

The Extent of Climate Change Mitigation and Adaptation Strategies Implementation: Evidence from a Systematic Literature Review

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Abstract

Climate change and its impacts have escalated in recent decades and its effects have been felt throughout the globe, making it a global concern and a major issue of the 2030 Sustainable Development Goal (SDG) 13 (climate action), which calls for urgent action to combat climate change and its impacts. In response to this, many nations have developed policies to implement climate strategies through Nationally Determined Contributions (NDCs), National Adaptation Plans (NAPs), and other specific multi-sectoral climate policies. Despite this, the extent to which these strategies are implemented and their transformative effect has been underexplored. A systematic literature review was conducted to address the research question using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) from academic databases such as Scopus, Web of Science and Google Scholar and a thematic synthesis revealed patterns in the literature. Implementation of climate strategies remains uneven, fragmented, pilot-scale and predominantly reactive rather than transformative, despite increased adoption of climate policies and planning frameworks and only about 40% of countries that have adopted NAPs systematically assess their implementation, making it difficult to understand their impact. In Africa, strategies such as climate-smart agriculture (CSA), agroforestry, renewable energy and early warning systems are advancing in implementation, although progress is slow, limited in scope and distributed and heavily dependent on donors. In Zambia, despite strong national policy frameworks and donor support, implementation remains limited due to factors such as weak policy-practice linkages, insufficient institutional coordination and socio-economic challenges. Addressing this global implementation gap is important in governance and systems integration, which requires deliberate vulnerability-informed scaling up of strategies that prioritize transformation and sustainability over short-term solutions that continue to make communities poor.

Keywords: Developing Countries, Monitoring and Evaluation, Climate Project Implementation, Policies, Climate Mitigation and Adaptation.

Introduction

Climate change presents as one of the most significant challenges affecting human civilisation in the twenty-first century (Malhi et al., 2020). The Intergovernmental Panel on

Climate Change (IPCC, 2018) reports that human-caused greenhouse gas emissions have elevated global surface temperatures by approximately 1.1°C above pre-industrial levels, threatening global systems with increased frequency of extreme heat, droughts, and flooding across regions. The World Bank highlights that climate shocks are projected to push an additional 132 million people into extreme poverty by 2030, with developing countries being the most vulnerable (World Bank, 2020). Additionally, climate change undermines food security for millions of people through disruptions to agricultural systems, freshwater availability and ecosystem services (FAO, 2022). Therefore, climate change is not only an environmental concern but also a threat to human health, development, food security and geopolitical stability, demanding urgent, coordinated and sustained global action (Wang et al., 2023).

Due to its impact on the environment, governments, international development institutions, civil society organisations, and communities worldwide have prioritized actions to mitigate and adapt to climate change through the United Nations Framework Convention on Climate Change (UNFCCC), the Kyoto Protocol, and the Paris Agreement of 2015 (Calvin et al., 2023). Various mitigation and adaptation strategies have been adopted across the globe, with at least one national adaptation strategy or plan, such as National Adaptation Plans (NAPs) and nationally determined contributions (NDCs) which have given formal expression to these commitments at the country level (UNEP, 2025) to enable developing countries to identify medium- and long-term adaptation needs and integrate them into national development planning (UNFCCC, 2015).

Despite the growing international climate policy framework and increase in climate finance flows the COP 29 reported failure to live up to its climate finance scope to help developing countries protect the lives of their people and economies against climate disasters by only approving USD300 billion against the USD1.3 trillion annually by 2035, representing only 23% of what was promised (The Lancet Regional Health – Europe, 2024). Evidence suggests that the translation of strategies into effectively scaled and sustained action remains inadequate with implementation gaps characterised by fragmented and pilot-scale interventions that fall short in national planning, budgeting and institutional practice integration (Berrang-Ford et al., 2019; Ford et al., 2015). This gap is mainly due to factors such as donor-driven conditions that are geographically concentrated and poorly aligned with locally defined vulnerability priorities in developing countries (Knittel et al., 2023), weak monitoring (Winkler & Rajamani, 2014), and underfunding (UNEP, 2021).

Existing reviews of climate mitigation and adaptation strategies implemented and impact of climate change without assessing how far in scale and wide spread they have actually been implemented (Abbass et al., 2022; Werners et al., 2021). Further study reviews, cross-sectoral and geographical evidence on the extent, scale and orientation of climate strategy implementation which connects global and African patterns as well Zambia within a single comparable analytical lens. The implementation gap addressed in this review is not primarily a shortfall in policy adoption or ambition but in the translation of adopted

mitigation and adaptation policies, plans and strategies into consistently scaled, sustained and institutionally rooted action in vulnerable communities.

