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Challenges to Effective Implementation of Climate Change Mitigation and Adaptation Strategies in Developing Countries: A Systematic Literature Review

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Abstract

The impacts of climate change have intensified the global urgency for effective implementation of mitigation and adaptation strategies in developing countries, where vulnerability is highest and implementation capacity is limited. The translation of climate policies in vulnerable communities remains weak and problematic despite the growing investment from governments, international development agencies, non-governmental organisations, civil society organisations and the private sector. A Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) was conducted using peer-reviewed to identify key challenges development agencies and governments experience in implementing climate change mitigation and adaptation strategies. Results were thematically synthesized into implementation challenges such as limited financial resources and high investment costs, insufficient government support and weak political will, inadequate knowledge and climate information, limited institutional capacity and fragmented governance structures, poor stakeholder coordination and sociocultural limitations. The review finds that these barriers are interconnected, limited finances undermine institutional capacity, weak governance affects stakeholder coordination, while inadequate knowledge leads to implementation failures at all levels. The findings underscore the need for integrated and context-based implementation strategies to mitigate implementation challenges. The review concludes by proposing directions for transformative governance reform, home-grown financing solutions and adaptive project management approaches capable of sustaining climate action within the complex realities of developing countries.

1. Introduction

Climate change is one of the major global challenges of the twenty-first century with consequences for ecosystems, economies, and human well-being (IPCC, 2023). The impacts of climate change excessively affect developing countries where populations are most exposed to climate risks and vulnerable, where governance systems, financial resources and institutional capacities are least equipped to manage the transition toward sustainable development(ibid).

In acknowledging Climate Change as a global climate injustice and a barrier to sustainable development, the Paris Agreement calls for enhanced international commitments to fund adaptation for the most vulnerable communities (UNFCCC, 2015) through Climate finance by investing to transition to a low-carbon global economy and to help communities build resilience to the impacts of climate change through grants and loans from financial institutions such as the World Bank, the African Development Bank, and the Inter-American Development Bank, among others. These grants and loans can be used to invest in projects that reduce, absorb, or prevent greenhouse gas (GHG) emissions, such as renewable energy power plants and forest conservation, or projects that build resilience to climate change, such as enhancing the resilience of agriculture and food systems(UNDP, 2019, 2023). Within this context, the standard that supports local adaptation has gained prominence (Nalau et al., 2015) for example, community-based adaptation projects have been increasingly adopted to operationalize local adaptation (Reid et al., 2016). While Mfitumukiza et al., (2020); Piggott-McKellar et al., (2019); Quang Dao & Thi Thu Huong, (2022) notes that developing countries in Africa, Asia, and the Pacific Islands have implemented thousands of community-based adaptation projects in recent years to adapt and mitigate climate change through governments, NGOs, Civil Society Organization and private businesses, among others. Dodman & Mitlin, (2013) report that these projects place the climate-vulnerable populations at the center of adaptation decision-making and capitalize on their local knowledge and needs for building adaptive capacity. However, the poorest and most vulnerable countries and communities have a weak adaptive capacity characterized by limited assets, limited income opportunities, high dependence on agriculture, and food insecurity (Meza & Rivera-Ferre, 2014; Piya et al., 2019).

However, despite the investment in the implementation of climate strategies, they often fail to achieve intended outcomes in developing countries where climate vulnerability is severe due to gaps between climate policy design and effective implementation with various challenges that undermine the translation of climate strategies into transformative action on the ground which hinder community resilience and livelihood across development sectors(Awuni et al., 2023a; Ceesay et al., 2025; Mafwela & Mafwela, 2025; Otto et al., 2025).

