groups in shaping adaptation initiatives – from planning to implementation.

Policy recommendations for the international community to implement locally led adaptation are as follows:

- **Increase international climate finance for locally led adaptation:** Enhance funding and allocate financial resources exclusively for the support of locally driven climate adaptation initiatives. Achieve this by creating dedicated funds, grant programmes and financial mechanisms that prioritise and direct resources to local communities and organisations.

- **Strengthen capacity building and knowledge sharing:** Support capacity-building programmes and knowledge-sharing platforms that facilitate the exchange of best practices, lessons learned and experiences between local communities, practitioners and policymakers from different countries. This can include funding training programmes, workshops and conferences that focus on enhancing the skills and knowledge of local actors in climate adaptation.

4 Nigeria

Nigeria is Africa's most populous nation, with an estimated population of 213.4 million, a total land area of 923 768 km² and an extensive coastline of about 853 km.[36] Nigeria is divided into six geopolitical zones: north-east, north-west, north-central, south-east, south-west and south-south and is made up of 36 states and Abuja, the Federal Capital Territory (FCT). Nigeria is Africa's largest economy and can be classified as a lower-middle-income country with a gross domestic product (GDP) of USD 441.54 billion in 2021.[37] The country is characterised by three distinct climate zones: a Sahelian hot and semi-arid climate in the north, a tropical wet climate in the south, and a tropical savannah climate in major parts of north-central. Nigeria is also an oil-producing country, with crude oil accounting for over 80% of exports, a third of banking sector credit and half of government revenue. Nigeria is facing several development challenges, including dwindling oil revenues, scarce foreign exchange, ineffective government policies, a massive infrastructure gap and high rates of inequality. All these are compounded by the rising cases of extreme weather events in all agroecological zones of the country, which have led to several hazards and disasters.

4.1 Climate change impact and vulnerability

Nigeria is ranked as one of the most climate-vulnerable countries in the world. The country specifically has been ranked by different bodies as highly vulnerable to climate change impacts. For example, Verisk Maplecroft ranked Nigeria as the 7th most vulnerable country in the world.[38] Similarly, in 2021 Notre Dame Global Adaptation Initiative (ND-GAIN) ranked Nigeria 161st out of 182 countries which were assessed on the basis of vulnerability to climate disasters and adaptive capacities.[39] This vulnerability has been attributed to the country's complex agroecological zones, burgeoning urban and rural populations, extensive coastline vulnerable to sea level rise and storm surges, as well as underlying economic challenges and a weak governance system.

The systemic risks posed by the burgeoning climate crisis in Nigeria have triggered more frequent outbreaks of infectious diseases, communal conflicts, farmer–herder crises, loss of livelihoods, loss of aquatic and terrestrial biota, decreasing food security and rising economic crises. Additionally, Nigeria faces several challenges in the form of complex, indirect externalities such as food insecurity, forced displacement, conflicts, negative health outcomes and others, which together constitute incredibly complex barriers to climate action and economic growth.[40] These issues have been exacerbated by a lack of climate finance, especially for sustainable adaptation initiatives, coupled with lack of basic amenities, inadequate infrastructure and inequality.

There are also regional differences in the way the impacts of climate change are manifested in the lives of the people. Southern Nigeria has experienced erratic weather patterns and high intensity rainfall events leading to recurrent flood disasters, while northern Nigeria faces droughts and

desertification in its arid and semi-arid regions. These two weather extremes have excessively affected the rainfed agricultural practices of local communities. Disease incidence has been on the rise: Vector-borne diseases such as malaria caused about 200 000 deaths in 2021 (32% of total global malaria deaths), which affected a total of 60 million Nigerians.[41]

Meanwhile, in other parts of the country a combination of droughts, saltwater intrusion and sea level rise are adversely affecting crop yields and urban infrastructure, leading to rising food prices, cost of development and other linked effects. Crop yields are particularly sensitive to changes in climate as agriculture is largely rainfed. Bearing in mind that 70% of the population engages in subsistence agriculture, accounting for nearly 23% of GDP, this stands to be one of the areas where climate change will exert the most pressure.

4.2 National policy and regulatory context

Nigeria's NDC provides a high-level, strategic vision for climate action, outlining the country's commitment to support mitigation and adaptation plans under the United Nations Framework Convention on Climate Change (UNFCCC). The focus of the updated NDC is heavy on mitigation. It aims to enhance the availability of clean energy for all Nigerians, create green jobs, institute sustainable waste management, provide clean cooking solutions and incorporate gender in all sectors of Nigerian economic development. The NDC has a stated 2050 target of achieving a climate-resilient Nigeria in alignment with the SFDRR, the Sustainable Development Goals (SDGs) and the Nigeria Economic Sustainability Plan (NESP). The updated NDC takes a collaborative and inclusive 'whole-of-society' approach, involving a wide range of stakeholders such as relevant MDAs, states, the private sector and CSOs, as well as United Nations Development Programme (UNDP) support. The government has determined vulnerability throughout Nigeria on a regional scale. This is a critical step in successfully implementing the NDC adaptation policies and plan in the NDC's five key priority sectors of agriculture, forestry and land use; food security and health; energy and transportation; waste management; and water and sanitation.

In addition to the NDCs, the Federal Government of Nigeria has over the last decade developed several adaptation policy frameworks (APFs), with short- and long-term strategies for the effective management of climate crisis and reduction of its impacts on the environment. In addition to the NDCs, Nigeria has developed several APFs for climate change over the last decade. The majority of these APFs highlight Nigeria's bold and ambitious plans, actions, goals and strategies for mainstreaming adaptation across all spheres of governance. Some of these policy documents include the updated NAP framework, the National Adaptation Strategy and Plan of Action on Climate Change for Nigeria (NASPA-CCN), the Nigeria Climate Change Policy Response and Strategy (NCCPRS), the Nigeria Climate Change Act (CCA) 2021, the National Climate Change Policy for Nigeria 2021–2030 (NCCP), the National Action Plan on Gender and Climate Change for Nigeria (NAPGCC) and other national policy frameworks which have components of adaptation and economic development plans.

An analysis of these policy frameworks shows that the Nigerian government has made concerted efforts to increase adaptation actions in 13 priority sectors such as agriculture; freshwater resources, coastal water resources and fisheries; forests; biodiversity; health and sanitation; human settlement and housing; energy; transportation and communication; industry and commerce; disaster, migration and security; livelihoods; vulnerable groups; and education.[42] Nigeria's Adaptation Communication to the UNFCCC (ADCOM), the NASPA-CCN, the NAP framework and the NCCPRS have well-structured adaptation strategies, policies and action plans that cover these 13 priority areas. Furthermore, a

review of the APFs shows that relevant stakeholders were integrated into the adaptation planning process. Some of these stakeholders include the federal, state and local governments; the private sector; civil society organisations (CSOs); households and individuals; and international organisations and donor agencies.

Nigeria's current climate adaptation plan utilises a top-down approach without including frontline communities and stakeholders in the decision-making process, coupled with their traditional knowledge, cultures, norms and values. Therefore, much needs to be done to mainstream locally led adaptation in the country's adaptation plans; ensure effective, efficient and equitable delivery of adaptation actions; and give local communities agency over the designing, monitoring and evaluating phases of the adaptation actions.

4.3 The role of key stakeholders and financing for climate adaptation actions

Nigeria has numerous stakeholders that play diverse roles in its climate adaptation actions at different levels.[43] The long list of stakeholders consists of national government agencies, NGOs, the private sector, academic institutions, international organisations, local authorities and communities. The majority of these stakeholders carry out diverse climate change adaptation and mitigation actions at the local level, while a good number of them play crucial roles in climate change policy advocacy at the national and sub-national levels. While the list contains a diverse range of stakeholders, other stakeholders like media organisations and government MDAs that have an interest in climate change are also important and play critical roles. It is also important to note that each stakeholder group has different sub-groups that may bring their own concerns and priorities, depending on what issues are under consideration. For example, a CSO would include associations of women, youth and farmers of different types. One of the major challenges in addressing climate adaptation is the disconnect between stakeholders, including the research community, politicians, small to medium-sized enterprises, social activists, consumers, producers and the media, among others. This presents a lack of shared understanding of the climate challenge on specific activities, roles and responsibilities that each may choose to play, and the potential solutions.

Climate adaptation projects in Nigeria have mostly been funded by international organisations, even if they are implemented at national and sub-national levels. Nigeria, just like most nations in sub-Saharan Africa, relies on foreign aid and grants to finance more than 50% of its climate adaptation and mitigation activities. A significant percentage of the project costs are borne by multilateral development banks (MDBs), mostly the World Bank and to a lesser extent the African Development Bank (AfDB). Other notable international donors to adaptation efforts in Nigeria include the German Agency for International Cooperation (GIZ), the Foreign, Commonwealth and Development Office (FCDO) and the United States Agency for International Development (USAID).

However, adaptation finance from the government and the private financial sector in Nigeria is yet to match the level of effort required to fill the funding gap and build resilience if Nigeria is to implement its NDC in various priority sectors of its economy within the next decade.[44] This shortfall amounts to USD 142 billion. The government has begun issuing Green Bonds, targeting about USD 248 million in climate finance, in order to support national projects in priority areas that include energy efficiency, clean transportation, sustainable land use, agriculture, renewable energy, conservation and sustainable water. The Nigeria Sovereign Green Bond will also help the country to seek a low-carbon pathway for socio-economic recovery in line with the Economic Recovery and Growth Plan

(ERGP). Since it issued its first and second Sovereign Green Bonds in 2017 and 2019, Nigeria has increased the outline of its green projects, thereby enabling the government to mobilise local, regional and global climate finance resources to service national climate actions. As a further step in this direction, Nigeria has also set up the Green Bond Advisory Group (GBAG). This is made up of public and private sector institutions and provides high-level oversight to the Green Bond process.

4.4 Local actions, strategies and practices

Frontline communities in Nigeria are building resilience against the impacts of climate change by using numerous LLA strategies. Evidence from this research has shown that local communities in Nigeria approach adaptation in an organised manner and use several traditional methods specific to their environment to increase their adaptive capacities and build resilience against climate change. While national adaptation strategies feature a great deal of high-level planning and policymaking, adaptation at the local level is usually fast-paced and iterative. Adaptation practices and initiatives of these communities are primarily controlled by different agroecological zones, indigenous/traditional knowledge systems and cultural values. These adaptation practices have been going on for decades, albeit at a small scale. However, there has been a surge in the number and frequency of adaptation practices and initiatives in all Nigeria's agroecological zones due to the increasing impacts of climate change.