Without evidence on the extent of climate mitigation and adaptation strategies, governments, donors and international organizations cannot verify whether climate finance and policy commitments are translating into climate risk and poverty reduction for every vulnerable community member. It also leaves the populations most exposed to climate risk in lower-income communities without knowing how much and how many communities' mitigation and adaptation strategies serve, thereby perpetuating the poverty and vulnerability that climate strategies intend to reduce. This review answers the question "to what extent have climate mitigation and adaptation strategies been implemented across developing countries?" and what factors account for variation in implementation extent?

Methodology

A systematic literature review was conducted using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)(identification, screening, eligibility and inclusion) due to its ability to be replicated and transparency(Islam et al., 2025)

Identification, Screening and Eligibility Strategy

Data were systematically searched mainly from Scopus, Web of Science and Google Scholar using the search strategy applied across publication titles, abstracts, main text, and keywords. ("climate change mitigation" OR "climate change adaptation" OR "National Adaptation Plans" OR "climate strategies" OR "climate projects") AND ("implementation" OR "extent of implementation" OR "implementation progress" OR "adoption") AND ("developing countries" OR "sub-Saharan Africa" OR "Africa") AND ("government" OR "NGOs" OR "communities" OR "Implementing agencies"). The databases and institutional searches produced 6,018 records, with an additional 74 records identified through citation tracking and manual review of key reference lists. A total of 4,449 records were subjected to title and abstract screening after removing 1,643 duplicates, 3,612 were excluded due to climate implementation analysis limitations, leaving 837 records that were retrieved for full-text assessment and 770 did not meet implementation extent, methodological rigor and full-text availability criteria. A final 67 studies published between 2015 and 2025 formed the primary analytical evidence base.

Inclusion and Exclusion Criteria

Studies were eligible for inclusion if there were (i) written in English (ii) focused on the implementation or assessment of implementation of climate change mitigation and/or adaptation strategies or projects (iii) published in a peer-reviewed academic journal or produced by a credible institution(IPCC, UNEP, World Bank, FAO) (iv) addressed issues of implementation scope, scale, extent, distribution or/and effectiveness (v) were grounded

on theoretical or policy analysis with clear methodological transparency. Those that were excluded included studies that (i) examined implementation in developed countries without context for developing countries, (ii) were unavailable in full-text format, (iii) focused only on the design or formulation of climate strategies without addressing implementation, (iv) were confined to climate science without engagement with policy or governance.

A standardised appraisal checklist appropriate to this study design was used for full-text methodological quality which included clarity of research objectives, appropriateness of data collection methods, transparency of analytical procedures and reliability of findings while theoretical or conceptual works assessment focused on coherence of argumentation, grounding in established frameworks and engagement with the broader literature. Studies were rated as strong, moderate or weak, with weak-rated studies excluded unless they provided unique theoretical contributions not available in other studies.

Data Extraction and Quality

Extraction of data was conducted using geographic and sectoral scope, evidence of scale, citation details, study methodology and population type and nature of implementation reported. Others included dominant strategies identified, factors shaping implementation extent and implications proposed by the authors for policy and research. Thematic synthesis was organized into global, regional, and Zambian implementation patterns and trends, urban and rural, and mitigation and adaptation distinctions. The methodological rigor of each included study was appraised to assess the strength of the evidence base, rather than treating all sources as equally reliable.