In Zambia like other developing countries, the government has committed to climate action through various policies, such as Nationally Determined Contributions (NDC), National Adaptation Plans and other climate strategies with international and local climate financing (GRZ, 2023), Literature shows that inadequate budget allocations, poor coordination, limited extension services, and weak institutional structures continue to pose a challenge to effective adaptation and mitigation efforts (Gombera, 2023; Manda et al., 2024; Nkhuwa, 2024). This review aims to systematically review literature to provide empirical evidence on key challenges that development agencies and governments face in the implementation of climate change mitigation and adaptation strategies

2 Methodology

2.1 Study Design

The study adopted the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework for its systematic literature review methodology due to its capacity to provide transparent, rigorous, and reproducible results of existing evidence, thereby reducing the risk of selection bias and enabling thematic conclusions(Knobloch et al., 2011; Page et al., 2021). A thematic narrative synthesis approach was employed to accommodate the methodological diversity of the included studies and to enable cross-contextual comparison of implementation challenges(Thomas & Harden, 2008).

2.2 Identification, Screening and Eligibility Strategy

Databases such as Scopus, Web of Science, Google Scholar and PubMed were used for a systematic search of the peer-reviewed literature to identify implementation challenges associated with climate adaptation and mitigation strategies. The search strategy included, ("climate change" OR "climate adaptation" OR "climate mitigation") AND ("implementation challenges" OR "implementation barriers" OR "implementation constraints") AND ("developing countries" OR "low-income countries") AND ("development agencies" OR "NGOs" OR "government" OR "institutions") across titles, abstracts, main texts and keywords. Other Supplementary searches included "National Adaptation Plans," and "climate finance".

From the search, the databases produced a total of 5,214 records with 62 additional records obtained through citation tracking and manual review of reference lists in studies, 1,487 were duplicates which were removed, and a total of 3,789 records remained and were subjected to title and abstract screening, with 3,041 excluded due to their irrelevance to the thematic focus. The remaining 748 records were reviewed for full-text review, and 601 were excluded due to insufficient focus on implementation challenges and methodological limitations, and unavailability of full text, with 67 records published between 2015 and 2025, which constituted empirical evidence base.

2.3 Inclusion and Exclusion Criteria

The study went through the inclusion and exclusion process and those that were included comprised of studies that were (i) published in a peer-reviewed academic journal (ii) written in English (iii) focused on the implementation of climate change mitigation or/and adaptation strategies (iv) addressed barriers or challenges or constraints faced during implementation (v) were empirically grounded on theoretical analysis with clear methodology.

Studies that were excluded those that (i) focused exclusively on climate impacts without examining policy or programme implementation processes; (ii) were limited to climate modelling without engagement with institutional or governance systems (iii) were conference abstracts, opinion editorials and commentary pieces without empirical evidence (iv) examined implementation of strategies in developed regions without relevance to developing countries challenges (v) were inaccessible in full-text format.

2.4 Data Extraction

Data extraction was performed using full citation details, geographic and sector relevance. Others includedspecific implementation challenges identified, mechanisms through which challenges operate and implications from the author's point of view.

3 Results and Discussion

3.1 Challenges faced by development agencies in implementing mitigation and adaptation strategies

Limited Financial Resources

The reviewed studies (Ceesay et al., 2025; Dasandara et al., 2023; IPCC, 2023; Messori et al., 2020; Namasani, 2022; Ostojic, 2022; Sinore & Wang, 2024; Wambwa et al., 2024), collectively identify limited funding, underfunding and financial limitations as a consistent theme across the literature that causes challenges in the implementation of climate actions, particularly in developing countries where competing priorities dominate budget allocations.

The successful implementation of adaptation policies in developing countries is determined by the presence of sufficient financial resources at both local and national levels. However, a study by Kidane et al.,(2023) notes the absence of a budget, particularly for implementing agriculture-related adaptation strategies in the district of Raya Azebo, Ethiopia, as most of the budget allocated to the agricultural sector was used for administrative purposes, such as paying staff salaries. The case is the same in Zambia, where Gombera, (2023) , observed that the Lusaka City Council allocated little to no funding (budget) for climate programs, prioritizing salary arrears over urgent adaptation initiatives, thereby undermining the capacity to implement plans and policies. Likewise Piggott-McKellar et al., (2019) and Nkhuwa, (2024) observe that limited project or insufficient budget and slow release of funds significantly hamper efforts to adapt, adopt and implement climate impact strategies in vulnerable communities. Additionally, Manda et al., (2024) highlights implementation climate projects is a challenge due to limited community participation since most of them were driven by funding logic(availability of funds) which constrains project scope and scale.