4.5 Lessons from cases

Despite the existing gaps and challenges explored above, local stakeholders have shown considerable resilience in their continued pursuit and promotion of climate action. In many cases, local communities have noticed changes in the climate and have been making do by adopting simple practices that buffer the effect of climate change. Three case studies discussed here help to understand the status, challenges, barriers and opportunities of locally led initiatives, as well as their alignment with Nigeria's NDC, APFs and other national policies. The three case studies fall within the 13 adaptation priority sectors of Nigeria as highlighted in the NASPA-CCN (2011), the NAPF (2020) and the NCCPRS (2021).

Case 1: Owode Town, Ogun State – biogas production for forest conservation

Forests in Nigeria control ecosystem services, protect biodiversity, support livelihoods, play a fundamental role in carbon sequestration and contribute to sustainable growth and development. However, Nigeria lost about 1.14 million hectares of forest cover from 2001 to 2021, which is equivalent to an 11% decrease in its forest cover since 2000 and equal to 58.5MtCO_2e.[45] A cassava processing centre and several farm settlements in Owode, Ogun State, are currently facing massive deforestation and energy poverty. These farmers, who are mostly women, resort to burning farm waste and other forms of waste (e.g. plastic) when they run out of fuelwood. The community is currently in the pilot phase of deploying a biogas production facility. Waste from cassava processing, livestock and poultry farms is expected to feed into the facility, and the by-products of biogas production will be used to improve soil health and fertility.

Motivation: Despite the relative lack of government support to tackle climate change impacts and implement several adaptation actions, farmers, artisans and members of Owode community and environs are already taking necessary steps toward addressing issues related to energy poverty and environmental degradation. The community members are motivated by the need to sustain

their means of livelihood given the high rate of poverty and unemployment in the country and their desire to have access to affordable, efficient, clean and sustainable energy sources. They are also motivated by the need to improve their health and well-being in the community, while averting the increasing incidence of climate impacts, especially flooding, environmental pollution and heatwaves.

Practices and strategies: Owode community has adopted several initiatives, practices and strategies as adaptation actions to address their immediate cooking energy challenges in a harmonious way with nature. The initiatives, practices and strategies employed by the farmers, labourers and artisans living in the community can be summarised as follows: use of a variety of agricultural biomass and residues as substitutes for fuelwood; use of agricultural waste to make charcoal briquettes and biogas production; use of residues generated from biogas production as a green manure to replenish the soil nutrients and control soil/gully erosion; and use of agricultural biomass (e.g. palm kernel shells, palm oil fibre, palm oil bunch and other waste generated during crop harvesting and processing) as substitutes for fuelwood during the rainy season when demand for dry fuelwood is usually high.

Outcome: There are a number of outcomes from the actions taken by the local farmers and labourers, in addition to the beneficial outcomes of using biogas as an alternative source of energy. These include the opportunity to: (i) reverse the trend of deforestation, restore biodiversity and improve ecosystem services, thereby enhancing carbon sequestration and reducing the concentration of GHGs; (ii) establish nature-based solutions (NbSs) as important, profitable actions which have the capacity to sustainably restore the natural ecosystem of the community by reducing several climate-induced hazards and risks associated with unsustainable harvesting of forest resources; (iii) improve the lives and livelihoods of the community members by reducing energy poverty through the availability of a renewable energy source that is affordable and accessible to the community.

Co-benefits: The main co-benefit of the project – biogas production for forest conservation – is the accelerated increase in speed and efficiency of *garri* processing using biogas as an energy source, and the overall improvement in the health and well-being of the farmers using biogas stoves. The adoption of biogas as an alternative to fuelwood has also led to the establishment of several biogas stove fabrication centres within the community. The project has made it easier to set up several community-based support groups solely for sharing information and knowledge on biogas production, storage and distribution, and the development of other renewable energy sources. Additionally, the adoption of biogas as a renewable energy source in the community has led to a significant decrease in forest biomass depletion, improved ecosystem services and environmental sustainability.

Alignment with NDC: The LLA initiatives, practices and strategies being implemented by the farmers and members of Owode community, including the use of waste agricultural biomass for biogas production, are in strong alignment with Nigeria's NDC and other relevant national policies, strategies and action plans developed to address climate change impacts, natural hazards and disasters, environmental sustainability and the socio-economic improvement of Nigeria. The initiative is also in line with the mission of the Nigeria National Renewable Energy and Energy Efficiency Policy (NREEEP) set up in 2015 to develop a framework for clean energy access by ensuring an affordable, reliable and sustainable supply of renewable energy.

Lessons: A number of lessons have been learned from the LLA initiatives and practices implemented by farmers, labourers and members of Owode community. Some of these are in the form of: (i) active engagement with members of the community for innovative ideas and solutions that are home

grown; (ii) the value of building strong collaboration with agricultural research institutions, private organisations and other tertiary institutions within Ogun State for innovative research on the scale-up of clean cooking stoves; (iii) social innovation as the community transitions away from the use of fuelwood towards a cleaner energy source.

Limitations and challenges: Despite the positive outcomes and opportunities associated with the LLA initiatives and practices of farmers and labourers in the Owode community, there are several limitations and challenges affecting the expansion and scale-up of the LLA initiatives and practices. Firstly, a majority of the farmers live in rural areas where energy poverty is prevalent and income is very low, and instruments such as credit facilities are not available to farmers and other members of the community. Secondly, there is a lack of synergy and collaboration between rural communities and relevant research institutions, such as the Forest Research Institute of Nigeria (FRIN), the National Parks Service (NPS), the National Agency for Great Green Wall (NAGGW) and State Forestry Services. Thirdly, the limited supporting policies and implementation plans, especially at the community level, make scaling-up challenging.

Entry points and opportunities: The Owode community project has the potential to increase the transfer of technological know-how, which may lead to an increase in investments in renewable energy, improved energy efficiency and interests in developing and deploying clean energy technologies. Moreover, the project has the potential to increase the resilience of the community's natural ecosystems and lead to the reforestation of degraded areas, restoration of wetlands and mangroves and a strengthening of the laws protecting the few existing areas. Building social resilience via capacity development, educating community members and investing in early warning systems, as observed in the Owode community, would also offer practice-based responses to addressing the impacts of climate change.

Case 2: Abesan and Shagari estates, Alimosho LGA, Lagos State – climate change adaptation strategies in fisheries and aquaculture

Fisheries and aquaculture are two important sources of livelihood in Nigeria's rural and peri-urban areas. The majority of the challenges facing fish farmers today are mostly attributed to the rising cost of feed and land acquisition, flood inundation on fish farms, inadequate training, insecurity, lack of disease-resistant stocks, shortage of genetically improved stocks (fingerlings and juveniles), lack of adequate technology and insurance, low water quality and lack of financial support, among others. The Abesan and Shagari estates case study presents an assessment and analysis of the adaptation actions of fish farmers in Nigeria with the primary objectives of determining their actions, the lessons that can be learned from these actions and how further improvements can be made to promote sustainable livelihoods.

Motivation: A detailed analysis of the data obtained from this case study shows that the fish farmers in Abesan and Shagari estates of Lagos State, Nigeria, are motivated by several factors. Some of these include: the need to maintain their means of livelihood and reduce the rising cost of fish farming as well as associated co-benefits such as access to clean water and utilisation of nutrient-rich fish farm effluent to improve crop yield, and the need to participate in the climate adaptation actions within the fish farming community.

Practices and strategies: The fish farmers currently face a multitude of climate impacts which adversely affect their means of livelihood. Consequently, the farmers employ a combination of

adaptation actions to ensure resilient operations. Their work is stratified into several stages of catfish production and processing, which include hatchery, fingerlings, melange, table size, grow-out, broodstock and processed (market-ready) catfish. The first two stages (hatchery and fingerlings) are the most technologically advanced in the production stages and are mostly done by just a few of the farmers, who are relied upon by others for supply.

Outcome: The main outcome of the adaptation actions of the fish farmers in Abesan and Shagari estates is their resilience to the negative impacts of climate change on their livelihoods. Furthermore, the case study results show that the LLA initiatives of the fish farming communities in these estates have the capacity to strengthen the livelihoods and resilience of smallholder fish farmers in rural and peri-urban areas of Nigeria. Indeed, by adopting these strategies, the participants have managed to maintain their fish farming practices and improve the economic, social and environmental sustainability of their community.

Co-benefits: The adaptation actions of the fish farmers are associated with several co-benefits. Some of these are: (i) access to clean water: The drilling of deeper water boreholes and the installation of water treatment plants help to reduce fish mortality; (ii) technological advancement: The fish farmers attend regular training exercises and apprenticeships as vital components of their adaptation actions, which have helped them to become technologically savvy and innovative; (iii) improved social coherence and integration: The distribution and stratification of fish farming services into several stages (e.g. hatchery, fingerlings, melange, table size, grow-out and broodstock) by the fish farmers helps them to build strong community relationships which ensure that quality is maintained all year round; (iv) reduced economic losses: The utilisation of bitter leaf juice (e.g. *Vernonia amygdalina*) as herbs to reduce fish mortality and the introduction of alternative sources of fish feeds, such as appropriate portions of food waste, vegetables and animal innards, have helped the farmers to reduce waste generation and conserve scarce resources.

Alignment with NDC: The adaptation strategies and actions of the fish farmers are found within the three NDC priority sectors: agriculture, forestry and other land use (AFOLU); food security and health; and freshwater and coastal wetlands. The adaptation actions of the fish farmers are also fully aligned with several national policy frameworks, actions and strategies. Furthermore, two important policy objectives of the Nigeria National Aquaculture Strategy (NNAS) – to: (i) support accelerated fisheries and aquaculture production through private sector investment, and (ii) strengthen the socio-economic life in fishing communities by providing access to credit, inputs, equipment and facilities – are aligned with the adaptation actions of the fish farmers.

Lessons: A critical review of the LLA initiatives and practices of the fish farmers in Abesan and Shagari estates reveals several lessons and practices that policymakers can integrate into Nigeria's NAPF and NDC. Frequent training and apprenticeship programmes have the value of enhancing the 'on-the-job' skills of the community. This has opened up the community's appetite for further training and capacity development. The fish farmers have also come to understand the importance of continuous monitoring, evaluation, learning and knowledge sharing, and have integrated these processes as an important part of their plan to build resilience against the impacts of climate change.

Limitations and challenges: The LLA practices and initiatives implemented by the fish farming groups in Abesan and Shagari estates in Lagos, Nigeria, face a number of challenges and limitations. The main challenge associated with the poor implementation of the farmers' adaptation actions stems from a lack of access to financial services (credit, insurance and advisory facilities), which

has made it very difficult for the farmers to acquire the necessary tools, skills, seeds and feeds needed to sustain their farms or expand their businesses. Another limitation is the lack of proper waste management systems to minimise pollution and improve environmental sustainability. More generally, the adaptation actions of the fish farmers are limited by weak government regulations, policies and support systems that do not cater for their needs.

Entry points and opportunities: Some of the entry points and opportunities associated with the climate adaptation actions in this case study include fish hybridisation, improved water and nutrient management, enhanced production infrastructure and improved supply chain resilience.