Summary of PRISMA Methodology

Figure 1. PRISMA Flow Diagram of Study Identification, Screening and Inclusion

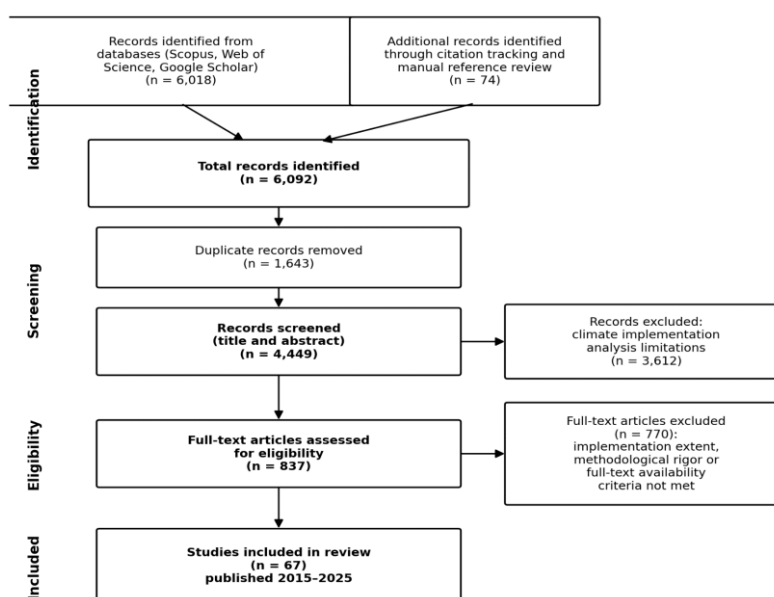


Figure 1: PRISMA flow diagram summary

Results and Discussions

Global Implementation Patterns

The development and implementation of climate policies have been supported by rising levels of national ambition under the United Nations Framework Convention on Climate Change (UNFCCC), the Kyoto Protocol, and the Paris Agreement at multiple levels of governance (Calvin et al., 2023). While studies have demonstrated that globally these policies have been developed and adopted through National adaptation plans (NAPs) which intend to provide evidence-based, coordinated, and systematic approach to climate preparedness initiatives by countries (Calvin et al., 2023; Woodruff & Regan, 2019) with countries adopting at least one national adaptation plan or strategy (UNEP, 2025), although Leiter, (2021) argue that more than 60% of countries that have adopted national adaptation plans (NAP) do not assess their implementation. Many are weak and have limited or non-operational monitoring and evaluation (M&E) to track their implementation raising concerns about whether plans translate into tangible action and how success is measured on the ground (Filho et al., 2023; Leiter, 2021; Woodruff & Regan, 2019). Evidence suggest that, NAP's effective development and implementation is constrained by limited participation of non-governmental stakeholders (Bhanye, 2025), with Woodruff & Regan, (2019) adding that the planning process of NAPs excludes a broad range of stakeholders and that plans written by a single agency with less stakeholders have significantly lower quality as compared to those that are written by multi-agency committee with a broad stakeholder engagement. Szpak (2021) further adds that stakeholders such as the local community, local industries and businesses need to cooperate and be actively involved with local government organisations in order to implement climate risk adaptation plans.

Progress on mitigation and adaptation implementation has been observed generating multiple benefits across sectors and regions with rising ambition and scope among governments at the local, national and international levels, corporations, businesses and civil society organizations by incentivizing individuals and communities to take action using various policy options, tools and strategies to respond to specific impacts of climate change which shape both adaptation governance approaches and longer-term reduction of risk and vulnerability (Calvin et al., 2023; Olazabal & Ruiz De Gopegui, 2021; Ulibarri et al., 2022). Findings demonstrate that most governments prioritize addressing climate change impacts with a call to implement mitigation and adaptation strategies (Wang et al., 2023), it is further highlighted that with planning, development and implementation of climate mitigation and adaptation being at the center of local government authorities on the ground to effectively address climate change, it is appropriate to develop suitable and acceptable initiatives for the local community (Dinshaw & McGinn, 2019; Scott & Moloney, 2022).

A consistent pattern emerging from the literature is that, globally, especially in developing countries, climate mitigation and adaptation strategies over the last two decades have been funded and implemented through the collaboration of communities, public and

private sectors to ensure maximum coordination and benefits of these climate strategies to beneficiaries (Bertana et al., 2022; Defe & Matsa, 2021; Kyriakopoulos & Sebos, 2023; Mills-Novoa, 2023). Although Türkeş (2024) and Calvin et al. (2023), suggest that implementation of strategies varies across geography, time, sectors, scale and level of political support. While Ray Biswas & Rahman, (2023) argues that there is lack of major commitments towards climate change mitigation and adaptation implementation by some governments, with a broad consensus in literature that implementation of mitigation and adaptation strategies for most regions especially in developing countries are low, fragmented and limited in scope and scale as well as isolated from the actual development challenges of the communities (Baninla et al., 2022; Bhanye, 2025; Messori et al., 2020; Ouma et al., 2018; Rippke et al., 2016; Werners et al., 2021). Studies further suggest there is limited evidence that most mitigation and adaptation strategies have full national implementation, as they are largely confined to pilot phases and demonstration as well as focusing on immediate needs rather than transformative ones, thereby being reactive and not proactive to climate risks (Mulimba, 2025; Saber et al., 2025; Werners et al., 2021). Likewise, Abbass et al. (2022) and Bhanye (2025), suggest that mitigation and adaptation activities are often concentrated in donor-funded requirements rather than surrounded by national development programs, which limit the extent of implementation across sectors. Some findings suggest that in certain study areas, the government and non-governmental organizations (NGOs) did not implement livelihood adaptation strategies or did not build sufficient capacity to withstand future climate impacts (Islam et al., 2025). Although Bhanye, (2025) argues that in formal governance systems, where mitigation and adaptation strategies are absent, inadequate, or unresponsive communities actively initiated and implemented context-specific responses such as adaptation to floods by drainage improvements and unblocking, and elevated housing solutions.