In Zambia, despite projects funded by the Climate Investment Funds' Pilot Program for Climate Resilience (PPCR), the African Development Bank and the Green Climate Fund, inadequate funding continues to be a major challenge to the implementation of essential adaptation strategies. Without

sufficient funding, the adoption of climate-resilient technologies, infrastructure improvements, and capacity-building is not possible (Nkhuwa, 2024; Sinyangwe, 2020). Moreover, the lack of funding limits the government's ability to mobilize resources for monitoring, evaluation, and reporting on adaptation efforts, hindering effective decision-making and policy development (Nkhuwa, 2024).

There is a broad consensus in literature that the implementation of agricultural technologies such as water-saving irrigation systems and solar-powered pumps, is limited by high investment costs and limited financial support schemes(Setiawan, 2025). Tunji-Olayeni et al., (2019) and Carlander & Thollander, (2023) confirms in their study by highlighting that though available, most of the mitigation and adaptation strategies and technologies are expensive. Access to agricultural credit remains low in rural and remote areas due to complex administrative procedures, collateral requirements, and a lack of financial literacy (Setiawan, 2025). Similarly, Selokane et al., (2025) note that in regions like Zambia and Malawi, where limited access to credit and extension services, inadequate infrastructure, high implementation costs and insufficient financial resources hinder the implementation of climate mitigation and adaptation initiatives.

Despite inadequate funding and underfunding in the implementation of mitigation and adaptation strategies Anjanappa & Samant, (2024) and Tunji-Olayeni et al., (2019) highlight that there are complexities and stringent criteria for accessing climate funds, both local and international and this exacerbates further the scale of implementation in most developed countries. Overall, these studies underscore a concern that while climate adaptation is universally acknowledged as urgent, financial challenges hinder implementation, which calls for homegrown solutions that will allow developing countries like Zambia to work with the limited resources to mitigate and adapt to climate change.

Limited Government Support

The role of every government, as the main actor, is to lead in the policy and implementation of climate mitigation and adaptation strategies (He et al., 2022; Leiter, 2021). Despite this, most scholars agree that a lack of government support is one of the major challenges in implementing climate mitigation and adaptation strategies (Ceesay et al., 2025; Otto et al., 2025). The challenges stem from the inconsistencies in policy implementation and weak enforcement of National Adaptation Plans(NAPs) which further exacerbate vulnerabilities to climate-related risks(Filho et al., 2023; Leiter, 2021; Nkhuwa, 2024). Moreover, Manda et al., (2024 and Tunji-Olayeni et al., (2019) further highlight that the lack of political will by leaders weakens the transformative potential and causes implementation challenges of climate mitigation and adaptation initiatives in many developing countries, hampering sustainable development (IPCC, 2023). For example in a study by Anjanappa & Samant, (2024) similarly found that fragmented governance structures posedchallenges to effective implementation of adaptation measures, as a lack of political will, many implementors do not coordinate and lack support from political leaders within the communities. This fragmentation not only poses a challenge to adaptation measures but also diminishes trust in institutional capacity. Collectively, these studies underline a critical contradiction in the government that, while they are positioned as central actors in climate resilience, their inconsistent engagement often transforms them into challenges rather than enablers of effective adaptation.