Case 3: Abatete town in Anambra State – adaptation practices of rural communities to land degradation

Gully erosion is one of the most significant processes that lead to land degradation in south-eastern Nigeria, often displacing several communities and resulting in forced migration and loss of livelihoods. Frontline communities in rural areas, whose sources of livelihoods are mostly subsistence agriculture and petty trading, are usually the hardest hit. However, the majority of these communities have learned to adapt to their changing environment by utilising traditional methods and local knowledge to minimise the risks of soil/gully erosion on their farms and farm roads. A typical example is Abatete town in Anambra State, south-eastern Nigeria, where women, men and youths use various traditional methods to curb the effects of soil/gully erosion and landslides on market roads, farm roads and vegetable/crop farms which serve as their major source of livelihoods.

Abatete is located in Idemili-North LGA of Anambra State, in south-eastern Nigeria. The study area has a wet equatorial climate with average high and low temperatures of 33˚C and 24˚C, respectively. The major sources of livelihoods for both men and women in the community include small- to large-scale cultivation and processing of palm oil, vegetables, cassava, maize, plantain, yams and rice. Other sources of livelihoods include trading, poultry and livestock farming, textile manufacturing, wood carving and blacksmithing.

Motivation: The need to combat gully erosion and loss of livelihoods and the importance of building climate resilience is the prime motivation of the Abatete's actions. Employing traditional methods is the chosen intervention by the community for cost as well as maintenance purposes. In the words of one resident, '*we are taking these actions to help us survive, because that's our only source of livelihood. We take these actions for economic reasons…we also take these actions for ease of access to our roads because people come to buy from us and we take these vegetables to other villages too*'.

Practices and strategies: Information obtained from the villagers and participants of the FGD showed that the community members integrate several LLA practices and strategies to reduce the impacts of land degradation on their livelihoods. According to the community members, the majority of these practices and strategies have been developed from the local knowledge, culture and traditional values of the community. Community members utilised five major practices and strategies to build resilience against the impacts of climate change. These include: planting erosion-resistant trees at soil/gully erosion sites, laying sandbags at active gully erosion hotspots, constructing high ridges and mounds around vegetable beds, placing logs in shallow ditches, and practising contour ploughing and mixed cropping.

Outcome: The women are able to identify potential gully erosion hotspots in time and apply the necessary preventive measures needed to avert potential disaster and property damage. This has led to a significant reduction in the evolution of sheet and rill erosion into ephemeral and permanent gullies and has improved the accessibility of farm roads, thereby increasing productivity and the shelf life of perishable foods. In addition to reducing poverty and food insecurity, the action has also improved the life and well-being of the community, including people with disabilities, women and youths, thereby fostering social integration.

Co-benefits: The action has led to a significant increase in food security for the community and the state at large. Other co-benefits include the enhanced economic development of the community and the state given the significant reduction in unemployment and hunger and the availability of jobs in the agricultural and financial sectors. The action has helped to foster social equity and has helped the community build resilience to the impacts of climate change.

Alignment with NDC: The farmers' actions have a direct connection to three key priority sectors – agriculture, forestry and biodiversity – and are within the strategic plans of national policies, including: NASPA-CCN, NAPF, NAPGCC and the Land Degradation Neutrality (LDN) of Nigeria. Others include the NAP, the Agricultural Promotion Policy (APP), the National Biodiversity Strategy and Action Plan (NBSAP) and the National Agricultural Resilience Framework (NARF). However, these actions are only partially aligned with Nigeria's NDC.

Lessons: One of the key lessons of the project is the value of well-structured, traditional, capacity-building activities such as apprenticeship and training opportunities, which create problem-solving skills.

Limitations and challenges: A number of limitations have been identified. The list includes: lack of government support, limited access to financial services such as insurance policies and credit facilities, poor government and policy support and lack of scientific knowledge required for mitigating permanent gullies

Entry points and opportunities: Adaptive management of liveable spaces builds trust and helps to reduce the vulnerability of communities to climate impacts. This serves to build confidence by national and local institutions, thereby increasing government investment in early warning systems, emergency management plans and disaster risk reduction strategies to better prepare for climate change impacts. Communicating the benefits is important to inform and explore scaling up the project into a programme. Key to this are education and awareness-raising campaigns for increased public understanding of the potential hazards and disasters associated with land degradation, and the need to build resilience using both traditional and indigenous knowledge systems. The policy-practice-knowledge interface creates the opportunity for agricultural practices and food security actions, e.g. mixed cropping, agroforestry, use of animal manure, sustainable land management, sustainable crop production and other soil and water conservation practices.

Table 2 Case studies results summary – Nigeria

Owode town	
Motivation	Sustain means of livelihoods. Gain access to sustainable energy. Improve health.
Actions and strategies	Use of agricultural biomass and residues as substitutes for fuelwood. Use of agricultural waste to make charcoal briquettes and produce biogas.
Outcome	Reverse deforestation trends, restore biodiversity and improve ecosystem services. Establish nature-based solutions (NbSs) as important, profitable actions. Reduce energy poverty.
Co-benefits	Establishment of several biogas stove fabrication centres. Establishment of several community-based support groups sharing information and knowledge. Decrease in forest biomass depletion.
Alignment with NDC	Alignment with Nigeria's NDC and other national policies and strategies on climate change impacts, natural hazards and disasters and socio-economic improvement.
Lessons	Active engagement with community members for home-grown innovative ideas. Value of building strong collaboration with agricultural research institutions, private organisations and other tertiary institutions. Lessons in social innovation in deploying cleaner energy sources.
Limitations and challenges	Lack of access to financial services (credit, insurance and advisory facilities). Limited supporting policies and implementation plans on the local level.
Entry points and opportunities	Potential to increase the transfer of technological know-how and increase in investments in renewable energy. Potential to increase the resilience of the community's natural ecosystems and lead to the reforestation of degraded areas and restoration of wetlands and mangroves.

Abesan and Shagari estates	
Motivation	Need to maintain means of livelihood and reduce the rising cost of fish farming. Associated co-benefits such as access to clean water and utilisation of nutrient-rich fish farm effluent to improve crop yield. The need to participate in the climate adaptation actions.
Actions and strategies	Drilling of deeper water boreholes and the installation of water treatment plants help to reduce fish mortality. Use of bitter leaf juice (e.g. *Vernonia amygdalina*) as herbs to reduce fish mortality.
Outcome	Strengthen livelihoods and build resilience of smallholder fish farmers. Improve economic, social and environmental sustainability of their fishing community.
Co-benefits	Access to clean water, technological advancement and improved social coherence and integration. Reduced economic losses.
Alignment with NDC	Aligns with NDC priority sectors: agriculture, forestry and other land use (AFOLU); food security and health; and freshwater and coastal wetlands.
Lessons	Value of enhancing the 'on-the-job' skills of the community. Fish farmers come to understand the importance of continuous monitoring, evaluation, learning and knowledge sharing.
Limitations and challenges	Lack of access to financial services (credit, insurance and advisory facilities). Lack of proper waste management systems to minimise pollution and improve environmental sustainability. Adaptation actions of the fish farmers are limited by weak government regulations, policies and support systems.
Entry points and opportunities	Fish hybridisation; improved water and nutrient management, enhanced production infrastructure and improved action in value addition in the supply chain.

Abatete town	
Motivation	Combat gully erosion and loss of livelihoods.
Actions and strategies	Five major practices and strategies were deployed: planting erosion-resistant trees, laying sandbags at active gully erosion hotspots, constructing high ridges and mounds, placing logs in shallow ditches and practising contour ploughing and mixed cropping.
Outcome	Improved accessibility of farm roads, thereby increasing productivity and the shelf life of perishable foods. Improved livelihoods in addition to reducing poverty and food insecurity. Inclusion of people with disabilities, women and youths, thereby fostering social integration.
Co-benefits	Increase in food security for the community and the state at large. Enhanced economic development and employment creation. Fostering social equity and community resilience to cope with the impacts of climate change.
Alignment with NDC	The farmers' actions have a direct connection to three key priority sectors – agriculture, forestry and biodiversity – and are within the strategic plans of some national policies: NASPA-CCN, NAPF, NAPGCC and the Land Degradation Neutrality (LDN) of Nigeria.
Lessons	Value of well-structured, traditional, capacity-building activities such as apprenticeships and training opportunities, which create problem-solving skills.
Limitations and challenges	Lack of government support, limited access to financial services such as insurance policies and credit facilities, poor government and policy support and lack of scientific knowledge required for mitigating permanent gullies.
Entry points and opportunities	Adaptive management of liveable spaces builds trust and helps to reduce the vulnerability of communities. Education and awareness-raising campaigns to increase public understanding of the potential hazards and disasters associated with land degradation.

4.6 Policy recommendations for locally led adaptation in Nigeria

The following policy recommendations are made for Nigerian policymakers for deepening adaptation and resilience through the LLA.

- **Facilitate community engagement and participation:** Federal policymakers and actors currently exhibit a gap in comprehending the significance of social cohesion, inclusion and civic engagement in fostering trust and equity among community members. Increased effort and resources are required to promote community engagement and participation. This entails actively involving local communities in decision-making processes related to climate adaptation, taking into account their knowledge, needs and perspectives.

- **Raise awareness about climate change, its impacts, adaptation measures and associated benefits:** The results of this research show that many communities have been engaging in adaptation actions for decades without an in-depth understanding of climate change.

- **Promotion of ecosystems-based adaptation (EbA):** Nigeria's agroecological zones have different ecosystems that require the utilisation of NbSs and other ecosystem services to improve environmental sustainability and livelihoods of rural communities as observed in the three case studies presented in this research. EbA is a potentially cost-effective solution that helps communities to conserve, sustainably manage and restore their ecosystems.

- **Encourage and support the adoption of climate-smart agricultural practices:** Local actors should encourage the adoption of climate-smart agricultural practices, such as crop diversification, fish hybridisation and the use of drought-resistant and heat-tolerant crop varieties. Nigerian government agencies can facilitate funding to invest in climate-smart agricultural

practices as part of the effort to promote livelihood diversification and the socio-economic well-being of rural communities.

Policy recommendations for the international community to implement locally led adaptation are as follows:

- **Allocate resources to support comprehensive climate research and data collection, especially in respect to local and indigenous knowledge, practice and strategies:** The international community should seek partnerships with the Nigerian government and local institutions to allocate resources needed to support comprehensive climate research and data collection. This information will provide a solid foundation for evidence-based decision-making, risk assessments and adaptation planning.

- **Provide and facilitate the availability, affordability and accessibility of climate finance:** The international community should work closely with the Nigerian government to identify and provide long-term support for transformative climate change at the local level.