Although most scholars agree that both rural and urban areas are implementing mitigation and adaptation strategies that are essential to address the impact of climate change (Awuni et al., 2023; Calvin et al., 2023; Grafakos et al., 2019; Ikehi et al., 2022; Melkonyan et al., 2024; Sharifi, 2021; Wang et al., 2023). Others suggest that urban areas are more focused on mitigation than adaptation (Grafakos et al., 2020; Kyriakopoulos & Sebos, 2023; Pietrapertosa et al., 2019). For example Burley Farr et al., (2023) observe that cities and regions are taking action to reduce emissions across sectors. This is likely because cities and urban areas account for a large share of greenhouse gas emissions, driven by concentrated industrial activity, transportation, and energy use associated with urbanized economies. Landauer et al. (2019), and Hurlimann et al. (2021), further highlight that in urban areas, integration and implementation of adaptation and mitigation is often limited and fail. It is further argued that differences in practices among regions and countries suggest that developed countries focus on mitigation strategies, while developing countries focus more on adaptation strategies (Ray Biswas & Rahman, 2023; Zhao et al., 2018). This may be due

to the high adaptive capacity that communities in developed countries have as compared to the high vulnerability of developing countries.

Considered together, the reviewed literature suggests that mitigation-oriented implementation such as renewable energy deployment and emissions-reducing infrastructure is comparatively more advanced in urban and higher-income areas, whereas adaptation-oriented implementation which includes climate-smart agriculture, early warning systems and water and soil management, is more prevalent in rural and lower-income areas (Ray Biswas & Rahman, 2023; Zhao et al., 2018). However, most reviewed studies address mitigation and adaptation jointly rather than in isolation, which limits the extent to which domain-specific patterns can be disaggregated from this evidence base.

African Implementation Patterns

In African countries such as South Africa, Kenya and Ethiopia are leading with an increased implementation of mitigation and adaptation strategies even though they remain unevenly distributed and slow in implementation (Baninla et al., 2022; Nyiwul, 2021) with climate-smart agriculture (CSA) practices, like other developing countries globally being widely promoted although its adoption remains moderate or low due to limited access to credit, extension services, and markets (Abawiera Wongnaa et al., 2024; Das et al., 2022; Selokane et al., 2025). CSA may be widely promoted in Africa because many countries depend heavily on agriculture for livelihoods, and this sector is highly vulnerable to climate change impacts such as floods and droughts. (Datta & Behera, (2022) In their study review, farmers implement various mitigation and adaptation strategies, with agroforestry being preferred. This may be so because combining agriculture and forestry enhances biodiversity, improves soil health, increases farm yields, and provides farmers with diverse income streams from timber, food, and livestock. Taken together, the literature (Calvin et al., 2023; Oduro et al., 2024; Wang et al., 2023) suggests that other mitigation and adaptation strategies include alternative livelihood diversification activities, early warning systems, solar energy, wind energy, electrification of urban systems, urban green infrastructure, energy efficiency, afforestation and reforestation, water management and storage, soil moisture conservation and irrigation.