Insufficient and lack of Knowledge on Climate Change

Even with the widespread occurrence of climate change and its impact, a consistent pattern emerging from the literature is that insufficient knowledge and lack of knowledge pose a challenge in implementing mitigation and adaptation strategies(Awuni et al., 2023a; Ceesay et al., 2025; Pillay et al., 2025). For instance, challenges such as inadequate climate information and capacity development through education and early warning systems hamper the implementation of climate initiatives. (Awuni et al., 2023c) argues that top-down decision-making approaches exacerbate this challenge by limiting opportunities for adaptation and mitigation projects implementers to learn from local communities already experiencing the effects of climate change(Awuni et al., 2023b). This knowledge mismatch between implementers and beneficiaries often undermines project acceptance and sustainability.

Further, while Spear et al., (2018) support the position that lack of access to information on climate change signifies challenges in implementing mitigation and adaptation strategies. Even ss Nkhuwa, (2024) and Anjanappa & Samant, (2024) agree that in Zambia and India the lack of reliable, accurate and localized climate data makes it difficult to accurately assess current and future climate risks which affects the effective development, prioritization and implementation of targeted evidenced based strategies and monitoring of adaptation strategy progress. For instance, empirical evidence (Setiawan, (2025) suggests that, the accuracy to determine planting schedules and crop selection for farmers is significantly affected by limited access to real-time, reliable, and localized climate data from seasonal prediction tools, which often fail to reach farmers at the grassroots level due to weak dissemination systems, technical illiteracy, and infrastructural limitations in rural areas.

Others like Carlander & Thollander, (2023), report that even though the information is available, a lack of knowledge and understanding of issues such as energy-efficient technologies, materials and environmental issues prevents stakeholders from making use of such information. For instance, in Africa, problems such as poverty, insurgency and leadership divert the attention of people away from reducing community interest in climate initiatives. It is, therefore, important that people are aware and understand that climate change can threaten their existence in order for them to become more interested in environmental issues (Tunji-Olayeni et al., 2019). Additionally Sinore & Wang, (2024), emphasize that individuals, communities, and institutions often require support in making well-informed decisions and taking appropriate actions but are limited due to a lack of awareness and understanding concerning climate change and available adaptation options. Interestingly, on the contrary, Otto et al., (2025), suggest that insufficient data and experience play minor roles in implementing climate change adaptation measures. This divergent view highlights an ongoing debate in the literature about whether insufficient knowledge is the primary challenge to implementing strategies. Nevertheless, the weight of evidence suggests that without accessible, reliable, and context-specific climate information, adaptation strategies risk being misaligned with local realities, thereby undermining implementation.

Limited Institutional Implementation Capacity and Experience

The reviewed studies collectively suggest that limited or a lack of institutional and management capacity to implementation of climate mitigation and adaptation strategies is a challenge (IPCC, 2023; Kundu et al., 2024; Mafwela & Mafwela, 2025; Messori et al., 2020; Pillay et al., 2025)

A study by Kidane et al., (2023), reviews that a lack of skilled human power and limited technical knowledge and leadership abilities of local-level government actors on climate change issues present challenges to effective implementation of adaptation policies and strategies. Many staff members had limited or no knowledge on climate issues and competence to coordinate and lead climate change activities during the implementation of adaptation projects. These findings align with Carlander & Thollander, (2023), Otto et al., (2025 and Sinore & Wang, (2024), who lack technical competence and technical skills, insufficient experience and fragmented institutional structures face challenges in implementing climate initiatives. Similarly, Nkhuwa, (2024) amplifies these findings, noting that challenges like limited technical expertise and weak institutional structures hinder the formulation, implementation, and monitoring of adaptation strategies across government agencies, non-governmental organizations, and community based organizations. For instance, Manda et al., (2024) further observed that over-reliance on project committees without necessary skills such as project and

financial management, climate specific skills, livelihood-relevant technical knowledge, procurement and contract, indigenous adaptive competencies and conflict resolution mechanisms capacity, among others, leads to community struggle to develop, implement and sustain projects.