5 Senegal

Senegal is a least developed country (LDC) with an area of 196 722 km² located at the western extremity of the African continent. The country is subject to the Sodano-Sahelian climate, which is tropical in the south and semi-desert in the north, with a dry season from November to June and a hot, humid season from June to October. Average annual rainfall follows a decreasing gradient from the south to the north of the country, from 1 200 mm to 300 mm respectively, representing a variety of climatic zones: a humid zone in the south, a wooded savannah in the centre and a semi-desert zone in the north.[46]

According to a 2022 demographic estimate, Senegal's population was 17.7 million in 2022, and is growing at a rate of 2.5% per annum – resulting in a doubling of the population every 25 years.[47] The Senegalese demography is characterised by its high proportion of youth population (one in two Senegalese is under 20 years old) and its predominance in rural areas (53.1% of the total population in 2019). In 2018/2019, Senegal's poverty rate was estimated at 37.8%,[48] with more than half (53.6%) of the rural population and nearly 20% of the urban population known to live below the poverty line. Senegal's Human Development Index (HDI) for 2022 was 0.512, which places the country in the 'low human development' category and ranks it 170th out of 188 countries and territories worldwide.[49] A large part of the Senegalese economy is based on production systems such as agriculture, livestock and fisheries, which employ a significant proportion of the working population. Given the climate sensitivity of these sectors, climate change and environmental degradation will weaken a country already facing a fragile socio-economic situation.

5.1 Climate change impact and vulnerability

Senegal is among the African countries considered to be highly exposed and vulnerable to the impacts of climate change due to its location in the Sahelian zone and in a wide coastal strip.[50,51] Indeed, the changes recorded over the past five decades are striking. From 1965–2013, minimum and maximum temperatures increased by an average of +1.1 to 1.7°C depending on the ecogeographical zone.[52] Future forecasts indicate an average increase of between +1.2 and 1.8°C by 2035, with major disparities between the centre-west (0.5°C), the north (1.7°C) and the agrosylvo pastoral zone (2 to 3°C). For rainfall, analysis of the Standardised Precipitation Index (SPI) over the period 1940–2013 shows a 16 mm decline in rainfall across Senegal, even though the last decade has seen a return to wet conditions and greater interannual rainfall variability. Future trends predict a decline in rainfall to an average of 89 mm by 2035, especially in the north, north-west and central regions. Concerning the state of the sea surface, an increase in water temperature of about 0.04°C to 0.05°C per year from 1980 to 2009 and a progressive increase in the salinity of the marine waters of the Senegalese coast have been observed.[53] A major part of the Senegalese coast, from Saint-Louis to the Saloum islands, has been experiencing erosion for the past 70 years, materialised by a

retreat of an estimated 146 m in the positions of the coastline between 1946 and 2017, an average rate of 2.06 m per year.[54]

The trend towards higher temperatures and disruption of the rainfall regime, often punctuated by extreme events that have become frequent, is generating growing climate risks linked to the frequency of hazards, impacts and vulnerabilities that expose and render fragile the foundations of the national economy and natural and human capital.[55] In the context of socio-economic poverty and persistently low human development, the high probability of present and future hazards, impacts and vulnerabilities risks attacking the main factors of production contributing to human and social capital in Senegal – that is unless climate change adaptation solutions are implemented.[56]

All of these trends combined contribute to the deterioration of the productive bases of the national economy, which illustrates the complex economic and social economic challenges that Senegal faces today, and which are likely to intensify into the future. Projections of the economic impacts of climate change made by the Planning Department of the Ministry of the Economy, Finance and Planning (MEFP) state that with an increase in temperatures of between 1°C and 2°C by 2050, there could be severe consequences on economic growth, with a drop of around 25% in productivity. Hence, climate adaptation, which is largely inspired by the country's economic and social vulnerability to climate impacts, is seen as an important leverage for transformational change in the Senegalese society and economy.[57]

5.2 National policy and regulatory context

The present and projected climate risks Senegal faces create a compelling need to plan and act to ensure risks are minimised and build resilience of the production systems, social sectors and communities. To this end, adaptation as a core area of climate action is often articulated within the NDC framework and the SDGs of Agenda 2030 and 2063. These national and continental frameworks prepare current and future actors for inclusive, coherent and effective management of future environmental and climate challenges.

Embedding adaptation actions into national and local development plans is necessary for the interventions to be effective and produce system-wide transformation. The government of Senegal launched its development strategy, the Emerging Senegal Plan (PSE) for the period leading up to 2035, with these intentions and to avoid fragmentation of actions. The PSE is well aligned with the Sustainable Development Goals (SDGs) and has the deliberate aim of integrating adaptation in economic and social development policies. In essence, this increases the resilience of the country's production systems to climate change impacts. This policy document also draws attention to climate risks and stresses, and the need to consider unconditional commitments in the NDC regarding both mitigation and adaptation to climate change, whilst integrating them into national medium- to long-term budgetary programming.[58]

In December 2020, Senegal validated its Nationally Determined Contribution (NDC), which includes priority adaptation options set out in the framework of National Sectoral Adaptation Plans (NAPs) finalised in august 2023. This is intended to provide more integrated, effective, efficient and sustainable responses to climate challenges.[59] The process of developing sectorial NAPs for agriculture, flooding, infrastructure, health and coastal zones has been completed. The priority adaptation options have been set out in the form of climate resilience projects and programmes that the Government of Senegal and its technical and financial partners have promised to support.

However, it is too early to gauge how effective the implementation of these policies will be since much will depend on availability of finance and capacity to meet the ambition level.

The obstacles to better taking climate into account are related to the weakness in the technical capacities and limited access to the climate financing of local authorities. Indeed, many of the actors in climate governance do not have access to scientific evidence to demonstrate climate additionality and accountability in production systems and other social sectors, and cannot therefore integrate this evidence into the planning process of development policies at national and local levels. A more holistic view of adaptation in Senegal would consider local adaptation experiences and initiatives led by local governments and communities in climate policies.[60]

With the need to integrate the NDC's unconditional commitments related to climate change adaptation into national medium and long-term budgetary programming, the State of Senegal is progressively moving towards an approach to climate action that harmonises the framework of national policies implementation by linking Sectoral Development Policy Letters (LPSD), Multiannual Expenditure Programming Documents (DPPD), Communal Development Plans (PDC), Departmental Development Plans (PDD), etc., to facilitate the integration of the climate change dimension and ensure better articulation, alignment and coherence of adaptation options with sustainable development objectives and economic and social development policies.[61]

5.3 The role of key stakeholders and financing for climate adaptation actions

The analysis of the adaptation sector in Senegal shows that a diversity of stakeholders with different areas of expertise are involved in climate action. The mapping of these different actors can be divided into seven categories of stakeholders.[62] The stakeholders include government agencies, NGOs, the private sector, academic institutions and international organisations. These stakeholders are implementing a range of policies, practices and strategies aimed at addressing climate change challenges at national and local levels. The national climate governance model is characterised by an ecosystem of diverse actors with different needs, priorities and approaches in the planning, implementation and coordination of adaptation policies.

The financing needs for climate change adaptation measures associated with Senegal's NDC total USD 13 billion – USD 8.7 billion for mitigation and USD 4.3 billion for adaptation.[63] Of this overall cost, USD 1.4 billion has been included in the national budget and USD 2.9 billion is expected from the contribution of technical and financial partners for the effective implementation of policies to combat the impacts of climate change. Senegal receives climate financing from various sources, including the Global Environment Facility (GEF), multilateral actors, bilateral assistance and the private sector. The Priority Action Plan of Senegal's Economic and Social Plan (PSE) integrates adaptation and climate action by allocating funds to key sectors, such as agriculture, water and sanitation, disaster risk management, and rainwater management. While efforts to involve the private sector are ongoing, private finance remains limited compared to the country's needs. Efforts are under way to accredit national private entities to the GCF and accelerate the process of private sector involvement in the mobilisation of climate finance. In addition, there is the emergence of Corporate Social Responsibility (CSR) in the climate space.

Resource constraints are also an issue for Senegal's lead agency, the DEEC: 'Over the last ten years, the budget dedicated to the management of environmental issues, including climate change, has

been significantly reduced [...] Continuous budgetary fluctuations are an obstacle to the smooth implementation of the climate adaptation options in the country.'[64] Acknowledging the few resources mobilised in relation to climate adaptation needs, there is a need for a paradigm shift in resource mobilisation, allocation and utilisation. Three recommended orientations include strengthening institutional mechanisms, enhancing domestic resources for the environment sector and mobilising private financing through public funds. However, these would need to be complemented by funds from other sources.

In taking advantage of the funding opportunities globally, Senegal has two national entities (Centre de Suivi Écologique and La Banque Agricole) accredited to the GCF, and is involved in 12 approved projects with a total budget of USD 160 million.[65] Work is under way to accredit additional entities, including the Priority Investments Guarantee Fund (FONGIP) and the Strategic Investments Fund (FONSIS). Pilot projects are also in the works to increase access to climate finance by local governments.[66] Greater access should assist Senegal in implementing its climate objectives and achieving its conditional NDC target.

Despite some progress, there are deep concerns about the uncertainty of climate financing mechanisms in Senegal. Local authorities and communities, in particular, face difficulties accessing these funds due to lack of capacity in climate finance to mobilise funds or the organisational readiness to propose fundable or grantable projects. Efforts are under way to build capacity in climate finance and climate risk management for local authorities aiming to integrate adaptation issues into local planning processes and facilitate community-developed adaptation technologies. The overall objective is to enhance Senegal's ability to implement its climate objectives and achieve the conditional NDC targets that have relevance to people and communities at the local level.

5.4 Local actions, strategies and practices

The climate-sensitive production sectors, which employ a large part of the active population, are the first to be affected by the impacts of climate change. These communities were engaged in innovative solutions for adapting to climate risks even before the intervention of state authorities. Despite spontaneous local adaptation efforts, they often go unrecognised in national and global solutions. Hence, documenting and capitalising on local actions to facilitate broader adaptation solutions involving local communities in climate change actions is crucial to ensure strategies are tailored, culturally appropriate and economically feasible. Indeed, some examples of climate actions at the local level can be placed in the register of LLA strategies.

A wide range of community-level climate change adaptation initiatives have been implemented in Senegal, emphasising a shift towards a territorial approach to climate change, particularly since the advent of Act III of decentralisation. The State of Senegal, with support from various entities such as the National Spatial Planning Agency (ANAT), the Local Development Agency (LDA) and the National Local Development Plan (PNDL), has been promoting strategies, and has genuinely bought into meaningful actions at the local level. Several LLA strategies have been identified in Senegal, focusing on key production sectors like agriculture, livestock, fishing, coastal zones and tourism.