Zambian Implementation Patterns

Zambia, like other southern African countries, is implementing mitigation and adaptation strategies in climate-sensitive sectors, such as agriculture, forestry, water, and energy, as an opportunity to improve rural and urban livelihoods and enhance sustainable development (Alemaw & Simatele, 2020; Milupi et al., 2019; Mulimba, 2025; Ngoma et al., 2024; Ngoma & Hamududu, 2019; Umar et al., 2023). Although Zambia has been implementing climate change programs and activities since the 1960s, with improvements in inclusion in development policy and implementation since the 2000s (Zulu, 2024), a common theme emerging from the literature shows that the extent of implementation

remains uncertain to the scale of climate risks even though the country has strong policy frameworks, weak linkages between national policies and local ground actions mean that many community-based adaptation initiatives operate in isolation and are heavily reliant on donor funding, pilot-scale, reactive as seen in the delayed implementation of early warning systems and disaster management preparedness until after a disaster has struck and geographically fragmented, raising concerns about sustainability and long-term continuity (International Food Policy Research Institute (IFPRI), 2023; Mulimba, 2025). Additionally, Manda et al., (2024) suggest that most projects are small, fragmented, underscaled, and driven by funding logic rather than livelihood realities, which discourages participation and sustainability.

Among many mitigation and adaptation strategies implemented, such as constructions of dams for water harvesting, tree planting in both rural and urban areas, sustainable forest management practices (reforestation and afforestation), early warning information, and Social Cash Transfer programs (Fuller & Lain, 2018; Gombera, 2023; Mweemba et al., 2024; Nkhuwa, 2024). For example, efforts in the renewable energy sector have been expanded but remain disjointed with Muhoza & Johnson, (2018) noting that the implementation of a solar mini-grid in Northern Zambia, successfully provided electricity access but struggled with long-term sustainability. Additionally, Kachapulula-Mudenda et al. (2018) argue that the implementation and household adoption of renewable technologies such as solar kits and improved cookstoves remain low, reflecting a broader pattern of scattered small-scale initiatives. Further, social networks and community perceptions significantly influence solar adoption and implementation, with uptake occurring in clusters rather than uniformly across rural and urban areas (Chanda et al., 2025). In the agriculture sector climate smart agriculture (CSA) has been implemented across the country, with significant livelihood impacts being reported (Guja & Bedeke, 2024; Mulimba, 2025; Mutenje et al., 2022; Umar, 2021).

Zambia in Comparative Perspective to Kenya and South Africa

Placing Zambia's climate implementation experience alongside Kenya and South Africa clarifies a context-specific and reflects a broader regional pattern. Kenya offers the closest parallel to Zambia's donor-dependent, coordination-constrained profile, although its National Climate Change Response Strategy sets out an ambitious mainstreaming agenda, institutional preparations for adaptation remain fragmented and lack a high-level cross-sectoral coordinating office, resonating with Zambia's own weak policy-practice linkages (Mohamed & Okumu, 2025). At the subnational level, an assessment of coastal governance in Kenya similarly found that well-developed national frameworks facilitate but do not automatically enable local implementation, since counties vary widely in the capacity, financing and information they can bring to bear on adaptation (Ojwang et al., 2017). A direct comparative study of climate finance coordination in Kenya and Zambia adds that in both countries, weak coordination is driven less by technical or administrative inadequacies

than by political power dynamics, competing framings of climate finance among actors and vested institutional interests (Shawoo et al., 2022). This suggests that the coordination gap identified in Zambia's own NAP and NDC processes is not simply a capacity deficit to be resolved with training and funding, but a politically structured outcome shared across similarly positioned developing countries.

South Africa presents a more instructive contrast than Zambia, as its adaptation policy landscape is considerably more institutionalized than that of Zambia which shows increasingly ambitious policy planning and implementation (Khavhagali et al., 2024). Zambia has strong national frameworks but is limited with a decentralized provincial or district-level to translate them into local action. South Africa has built exactly that intermediate layer of subnational policy that Zambia currently lacks. However, despite this South Africa does not escape the implementation gap identified throughout this review. A study of mitigation governance in Gauteng's West Rand District Municipality found gaps in local-level mitigation legislation despite national mandates for local action, compounded by limited financial and human resources and poor availability of local emissions data (Rasebechele et al., 2025). These cases suggest that Zambia's implementation gap is not unique to itself but may be generalizable to other developing countries.

Cross-Cutting Implementation Factors

Several factors shape the extent of implementation of climate strategies for mitigation and adaptation, both globally and within Zambia. Insufficient climate finance affects the scaling of pilot projects into national programs (Brullo et al., 2024; Saber et al., 2025). The absence of Institutional capacity and policy coordination, through a strong governance framework, technical expertise, and intersectoral coordination, limits implementation (Baninla et al., 2022; Werners et al., 2021). Ngoma et al. (2021) Umar, (2021) further argue that socio-economic factors such as poverty, low education levels, and limited access to credit reduce households' ability to adopt adaptive practices or invest in renewable technologies and contribute to the low implementation of these strategies. Social and cultural dynamics, including gender roles and community norms, also affect participation and uptake, highlighting the need for context-specific approaches to implementation (Chanda et al., 2025).