On the contrary Piggott-McKellar et al., (2019) and Messori et al., (2020) argue that, lack of interest and commitment from project staff, and reluctance to implement new technologies, as well as limited and a lack of staff, may contribute to implementation challenges. In Zambia, Nkhuwa, (2024) observes that the scarcity of extension officers in the agriculture sector poses a critical challenge to disseminating vital information and to the adoption and implementation of climate-resilient practices among rural farmers in response to increasingly erratic weather patterns and other climate-related challenges, leading to a risk of decreased agricultural productivity and food insecurity. Other findings (Carlander & Thollander, 2023), review that organizations' staff or employees have the zeal to plan and implement ideas for new technologies are most often brought up and decisions about implementation but lacks the mandate for staffing and structures. Similarly, at Lusaka City Council in Zambia, empirical evidence suggests that even though there was no specific department that is solely focused on combating climate change, a lack of opportunity for the employees to express their knowledge and be heard was absent, even if employees had knowledge of the current demands of the city in mainstreaming climate change as new initiatives cannot be introduced or reviewed openly(Gombera, 2023). This confirms the idea of fragmented governance structures which is one of the challenges to effective implementation of adaptation measures, highlighting lack of capacity by institutions(Anjanappa & Samant, 2024).

These findings provide a critical perspective that while institutions are expected to provide leadership and technical expertise in climate mitigation and adaptation projects, their limited capacity, fragmented structures, and weak motivation of staff often turn them into challenges rather than opportunities. Addressing these challenges requires not only technical training and capacity-building but also institutional reforms that empower staff, streamline governance structures, and foster accountability in climate action.

Limited Coordination of Stakeholders

A common theme emerging from the literature(Mohammed Duhis et al., 2025; Omala, 2023; Ouma et al., 2018; Pacillo et al., 2024; Pillay et al., 2025; Wambwa et al., 2024) is that limited stakeholder engagement or coordination and communication undermine the implementation of climate mitigation and adaptation across different governance levels and sectors. Empirical evidence attributes these challenges to inconsistent or inadequate support, lack of policy coherence and clear roles across governance levels and actors (Dale et al., 2020; Manda et al., 2024; Namasani, 2022; Otto et al., 2025)

While Mafwela & Mafwela, (2025) and Nkhuwa, (2024) in their studies review that, despite contributions by development agencies to support the implementation of climate change Mitigation and Adaptation strategies poor coordination among various stakeholders persist to effective implementation of climate change adaptation efforts. This lack of coordination, communication and cooperation between government agencies, non-governmental organizations, local communities, and other relevant actors undermines the development and implementation of coherent and impactful adaptation strategies leading to duplication of efforts, overlapping mandates, inefficiencies in resource allocation and gaps in knowledge sharing and capacity building(Awuni et al., 2023b; Mafwela & Mafwela, 2025; Nkhuwa, 2024; Sinore & Wang, 2024). Similarly, Setiawan, (2025) contends that different sectoral offices, such as agricultural, environmental, and public works agencies, tend to run adaptation programs independently, without an integrated framework or clear division of responsibilities to implement climate adaptation policies and strategies at the regional level which demonstrates weak inter-agency coordination. This fragmentation results in overlapping projects, inefficiencies in resource allocation, and the absence of coordinated adaptation roadmaps in communities which may lead to maladaptation risks.

Likewise, donor or implementors priorities and requirements cause challenges in implementing climate projects(Piggott-McKellar et al., 2019). Seddon et al., (2020) suggest that certain institutions and project committees dominate decision making to implement solutions familiar to them which leads to mistrust and lack of accountability (Manda et al., 2024). Additionally a lack of communication and coordination between donors and implementers on project timelines creates a challenge in implementation with Masud-All-Kamal & Nursey-Bray, (2021) highlighting that donors compel project activities to finish in a certain timeframe from the intended period. This undermines the fact that with climate mitigation and adaptation strategies, it is impossible to transform or build capacities of communities to adapt to climate change within a tight timeframe. Donors and implementers must begin to look at using sustainable project management (social, economic and environmental impact) away from the traditional project management that prioritizes time, budget and scope(quality).