Integrated Territorial Climate Plans (ITCP) of the Territory Approach to Climate Change (TACC) programme: This initiative was supported by the UNDP, the LDA and the PNDL, as well as other technical and financial partners (Agronomists and Veterinarians without Borders (AVSF), the CSE, the Drylands Pastoral Pole (DPP), the Cheikh Anta Diop University of Dakar (UCAD), the French

Committee for International Solidarity (CFSI) and the Rhone-Alpes Region). The TACC programme led to the development of ITCP for Dakar, Fatick and the Ferlo in 2012, with climate change adaptation measures identified with the participation of local stakeholders, decentralised technical services, grassroots communities and civil society organisations. However, the adaptation strategy planned at the local level using a top-down approach has not yet been effectively implemented due to the lack of financial resources, skills and capacities of local actors.

Local Climate Change Adaptation Plans (PLACC): Various sustainable development or climate resilience projects and programmes have been supported by agencies such as USAID, the African Development Bank (AfDB), the West African Development Bank (BOAD), FAO, the Adaptation Fund (AF) and GCF. Through these, the CSE has provided technical support to key production sectors such as agriculture, livestock and fisheries to develop local climate change adaptation plans (PLACC) with the participation of technical services, local elected officials, communities of practice and local populations in coastal and agropastoral areas of national interest.[67] However, these top-down adaptation plans are rarely implemented due to a number of barriers, including the insufficient financial resources, skills and capacities of local actors.

Initiatives driven by research institutions and civil society organisations: Research institutions such as the Consultative Group on International Agricultural Research (CGIAR) through the Platform on Climate Change, Agriculture and Food Security (CCAFS) and civil society organisations such as ENDA Energy, IED Africa (Innovation, Development (IED Afrique) and IPAR have also carried out agropastoral adaptation initiatives at the local level. They have focused on capacity building in partnership with local communities, especially in the groundnut basin and Ferlo area.[68] Though adaptation strategies have been identified through a process of consultations with local stakeholders, the planning and implementation of planned activities have not been the work of local actors or communities.

CECI-supported co-production of adaptation strategies: The Centre for International Studies and Cooperation has been implementing a project called 'Women, Agriculture, Resilience' since 2020. A major component of this project is the identification and implementation of technically, socially and economically acceptable and sustainable adaptation measures for agricultural producer organisations in the regions of Tambacounda, Kolda and Sédhiou.[69] With a participatory and inclusive approach carried out with producer actors, this process resulted in the identification, prioritisation and cost-benefit analysis of a number of adaptation measures recommended to ensure the resilience of production systems. However, the concrete implementation of the local adaptation strategies prioritised with the producers' organisations requires a strategy for mobilising funding, which is currently beyond the reach of these local actors.

Disparate initiatives documented by field research: Many technical reports and scientific works have reported on a range of adaptation strategies invented by local populations in the agropastoral area of the Ferlo,[70] the groundnut basin[71] and the Upper Casamance.[72] These spontaneous, locally developed strategies are often considered good responses to the impacts of climate change: They are endogenous and function outside of any financial support or capacity-building processes.

In summary, the shift towards a territorial approach and the involvement of various stakeholders are positive steps, but issues related to the application of LLA principles, barriers to local implementation and the need for substantial climate finance pose significant challenges to achieving effective and sustainable adaptation strategies.

5.5 Lessons from cases

At the local level, communities are developing and implementing several strategies, initiatives and practices to adapt to the impacts of climate change. In some cases, these have the benefit of support from technical services, civil society and NGOs, but they will need to be supported and sufficiently integrated into broader practices and national strategies. Actions to enhance access to climate finance and technical capacity are two factors that are needed to strengthen the effectiveness and sustainability of climate actions in the country. Part of the challenge is that most of the climate actions are funded through donor support with limited time frames. As such, there is a need to mobilise domestic resources to sustain climate actions in the long term. At the same time, finance flows targeting adaptation are small compared to other investments in mitigation activities.

Overall, the insights from stakeholder engagement revealed that the value of LLA is well received and that deepening such an approach is recognised as an essential pathway for the implementation of NDCs. However, challenges remain to ensuring access to evidence-based knowledge on climate change, the integration of endogenous adaptation practices in climate policies and implementation, climate finance and access, and steering climate actions at both the national and local levels. Overall, the magnitude of climate change challenges shows that the enormous financial needs for climate change adaptation measures lie beyond the reach of the national budget. Thus, Senegal depends largely on the contribution of technical and financial partners as well as other innovative and strategic means of leveraging local financial support and investments.

To document and capitalise on information and knowledge from relevant LLA initiatives in Senegal, deep dives in three field case studies with relevance to key prior NDC adaptation sectors were conducted. The objective was to explore motivations for action by local actors, existing adaptation strategies and practices, and challenges and opportunities, and to identify entry points through which various actions can be strengthened to better build the adaptation capacity of local communities. Additionally, this exercise aimed to generate lessons on the enablers of and barriers to climate change adaptation actions and to provide insights into the ways in which the implementation of the NDCs through LLA can influence livelihoods within the host and surrounding communities.

Case 1: Daga Birame – agriculture experience

The local adaptation initiative of women farmers in the climate-smart village of Daga Birame is an experience from the agriculture priority sector of the country's NDC. This village is located in the department of Kaffrine in the heart of the Senegalese agricultural basin. The local adaptation experience concerns a set of adaptation practices co-identified by the local community, scientists from ISRA and technical development services composed of ANACIM, the National Agency for Agricultural and Rural Advice (ANCAR), the Directorate of Agriculture (DA) and the Regional Directorate for Rural Development (DRDR).

Motivation: The members of Daga Birame have a good understanding of climate variability and change, which they associate with hydrometeorological events such as rainfall variability, temperature increase, frequency of strong winds, scarcity of water resources, frequency of rainfall breaks and irregularity of the rainfall cycle. The women farmers have experienced the negative impacts of these changes and variability on their yields and income from their farms, directly affecting their livelihoods. The community's knowledge of climate risks on the agricultural sector and their living

conditions explains their commitment to and engagement in the development and implementation of the project of the climate-smart village of Daga Birame. Their specific motivations for local adaptation include financing, training, access to fresh water, awareness raising and provision of agricultural equipment. The community's engagement in the climate-smart village project is driven by enhanced awareness, sensitisation and a participatory approach.

Actions and strategies: The implementation of the Climate Smart Village (CSV) project has encouraged the community to adopt a number of good farming practices to optimise and make their activities more profitable. They have adopted a technological package that includes agroforestry, climate services utilisation, a solar-driven crop-watering system, seed adaptation, market gardening, assisted natural regeneration and reforestation. These practices and strategies have taken on a consultative process between the project team and the beneficiaries, benefiting from a deep awareness of climate risks by a large part of the population, a culture of community development and the existence of partnerships between the village and various structures and technical services of the state and development support organisations.

Outcome: The Climate Smart Village project has led to positive outcomes such as collaborative agroforestry management, protected forest areas, increased agricultural yields and enhanced community resilience. This highlights the importance of community-led local adaptation, collaboration between researchers and communities and knowledge of climate information services. As part of the initiative, an innovation platform (IP) consisting of 194 farmers, 110 of whom are women, was created as a driving force. This functional platform brings together all social strata of the community, including men, women, youth, traditional leaders and minority groups in the village. It also brings together external stakeholders such as technicians, administrative staff, locally elected officials and researchers, as well as members of associations, local organisations and savings and credit groups.

Co-benefits: The initiative in Daga Birame has generated a number of co-benefits. These include community development, environmental awareness, reduction of greenhouse gas emissions and improved food security. Lessons learned include the need for technology transfer, technical capacity and funding for sustained impact.

Alignment with NDC: This initiative is aligned with the country's NDCs (Nationally Determined Contributions) in agriculture as it aims to enhance food security and resilience to climate change. The adaptation practices include climate information services, development of climate-smart agricultural practices, capacity building, knowledge strengthening and agricultural insurance. However, there are concerns that support from the central government is insufficient to build the climate resilience of women and vulnerable groups, and to build local institutions and enhance direct access to funding and decision-making powers.

Lessons: Daga Birame demonstrates that adapting to climate change must be done in partnership with vulnerable communities capable of proposing viable and sustainable solutions to combat climate risks. Communities are able to domesticate local NDC adaptation options for the agricultural sector with new innovative farming practices. However, their impacts may be limited without access to technology transfer, technical capacity and funding to support implementation. Providing technical and financial support to the populations is considered an important aspect of ensuring the sustainability of their adaptation to climate change and the purchase of agricultural production and processing equipment.

Limitations and challenges: Despite the alignment of community strategies with national policies and the involvement of women in the project as its driving force, the findings point to limited support from the central government for community-led adaptation. Challenges and limitations include governance problems, financial constraints, lack of agricultural inputs and weak support for women's access to resources.

Entry points and opportunities: Municipalities and local representatives have an important role to play in adapting to climate impacts: They decentralise climate action by facilitating better consideration of climate issues and the development of local initiatives to combat climate change. Some specific entry points can include existing projects/initiatives (e.g. AfDB, World Bank, BOAD, AFD, USAID, FAO, UNDP) to integrate the needs of locally driven adaptation in the implementation of activities. Others integrate adaptation into agricultural development initiatives, such as implementing the National Adaptation Plan for agriculture and Africa Adaptation Acceleration Program (AAAP) from the Global Center on Adaptation (GCA) in Senegal. Further opportunities involve strengthening existing institutions so they can provide expertise to local communities. There are numerous training and research programmes on climate issues and challenges for the agricultural sector, provided by institutions such as national universities, ISRA, and the African Centre of Excellence in Agriculture for Food and Nutrition Security (CEA-AGRISAN).

Case 2: Dionewar Island – coastal erosion experience

The local adaptation to coastal erosion initiative of the island communities of Dionewar is a project from the priority coastal zones sector. The community of Dionewar is located in the central western part of Senegal. Following multiple warnings from the population, the CSE (Centre de Suivi Ecologique) in collaboration with the Association for the Development of Dionewar (ADD) set up the Reducing Vulnerability and Improving Resilience of Dionewar's Coastal Communities (REVARD) project, financed by the AF, to fight flooding. This local adaptation experience is related to protection of land, houses and tourist camps against coastal erosion using the Epis Maltais Savard system, a local initiative supported by the Nébéday Association and the Delegation of the European Union in Senegal. This local initiative employs groynes made from stakes and palm fronds to create a natural barrier against waves.

Motivation: The main sources of livelihood for the community of Dionewar are artisanal fishing; processing of fish products such as arches, oysters and cambiums; market gardening; and rainfed agriculture. All of these are affected by rising sea levels, recurrent heavy swells and dwindling and/or scattered rainfall. The main impacts for the community are the rarefaction of arches, oysters and other halieutic products by the silting up of mudflats and the disappearance of the mangroves, where these species breed. Agricultural yields have also decreased as dry periods during the winter have lengthened, and salinisation has led to the loss of arable land. Tourist activity has also suffered from the loss of beaches and the associated destruction of houses, tourist camps and flora. The need to address these impacts on key livelihood activities was the main reason for the Dionewar community's participation in the LLA initiative. Actions were further motivated by the awareness and involvement of the people at the beginning of the project, the obligation to adapt to climate risks and the need for a solution that is easy to understand and implement.