The reviewed literature clearly demonstrates a consistent pattern: mitigation and adaptation strategies are being implemented worldwide at both national and local levels, in urban and rural areas, with most of these concentrated in rural regions. Additionally, the scope of implementation is uneven or limited to an extent, as most actions tend to be small-scale, poorly integrated, underfunded, and rarely monitored for effectiveness. Although informative, these studies are limited because they do not conduct national censuses to assess the extent of implementation.

Conclusion and Implication

The development and implementation of climate policies in developing countries have been supported by international frameworks such as the UNFCCC, the Kyoto Protocol, and the Paris Agreement. While over 60% of countries globally have adopted National Adaptation Plans (NAPs), only 40% of developing countries report on their implementation. Many of these plans lack operational monitoring and evaluation (M&E) frameworks, raising concerns about whether they translate into tangible action. For instance, Zambia has established strong policy frameworks but struggles with weak linkages between national policies and local implementation efforts.

Limited stakeholder participation, particularly from non-governmental actors, undermines the quality and effectiveness of NAPs. Plans developed by single agencies are of lower quality than those created through multi-agency collaboration with broad stakeholder engagement. Local communities, industries and businesses are often excluded from planning processes, despite their critical role in implementation.

Implementation of mitigation and adaptation strategies remains fragmented, small-scale and reactive rather than proactive. Most initiatives remain confined to pilot phases and rely heavily on donor funding, limiting their scalability and sustainability. In Zambia, for instance, strong policy frameworks exist, but weak linkages between national policies and local actions hinder effective implementation.

Urban areas tend to focus more on mitigation strategies such as reducing greenhouse gas emissions while rural areas prioritize adaptation strategies like climate-smart agriculture (CSA). However, the adoption of CSA practices remains moderate to low due to challenges such as limited access to credit and markets. Similarly, renewable energy initiatives, such as solar mini-grids, have shown promise but struggle with long-term sustainability.

Factors such as poverty, low education levels, and limited institutional capacity significantly constrain the implementation of climate strategies. Social and cultural dynamics, including gender roles, further affect participation and uptake, underscoring the need for context-specific approaches.

This study contributes to the growing body of literature on climate change by providing an understanding of the challenges and opportunities associated with implementing mitigation and adaptation strategies in developing countries. It highlights the critical need for integrated, multi-stakeholder approaches and robust M&E frameworks to ensure that climate policies translate into meaningful action in vulnerable communities. It is also the first synthesis integrating global, African-regional and Zambian implementation evidence in one framework.

Recommendations

1. Strengthen governance and institutional coordination: Establish or reinforce Monitoring and Evaluation (M&E) frameworks with clear, context-specific indicators and improve intersectoral coordination and policy review mechanisms so

that national policies translate into consistent local action rather than fragmented, isolated initiatives.

2. Broaden and formalize multi-stakeholder participation: Create inclusive platforms that bring local communities, industries, businesses and civil society organizations into the planning and implementation of climate strategies from the outset, supported by capacity-building for effective participation, particularly of marginalized groups.
3. Diversify and scale sustainable financing: Expand access to international climate finance and public-private partnerships, and develop innovative mechanisms such as green bonds and climate funds that allow successful pilot projects to scale into national programs and remain viable beyond the duration of donor funding.
4. Align strategies with local development realities and equity: Tailor climate strategies to local socioeconomic, cultural and environmental contexts, integrate mitigation and adaptation efforts to reduce duplication and pair implementation with targeted livelihood capital development.
5. Prioritize proactive, technically robust implementation: Shift from reactive, pilot-scale responses toward transformative, long-term strategies by investing in institutional and technical capacity and expanding mitigation and adaptation strategies such as renewable energy, climate-smart agriculture and developing early warning systems ahead of, rather than after, climate shocks.

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Disclosure of conflict of interest

The author declare that he is not aware of any competing financial interests or personal relationships that may have influenced the work described in this document.

Statement of ethical approval

This study is a review of published literature and did not involve human or animal subjects. Therefore, ethical approval was not required.

Statement of Informed Consent

Due to the nature of this work (secondary analysis of peer-reviewed published data), informed consent is not applicable.

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