Overall, these studies converge on the argument of the importance that coordination among stakeholders is paramount for effective climate action and that without integration, even sufficient finance, institutional capacity, and adequate climate information among other enablers cannot guarantee successful implementation. This to the lack of integration and coordination of programs and institutions, which threatens the sustainability of adaptation projects, highlighting the need for governance reforms that institutionalize collaboration, clarify mandates, and align donor priorities with community needs.

Other Challenges

From literature it is sufficient to say that development agencies face various challenges when implementing mitigation and adaptation strategies and in addition to what has been mentioned, Sinore & Wang, (2024) that in Africa, traditional habits and practices, norms, attitudes, gender inequality land tenure and unequal power dynamics form part of sociocultural challenges in implementing strategies. For example, in western province of Zambia, while project implementers may prioritize floods as a disaster their culture and tradition practices may that as an opportunity for fishing and rice farming(Manda et al., 2024). Moreover, South African Selokane et al., (2025) reviewed that, gender disparities limited female-led farms in participating and accessing resources and decision-making power in climate adaptation initiatives. Even though Ceesay et al., (2025) argue that gender did not have any significant negative effect in participating and access to community adaptation strategies.

Mitigation Projects in the reforestation and afforestation as observed by (Andoh et al., 2024; Owusu & Asante, 2020; Rajasthan & Chauhan, 2024) such as overgrazing, bushfires, illegal logging, the destruction of young trees by activities of livestock herders, and illegal mining activities undermines project implementation

4 Conclusion and Implications

Implementation challenges in climate change strategies are not attributable to a single independent barrier but to the interaction of multiple mutually inclusive challenges. The interdependence of these challenges means that addressing one barrier is unlikely to generate sustainable improvements in

the effectiveness of implementation. These findings provide evidence for the need of integrated implementation frameworks that address the challenges that climate project implementers face and that are designed to account for the interactions among them rather than managing them individually.

In doing that, this study supports the reduction of dependence on international climate funds or donations by advocating for the development of homegrown and country led climate financing solutions which can be done by strengthening domestic revenue allocation to climate programmes, developing innovative private-public partnership financing and building the financial management capacity of local institutions to absorb and deploy climate resources effectively. Although such funds including donor funding must be reformed to reduce administrative misuse, disbursement of funds must also be accelerated and ensure that they reach the local implementing agencies and communities where they are intended to serve.

Weak governance and a lack of political will call for institutional reforms that support climate action within government and establish dedicated and adequately resourced climate implementation units at national and subnational levels with strategic and deliberate monitoring and accountability strategies. This demonstrates that these challenges are not just technical or managerial but shaped by power relations and competing interests among actors across governance levels. This calls to investigate how decisions are made between donors and recipients, national and local governments, project implementors and vulnerable communities to lead on what gets to be implemented, for whom and with what outcomes.

Investment in localized climate data infrastructure such as meteorological services, community-based monitoring systems and early warning platforms that integrate indigenous and scientific knowledge, must be strengthened. This calls for Project donors and implementors to transition from top-down knowledge dissemination to co-production approaches that position local communities as active contributors to climate knowledge systems which may improve both the accuracy of local adaptation plans and the community ownership required for sustained implementation.

Stakeholder coordination may require multi-stakeholder climate platforms at national and subnational levels with clearly defined mandates, transparent resource allocation and monitoring and accountability. Donor agencies and project implementers must adopt adaptive and flexible sustainable project management approaches with longer-term outcomes aligned with immediate, realistic community needs and transformation

Sociocultural dimensions, such as gender-responsive projects in climate mitigation and adaptation, must be included in decision-making processes to have equitable access to resources and technologies. However, this must be done consciously to avoid gender social conflicts. Community local culture must be put into perspective to identify potential conflicts between proposed climate interventions and local norms, traditions and livelihood practices and develop culturally appropriate solutions through community co-designed projects.

Declaration of Competing Interests

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

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Ethical considerations

The article followed all ethical standards appropriate for this kind of research.

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