Actions and strategies: Local adaptation practices within the REVARD project include night fishing, oyster farming, protective structures, Maltese groynes, environmental education programmes for students, reforestation, disaster risk management and the installation of a weather station. The Epis

Maltais Savard system involves the construction of groynes using local materials, providing cost-effective and environmentally friendly solutions.

Outcomes: The main outcomes of the project include implementation of collaborative and sustainable management of coastal erosion and establishment of an inclusive, community-based coastal erosion management process, beach reconstitution and maintenance of income-generating activities mainly related to fishing, all of which have contributed to improved resilience of island communities and increased knowledge and capacity building on innovative technology.

Co-benefits: A number of co-benefits have been identified in relation to the Dionewar case. They include the reduction of coastal erosion, student training on environmental issues, raising community awareness, and contributing to greenhouse gas emission reduction through reforestation. Additional co-benefits also include integration of a gender dimension in the process of managing coastal erosion and environmental resources, including forests, and the deployment of appropriate and locally replicable technologies.

Alignment with NDC: The findings from the fieldwork demonstrate a strong alignment between the local community's adaptation strategies and the national adaptation options and actions outlined in the NDC for the coastal zones sector. However, some challenges remain such as the lack of viability of certain technological solutions, poor communication and insufficient financial means for sustained impact.

Lessons: A number of key learnings and best practices can be derived from the Dionewar case. The experience demonstrated that nature-based soft methods prove effective in coastal erosion control, highlighting the possibility of repairing nature with nature. The examples of using Maltese groynes as a soft method to slow down the rate of coastal erosion are identified as effective and sustainable solutions for coastal erosion, as are the use of coconut leaves to protect against coastal erosion by trapping sediment. The deployment of technical committees or small groups for community-led actions, rather than larger and extended groups, was seen to be important as it allowed for continuous monitoring and community engagement.

Challenges: The Dionewar Island experience on LLA conducted by the community faced a number of challenges. Some of these were technical in nature; others were related to management and sustaining the commitment of various actors. More specifically, Maltese groynes in Dionewar were found to have low resistance to the force of certain swells, and the inadequacy of financing meant that intensifying and extending the installation (and good maintenance) of Maltese groynes for a greater impact on coastal erosion meant that the results fell short of optimal. Part of the problem with this was the decline in population engagement, especially in periods of high swell.

Entry points and opportunities: Opportunities for improvement involve integrating local knowledge, empowering populations to develop their strategies, supporting local associations and strengthening technical, organisational and financial capacities. This implies leveraging existing initiatives, such as the West Africa Coastal Areas Resilience Investment Project, NAP for the coastal zones sector and training and research programmes on climate issues.

Case 3: Widou Thiéngoly – forestry experience

The village of Widou Thiéngoly, situated in the silvopastoral zone within the commune of Téssékéré, faces a challenging semi-arid tropical climate marked by a prolonged dry season with exceptionally high temperatures ranging from 46 to 48°C. The community has proactively undertaken a local adaptation initiative to enhance resilience against the health impacts of heatwaves, aligning with the health sector priorities of the country's NDCs. This adaptation action in northern Senegal is embedded in two projects: the Alert to Heatwaves and Health Impacts in the Sahel (ACASIS) and the implementation of an early warning system to bolster community resilience to health impacts of heatwaves (CR4D). Various organisations are playing crucial roles in implementing this local community adaptation, including the Directorate of Civil Protection (DPC) overseeing disaster risk reduction, ANACIM and the National Oceanic and Atmospheric Administration (NOAA) providing climate information and services.

Motivation: Climate change in Widou Thiéngoly is perceptible through temperature increases, pronounced heatwaves, irregular rainfall and frequent extreme events like droughts and floods, which lead to livestock and agricultural losses due to water scarcity and pasture shortages. Additionally, the changes result in a rise in chronic health issues, particularly impacting vulnerable groups such as the elderly, young children, pregnant women and individuals with pre-existing conditions. The community recognises the urgency of addressing climate challenges through a grassroots commitment, understanding that effective responses require active participation and mobilisation at the local level.

Actions and strategies: The actions are built on a series of interventions that include the establishment of an early warning system through intersectoral collaboration to prevent heatwave occurrences and monitor climate-sensitive diseases. Capacity-building actions for local actors, reforestation efforts, construction of heat-adapted habitats and free medical consultations for climate-sensitive diseases are integral components. The strategy also involves strengthening surveillance for vulnerable groups and issuing alerts to minimise health risks linked to rising temperatures. Inspired by successful models in various sectors, this initiative underscores the importance of a collaborative, intersectoral approach involving institutions like the Directorate of Civil Protection, ANACIM, NOAA and others. These efforts aim to enhance community resilience and contribute significantly to adaptation and sustainable development in the health sector.

Outcomes: Key outcomes include capacity building in heatwave health risk management through awareness campaigns, integrating health sector adaptation strategies at the local level and promoting the importance of climate services in combating climate-sensitive diseases. The initiative has led to a reduction in the morbidity of climate-sensitive diseases and improved community health and well-being through free consultation campaigns. Additionally, community resilience to health risks related to heatwaves has been strengthened by early detection of dehydration symptoms, and reforestation actions have contributed to mitigating the adverse health impacts of rising temperatures.

Co-benefits: The adaptation practices in Widou Thiéngoly have resulted in several co-benefits. These include a reduction in climate-sensitive diseases, leading to improved community health and reduced health costs. Reforestation efforts have countered the effects of temperature increase, preserving ecosystems, sequestering carbon, reducing greenhouse gas emissions and fostering income-generating activities. The construction of bioclimatic buildings provides economic and

ecological advantages, offering durable and cost-effective housing with thermal, acoustic and aesthetic comfort. Furthermore, enhancing the community's capacity to address climate change contributes to climate action governance at the national level.

NDC alignment: Widou Thiéngoly's efforts to address health risks from climate change align well with the health sector's key adaptation options outlined in the NDCs. However, the central government's consideration of the community's LLA needs is weak for actions related to direct access to climate finance, decision-making, predictable funding, capacity building in understanding climate risks, transparency in climate change programme financing, enhancing climate resilience for women and vulnerable groups, promoting youth livelihoods, managing health risks and integrating gender aspects into climate action. Conversely, government actions addressing gender inequalities, accessing diverse knowledge for adaptation decisions, providing climate services and supporting gender-sensitive sustainable forest and water resources management were rated as satisfactory to very satisfactory.

Key lessons: The lessons learned from Widou Thiéngoly's LLA experience highlight several key insights and best practices. When provided with reliable and timely information, the community demonstrated the ability to adapt to the health impacts of climate change through endogenous practices. The success of the community-based resilience model was attributed to effective coordination and synergy between academic institutions, technical services and communities. Easy-to-understand and ready-to-use climate services, particularly in text and voice formats, were crucial for grassroots communities' engagement in early warning systems. The internalisation and institutionalisation of climate information use in community healthcare were noted, emphasising the importance of capacity building and awareness raising for successful community mobilisation.

Limitations and challenges: The Widou Thiéngoly experience in LLA faces several limitations and challenges: (i) the low technical and financial capacity of local actors hinders the sustainability of local adaptation to climate change; (ii) the heatwave early warning system exhibits limited efficiency and performance; (iii) weak integration of local adaptation into the priority options of the health sector in the NDCs; (iv) challenges in accessing daily morbidity data for determining alert thresholds based on biometeorological parameters.

Entry points and opportunities: To enhance LLA implementation with the support of technical structures, several entry points and opportunities are identified. These include: (i) the implementation of the NAP for the health sector; (ii) development of a health system and community-resilience project by Save the Children and MSAS, currently under evaluation by the GCF; (iii) implementation of the World Health Organization COP26 commitments on climate change and health. Other entry points and opportunities encourage the Community Health Strategy Plan (CHSP) to incorporate communities' locally directed adaptation needs in its implementation; as well as the country's national universities and research centres that offer training on climate-related issues.

Table 3 Case studies results summary – Senegal

Daga Birame	
Motivation	Facilitate financing, training and access to fresh water.
Actions and strategies	Agroforestry, solar irrigation, climate information, seed adaptation, market gardening.
Outcome	Collaborative agroforestry management, protected forest areas, increased agricultural yields and enhanced community resilience.
Co-benefits	Awareness in nature protection, GHG emissions reduction and carbon sequestration, increased food security and income generation.
Alignment with NDC	Adaptation and agriculture NDC.
Lessons	Partnership with vulnerable communities as a prerequisite to sustain climate solutions. Climate Smart Village is at experimental stage but can be scaled up.
Limitations and challenges	Weak institutions. Insufficient finance. Lack of agricultural inputs and equipment. Weak support for women to acquire assets.
Entry points and opportunities	NAP. Integrate adaptation in existing agricultural plans. Africa Adaptation Acceleration Program (AAAP). Strengthen existing institutions.

Dionewar	
Motivation	Concerns with impacts of climate change on key livelihood activities, e.g. artisanal fishing, fish processing, market gardening and agriculture. Concerns with rising sea levels, recurrent heavy swells and changing rainfall patterns.
Actions and strategies	Night fishing among men. Development of oyster farm activities. Implement various measures for coastal erosion. Local species tree plantation. Environmental education programmes. Installation of a weather station.
Outcome	Beach reconstitution. Maintenance of income-generating activities. Reduction of risky fishing practices. Establishment of an inclusive, community-based coastal erosion management process.
Co-benefits	Training of students on environmental issues. Raised community awareness on the importance of nature protection. Use of appropriate technology.
Alignment with NDC	Aligned with the national adaptation options and actions of the NDC coastal zones sector. Support by the government is regarded as weak and lacks coherent direction. For local adaptation to be effective, a tightly knit research team will be needed.
Lessons	Effectiveness of nature-based solutions. Importance of small technical committees for community-led actions. Need for continuous monitoring and community engagement.
Limitations and challenges	Lack of viability of the technological solution, sustainability of action due to poor communication, transparency in financial activities, and insufficient finance.
Entry points and opportunities	Numerous coastal erosion prevention activities. Existence of numerous training and research programmes on climate issues and challenges for the coastal zones sector.

Daga Birame	
Motivation	Community recognises the urgency of addressing climate challenges through a grassroots commitment. Understanding that effective responses require active participation and mobilisation at the local level.
Actions and strategies	Establishment of early warning system. Training local actors in health risks from heatwaves. Reforestation of public spaces. Promotion of heat-adapted habitats in construction. Improved surveillance of vulnerable and at-risk groups.
Outcome	Improved awareness and skills in managing the effects of heatwaves. Reduced morbidity of climate-sensitive diseases and improved well-being.
Co-benefits	Improved community health status and reduced health costs. Conserved ecosystems services and improved environmental indicators. Construction of bioclimatic buildings offers thermal, acoustic and aesthetic comfort at lower cost.
Alignment with NDC	Aligns well with the health sector's key adaptation NDC. But the level of attention given to LLA by the government is not sufficient.
Lessons	Demonstrable ability of communities to adapt to health impacts of climate change. Importance of effective coordination and synergy between academic institutions, technical services and communities. Easy to use and understand climate services are crucial to success.
Limitations and challenges	Low technical and financial capacity of local actors. Early warning system shows limited efficiency and performance. Difficulty of accessing daily morbidity data to determine an alert threshold according to biometeorological parameters.
Entry points and opportunities	NAP in health sector. Other initiatives by NGOs and international organisations (such as WHO). Community Health Strategy Plan (CHSP). Universities and research centres through their existing and future training programmes.

5.6 Policy recommendations for locally led adaptation in Senegal

The following policy recommendations are made for Senegal's policymakers for deepening adaptation and resilience through LLA.

- **Devolve and develop climate governance and institutions at the local level:** Climate governance stakeholders must recognise the importance and added value of locally led adaptation and encourage the integration of communities' endogenous adaptation practices into the various priority adaptation options of the NDC for greater efficiency, performance and impact of climate action in Senegal.

- **Encourage and support collaborations between research institutions, policymakers, civil society organisations and local communities:** This collaboration is critical to ensure that all relevant stakeholders are included in the identification, documentation and communication of relevant local adaptation experiences in order to inform and support decision-making and implementation processes of the NDCs and other national and local development policies and strategies.

- **Invest to remove barriers related to access to technical capacity building and climate finance for local communities:** In order to successfully integrate locally led adaptation into climate action planning in Senegal and improve synergy between adaptation options in the NDC and endogenous adaptation practices that are already well aligned, the government needs to invest heavily in building local human and technical capacity at all levels of society as well as actively seek innovative climate finance to support and, where appropriate, to scale LLA. This also requires the mobilisation of domestic resources to sustain climate actions in the long term.

Policy recommendations for the international community to implement locally led adaptation are as follows:

- **Champion the integration of locally led adaptation action into the implementation of national and global climate goals:** Considering the alignment of community adaptation strategies and solutions with the priority adaptation options of the NDCs and other national policies as well as their added value in enhancing the health and well-being of local communities, the international community, through the United Nations Framework Convention on Climate Change (UNFCCC), should recommend and encourage countries and their international partners to centre LLA adaptation in their financial support and implementation processes.

- **Adapt proactive and innovative ways to finance and ensure access to local-level actors:** Climate facilities such as the Green Climate Fund (GCF), the Adaptation Fund (AF), the Global Environment Facility (GEF) and bilateral development agencies must set up a common fund exclusively reserved for financing local adaptation initiatives directly led by communities to make endogenous practices more sustainable and increase the efficiency and performance of climate action.

PART THREE

Discussion and recommendations

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6 Enabling locally led adaptation (LLA)

The cases from Ghana, Nigeria and Senegal examined in this research demonstrate that communities have been adapting to the impacts of climate change. It is evident that those on the frontlines of climate change are innovative in developing adaptation solutions but lack access to the necessary resources and power for implementation.[73] Despite being well placed to understand their priorities, local actors often find themselves receiving decisions from distant experts rather than taking leadership roles in climate finance planning.[74] The current climate finance model channels funds through numerous intermediaries for short-term projects, and local decision-making in climate interventions is frequently deficient, affecting project effectiveness and sustainability. There is a growing political push for bottom-up approaches to empower local communities and institutions to lead, rather than merely being 'beneficiaries' of adaptation efforts. However, despite the increasing interest in LLA, practical experience with its implementation on the ground remains limited. The cases explored in this research have shown that successful LLA requires flexibility, investments in community leadership and local institutional capacities, as well as the integration of adaptation across different scales and programmes. Some of these observations are summarised in this section.

6.1 What constitutes LLA in West Africa?

According to the GCA and the World Resource Institute (WRI), LLA is the process by which individuals, communities, networks, organisations, private entities and governments set their own agendas, develop solutions to climate change adaptation and provide the capacity, leadership and resources to make these solutions a reality.[75] Additional definitions note that LLA involves the support of local capacities to design, implement, monitor and maintain measures, including the management of financial resources to develop long-term sustainable outcomes and institutional capacities.[76] Others have argued that in LLA processes, local actors decide which local adaptation technologies to implement, which approaches to advocate for and which actors to mobilise to provide climate planning and improved institutional capacity.[77] These changes can directly benefit the target populations and create conditions for the flow of climate adaptation finance from national to local governments, thereby improving the health and well-being of vulnerable communities.[78]

In West Africa, stakeholders in climate action, including decision-makers, local representatives, technical experts, development practitioners and the research community, align their vision of adaptation closely with global organisations such as the IPCC, UNDP, FAO, GCA and WRI. This shared perspective emphasises the significance of community participation, ownership and empowerment in developing and implementing adaptation strategies, specifically within the framework of LLA.

Embracing a locally led approach in Ghana, Nigeria and Senegal allows for the utilisation of local knowledge, resources and community networks inherent in these communities. Empowering local communities in these countries to take the lead in adaptation and resilience-building ensures that interventions are in harmony with their needs, priorities and aspirations, fostering ownership, participation and buy-in for more sustainable and impactful outcomes. Moreover, local communities possess deep-rooted connections to their environment and hold traditional knowledge crucial for informing adaptation strategies and practices.

To fully implement this approach, it is crucial to establish an enabling policy and institutional framework supporting LLA. This entails providing financial resources, technical support and capacity-building opportunities to communities, while also fostering partnerships and collaboration between government agencies, CSOs and local communities. By placing local communities at the forefront of climate impact and LLA, policymakers in West Africa can tap into the resilience, creativity and innovation within these communities. This not only enhances climate resilience but also contributes to community well-being, promotes social cohesion and supports the overall sustainable development of the region.

Additionally, the study found that LLA strategies exhibit distinctive characteristics, including participatory practices, diversified approaches, prioritisation of vulnerable community members and the utilisation of local knowledge to enhance resilience. Despite spontaneous adaptation efforts by many segments of society in Ghana, Nigeria and Senegal, planned adaptation processes by key stakeholders often overlook these grassroots initiatives. The study underscores the need to integrate both planned and spontaneous dimensions of adaptation solutions, recognising the interconnectedness of climate change adaptation with sustainable development goals and key sectors like agriculture, water resources, disaster risk reduction, coastal zones, infrastructure, health and biodiversity. Although local adaptation actions play a crucial role, they are often not integrated into national and global solutions. Documenting and capitalising on local efforts is essential to facilitate effective adaptation solutions at multiple levels.

Despite its potential, there are a number of possible dangers that LLA may create. Firstly, due to competing interests and inequalities among the various actors, LLA risks reproducing many issues seen in earlier adaptation approaches like community-based adaptation.[79] It is particularly problematic when finances remain controlled by non-local actors, typically national governments and non-government entities, including foreign actors and NGOs/INGOs that resist relinquishing control over fund allocation and expenditure. This control over adaptation finance keeps decision-making power away from local actors, hindering the possibility of increased local participation and the development of more appropriate monitoring and evaluation methods. Secondly, LLA has the potential to reinforce existing power dynamics, allowing certain actors to maintain control over the agenda and exert influence over local decision-making.[80] Thirdly, LLA runs the risk of overlooking the intricacies of the local political economy and power structures. Marginalised groups, such as the rural poor, may become ensnared in 'tightly knitted patron–client networks', where local elites, with or without support from external patrons, create processes of 'participatory exclusion' or superficial forms of inclusion.[81] Simultaneously, individuals and households at the local scale are already creatively adapting to climate change, driven by the necessity for their lives and livelihoods.[82] These actions, coupled with indigenous-led approaches to addressing climate impacts, could be pivotal for more effective adaptation if these actors assume leadership roles in the adaptation process.

6.2 Gaps, challenges and barriers

Despite the evident benefits demonstrated in the case studies across the three countries, LLA is insufficiently recognised within the formal institutional climate governance structures. This lack of acknowledgement may stem from a limited understanding of endogenous adaptation practices, which are often poorly documented. Additionally, the absence of engagement from institutions capable of offering sustained support to communities, coupled with the inflexibility of climate governance systems, hinders the prioritisation of LLA. National stakeholders perceive climate change as a disruptive force requiring adaptation, yet the implementation of climate action and adaptation policies in Ghana, Nigeria and Senegal reveals several gaps and barriers.

Access to evidence-based knowledge: LLA involves empowering communities to devise context-specific solutions based on their unique vulnerabilities and needs. However, a significant hurdle arises when these communities lack access to evidence-based information that could inform their adaptation strategies. This gap between scientific knowledge and on-the-ground actions often leads to suboptimal decision-making and implementation. Access to evidence-based knowledge is a pivotal challenge in LLA efforts across West Africa. Countries will need to invest in robust climate services, training experts, supporting vulnerability assessments and creating adaptation plans for sectors and territories.

Integration of climate considerations in development policies: Historically, climate change adaptation planning has often operated independently from broader sectoral development policies. This is of particular concern in regard to local adaptation efforts which isolate local economies and livelihoods from the broader development planning processes. It becomes crucial to synchronise national, sub-national and sectoral strategies to guarantee a cohesive and coordinated response to minimise duplicated efforts, fragmented initiatives and inefficient resource utilisation.

The key role of women in LLA: The essential contribution of women to the success and sustainability of climate resilience efforts in LLA practices is evident in the various examined cases. Despite their crucial roles in managing household resources, agriculture and community welfare, women face constraints in participating in decision-making and holding leadership positions within LLA initiatives. Prevailing gender norms and societal expectations often confine women to traditional roles, limiting their active engagement in shaping and executing adaptive strategies. This restriction extends to LLA, where the distinctive perspectives, knowledge and experiences of women are not fully leveraged.

Neglect of local adaptation practices: Mainstream global and national-level institutions often overlook the valuable adaptation practices developed by local communities. This is largely due to the inflexibility of climate governance systems as they often fail to prioritise the essential role of locally led adaptation. A paradigm shift is needed to integrate the lived experiences and initiatives of communities engaged in agriculture, livestock and fisheries facing coastal zone erosion, floods, biodiversity and health issues without the assistance of central or local government.

The role of endogenous knowledge in climate solutions: The neglect of endogenous knowledge in climate adaptation efforts represents a missed opportunity to harness valuable insights deeply rooted in local communities. Endogenous knowledge, developed through generations of lived experiences and adaptation practices, holds unique solutions for addressing the impacts of climate change. Embracing and learning from the diverse knowledge systems within communities,

in collaboration with non-community experts, can pave the way for more effective and holistic approaches to climate resilience.

Community engagement and participation: Participation goes beyond mere consultation; it involves creating spaces for communities to actively contribute from planning to implementation of adaptation measures. This collaborative approach not only enhances the effectiveness of initiatives but also strengthens social cohesion and community resilience. As the ultimate beneficiaries of LLA strategies, some of the cases explored in this study have shown that communities have limited awareness and participation in the design and implementation of adaptation strategies, which has led to limited ownership of adaptation projects, affecting their sustainability.

Funding gap: LLA practices, despite their substantial potential in tackling climate challenges, encounter a significant funding gap attributed to inadequate domestic resources and unreliable international climate finance. This impedes the execution of locally customised solutions, restricting the transformative potential of scaling up and out LLA efforts. Addressing this funding deficit is vital to empower communities, foster innovation and guarantee the sustainability of adaptive measures. Mobilising resources across local, national and international domains becomes imperative to unleash the complete potential of LLA and enhance the resilience of communities at the forefront of climate change.

6.3 Opportunities and entry points for strengthening LLA in West Africa

Locally led adaptation (LLA) presents numerous opportunities and entry points to cultivate resilient communities and sustainable development. The case studies conducted in Ghana, Nigeria and Senegal bring to light that local communities use local knowledge and practices related to their local ecosystems, natural resources and weather patterns. Such knowledge is employed in agriculture, biodiversity conservation, land management and forestry, and fishery and energy activities, yielding valuable lessons. Seizing these opportunities ensures that local priorities, resources and needs take centre stage in adaptation policies and implementation efforts across all levels of government. Beyond these opportunities, there are several entry points for governments and the international community to strengthen the role of LLA in climate action processes. Some of these are discussed below.

Willingness of communities to be involved in LLA: The cases from the three countries demonstrated that communities are not passive recipients of outside support but can be enthusiastic contributors to sustainable solutions. Fostering this readiness involves recognising and respecting local autonomy, valuing indigenous knowledge and providing avenues for meaningful participation. Community participation can also help to build trust and enhance social cohesion – important factors in resilience-building. The National Adaptation Policy Framework and the recent interest in promoting local-level vulnerability analyses can provide important opportunities for strengthening community participation. Governments, NGOs and international partners can play a vital role by creating enabling frameworks, facilitating capacity-building initiatives and acknowledging the agency of communities in steering their adaptive pathways.

Using and strengthening existing institutions: In all three countries, the existing institutional landscape holds untapped potential for fostering resilient communities through LLA. Rather than starting from scratch, utilising and strengthening existing institutions can provide a strong foundation

for sustainable and impactful adaptation efforts. To harness this potential, it is imperative to recognise and understand the dynamics of these institutions, and to acknowledge their historical significance, their role in local governance and their capacity to mobilise community members. These existing structures often carry valuable insights into the community's needs, priorities, vulnerabilities and adaptive capacities. Strengthening these institutions entails empowering them with the requisite resources, knowledge and capacities to spearhead climate adaptation initiatives. This support may come in the form of capacity-building programmes, financial resources or collaborative partnerships with governmental and non-governmental entities. For example, organisations such as MORE Women, ORGIIS and the Keta Ramsar Centre in Ghana work with communities to train, disseminate and enhance traditional knowledge and practices, supporting locally led adaptation.

Support collaborations between knowledge, policy and practice communities: This collaboration is critical to ensure that all relevant stakeholders are included in the identification, documentation and communication of relevant local adaptation experiences in order to inform and support decision-making and implementation processes of the NDCs and other national and local development policies and strategies.

Nurture the concept of problem-solving knowledge: The nine cases explored in the three countries demonstrate that there are ample opportunities to advance a research programme that links scientific insights to local climate action and enhances the effectiveness of climate change adaptation in local communities. Such an effort would involve recognising, documenting and leveraging experiences and best practices in community-led adaptation. The objective is to bolster the adaptation process at the local level, provide guidance for capacity building among local actors and inform strategies for mobilising financial resources. Amounting to science at the service of society, this would yield knowledge and practice applicable to the ways that researchers work on real world challenges. Additionally, such a programme would reinforce the value of research institutions by showing their contribution to their citizens.

Integrate traditional knowledge and practices into national innovation systems: In the pursuit of comprehensive innovation for climate action and sustainable development, traditional knowledge and practices can play an important role within national innovation systems. Harnessing this knowledge can not only enhance the resilience of communities but also contribute to broader innovation agendas. This constitutes a strategic move towards building more resilient, inclusive and innovative solutions that address contextual challenges. This also implies that the government should deepen its partnerships and collaborations with local communities, indigenous groups and other stakeholders in building knowledge for planning, implementation and evaluation of climate adaptation policies and programmes.

Establish platforms for communities of practice and mutual learning in climate adaptation: This holds immense potential for collective learning and collaboration where diverse stakeholders, including local communities, policymakers, researchers and practitioners, come together to share knowledge, experiences and best practices. These could serve as incubators for mutual learning, enabling participants to benefit from each other's insights and expertise, and sources of inspiration for innovative and context-specific solutions drawing on the wealth of collective knowledge. They provide a space for dialogue, where challenges can be openly discussed, and adaptive strategies co-created. To strengthen these communities, it is essential to invest in mechanisms that facilitate regular interactions, knowledge exchange and collaborative problem-solving. This can be achieved through workshops, forums, online platforms and other networking opportunities.

Capitalise on the favourable international context: The current global commitment to climate adaptation provides a favourable momentum, offering countries an opportune moment to harness this shared goodwill. To take advantage of this positive international context, the three countries studied here must elevate their ambitions by prioritising the development of resilient communities, bolstering adaptive capacities, adopting sustainable practices and investing in knowledge institutions. While active participation in global discussions on climate adaptation is crucial, tangible actions on the ground are equally essential to raise global awareness and showcase concrete results. Demonstrable achievements generate interest, attracting investment from international sources.

Incentivise domestic finance institutions: Recognising the uncertainties surrounding international funding sources, there is a growing acknowledgement that unlocking domestic finance is pivotal for sustainable and impactful climate adaptation endeavours. However, domestic financial institutions often prioritise short-term gains, with insufficient attention directed towards climate adaptation projects. Aligning their focus with the pressing need for adaptation is imperative in constructing climate-resilient communities. To achieve this, governments should formulate policies, introduce incentives and foster collaborations between domestic finance institutions, government bodies, local communities and international climate funds. Such partnerships aim to harness collective expertise and resources, making climate adaptation more appealing to financial institutions. The overarching objective is to empower communities to invest in their resilience initiatives, with financial institutions actively contributing to the support system for local adaptation.

7 Conclusion

Climate change is one of the largest risk multipliers for people in West Africa. When these risks intersect with other challenges like pandemics or conflicts, their management becomes even more challenging. The increasing frequency of extreme weather events, including floods and droughts, directly impacts livelihoods in the region. Erratic rainfall patterns particularly affect rainfed agriculture-dependent regions, leading to low agricultural yields and creating multifaceted vulnerabilities across socio-economic, political and environmental dimensions. Coastal areas also grapple with challenges induced by climate change, including rising sea levels, which strain ecosystems and marine resources vital for the livelihoods of coastal communities.

Adaptation to the adverse impacts of climate change is urgent and essential for preserving development gains and addressing the needs of the poor and the vulnerable. However, most observed adaptation responses are fragmented, incremental, sector-specific and unevenly distributed across areas. In many parts of West Africa, significant adaptation gaps persist across sectors. These gaps are expected to widen under current levels of implementation. Historically, adaptation initiatives have been driven from the top down, sidelining the very communities most affected by climate change. The exclusion of local voices from decision-making processes results in a lack of access to resources for smaller organisations and communities, impeding their ability to recover and build resilience. Recognising this, locally led adaptation (LLA) strategies are advocated as a crucial shift toward empowering vulnerable communities, giving them a voice in decisions that impact their lives.

This research explored climate change adaptation within the West African countries of Ghana, Nigeria and Senegal. Its primary focus encompassed an examination of the existing policies, strategies and localised actions aimed at addressing the challenges posed by climate change in the three countries. A key highlight of the study was the emphasis on LLA strategies, practices and the valuable lessons derived from an in-depth analysis of carefully selected and representative cases, each aligned with the priority sectors identified in the Nationally Determined Contributions (NDCs) of the respective countries. By adopting this sector-specific approach, the research aimed to provide nuanced insights into the effectiveness of adaptation efforts, offering practical lessons that can significantly contribute to guiding and shaping the successful implementation of NDCs and broader climate actions. The chosen cases served as microcosms, allowing for a more detailed understanding of the complexities, challenges and potential solutions within the priority sectors identified by each country in their climate action plans.

This research highlights the critical importance of LLA in Ghana, Nigeria and Senegal as a means of enhancing climate change resilience, reducing vulnerability and promoting sustainable development. While the countries have made significant progress in developing climate policies,

strategies and initiatives, there is a need to enhance the coherence and alignment of these efforts with LLA practices across the different ecological zones of the countries. Furthermore, the research identified a range of challenges, barriers and opportunities for promoting LLA. These include the need to address institutional and governance challenges, enhance access to financial resources, the importance of local knowledge in planning adaptation efforts and leverage the socio-cultural and economic motivations of communities to support LLA efforts.

The research also illustrated that the rate and scale of adaptation progress at the national and local level is not sufficient to keep up with the growing needs of communities. For example, community-led adaptation, including endogenous climate change knowledge and know-how, is not yet reflected in adaptation strategy planning documents such as the NDC and NAP. This is despite the alignment between local adaptation strategies and practices and the adaptation options of priority sectors. In this respect, there is a need to enhance the coherence and alignment of these efforts with LLA practices across the different ecological zones of the countries.

The study emphasises the pivotal role of involving local communities actively in the formulation and execution of climate change policies and strategies. Empowering communities to take the lead in adaptation endeavours is vital for the development of more effective, inclusive and sustainable climate policies in Ghana, Nigeria and Senegal. This approach ensures that the unique needs and priorities of the most vulnerable populations are adequately addressed.

In summary, the evidence derived from the experiences of LLA, as revealed through the case studies, should serve as a compelling argument for climate policymakers. It underscores the significance of embracing local adaptation solutions rooted in endogenous knowledge, thereby fortifying the resilience of vulnerable communities against the impacts of climate change. The study also raises a number of key questions that could be explored further in follow-up studies. Some of these are:

- What mechanisms and systems can be put in place to strengthen the agency of women to lead on LLA actions?
- How can local communities move from isolated LLA examples (experimentation) to scaling up and scaling out best practices?
- How can LLA genuinely challenge business-as-usual practices and encourage multi-scalar transformations?
- What measures can be put in place to avoid persistent distributive injustices when finances are still controlled by non-local actors such as national governments, NGOs and international institutions?
- What provisions can be made to prevent non-local actors from having control over adaptation finance and keep decision-making power in the hands of local actors?

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