

Harnessing International Finance Options to Strengthen South Africa's Subnational Strategies on Climate Change Adaptation: Implications for Agriculture and Food Security

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ABSTRACT

South Africa faces escalating climate threats, with extreme weather events severely impacting agriculture, water resources, and food security. Addressing these challenges requires significant financial investment. This review synthesises literature and policy documents sourced from key databases, including Google Scholar, Web of Science, Scopus, and ScienceDirect, as well as the Mangosuthu University of Technology online library. Initial screening of over 150 sources identified 86 studies (49 peer-reviewed articles and 44 grey literature reports) based on relevance and inclusion criteria to examine the role of international climate finance in supporting subnational adaptation, particularly in the agricultural sector. This narrative literature review explores financial mechanisms, climate finance frameworks, and case studies of community-driven adaptation initiatives. The findings highlight the role of global climate funds, including the Adaptation Fund, Green Climate Fund, and COP28 pledges, in addressing South Africa's adaptation finance gap. However, bureaucratic hurdles, inadequate institutional support, and limited direct funding for local adaptation persist. Community-driven initiatives that prioritise local decision-making, resource mobilisation, and participatory strategies remain underfunded

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despite their significance. This paper emphasises the need for improved financial accessibility, stronger governance, and enhanced collaboration between donors, government agencies, and grassroots organisations. Recommendations include aligning domestic finance frameworks with global funding criteria, streamlining fund disbursement, and integrating community-led adaptation into national policies. Strengthening these mechanisms can ensure financial resources reach vulnerable populations, enhancing resilience and promoting sustainable agricultural practices in South Africa.

Keywords: Climate Finance, International Funding, Local Adaptation, Community Engagement, Agricultural Resilience, Financial Inclusion, COP28 Fund.

1. INTRODUCTION

Climate change has led to more frequent and intense extreme weather events in South Africa, including rising temperatures, reduced winter rainfall, more frequent droughts (e.g. Cape Town's drought from 2016-2018), and stronger precipitation events, such as the 2022 Durban floods (Ziervogel et al., 2022). These changes have accelerated warming, worsened water shortages, and hindered economic growth (Ziervogel et al., 2022).

South Africa faces unique challenges in adapting to climate change while addressing existing developmental issues. The country's climate goals overlap with broader objectives of economic growth and poverty reduction, presenting significant challenges (Department of Environmental Affairs [DEA], 2011; Cassim et al., 2021). These difficulties extend across various sectors, with climate-induced water scarcity and extreme weather events exacerbating food insecurity and threatening livelihoods (Montmasson-Clair, 2013). The country's semi-arid climate, high evaporation rates, and limited water resources intensify these issues (World Bank Group [WBG], 2021). Additionally, limited resilience within the population and strain on already scarce water resources further undermine the nation's ability to combat climate change (Montmasson-Clair, 2013). These challenges, shared across Africa, impede post-COVID-19 recovery and sustainable development (United Nations Economic Commission for Africa [ECA], 2023).

Agriculture, one of South Africa's most vulnerable sectors, is severely affected by changing temperature and rainfall patterns, which reduce crop yields and escalate food insecurity (Liaqat et

al., 2022; Balasundram et al., 2023). The country's existing environmental degradation, coupled with predicted hotter and drier conditions, worsens agricultural productivity and water scarcity (Oxfam, 2009). These changes are expected to lead to greater variability in production, income loss, and increased vulnerability among disadvantaged groups, further impacting global food security (Food and Agriculture Organisation [FAO], 2013; Obi & Maya, 2021). The rising frequency of extreme weather events, such as droughts and floods, shows the urgent need for adaptive measures to manage climate risks, particularly for smallholder farmers (Agbenyo et al., 2022; Autio et al., 2021). Over the past decade, development partners have committed to scaling climate-smart agriculture (CSA) in Africa, offering technical and financial support for its implementation (Ogunyiola, Gardezi & Vij, 2022).

However, addressing climate change requires more than technology; it necessitates a shift towards community-driven adaptation approaches. Local communities must be empowered to effectively adapt to climate change, with strong community engagement in climate resilience (Restrepo-Mieth et al., 2023). Community-based participatory efforts are critical in climate change adaptation, helping to tailor responses to local contexts (SANBI, 2023). Evidence suggests that collaboration among local communities, government bodies, the private sector, and NGOs is key to the success of adaptation strategies (Mfitumukiza et al., 2020). Effective Community-Based Adaptation (CBA) requires targeted resource mobilisation, including decentralised funding mechanisms to reach vulnerable communities directly (Mfitumukiza et al., 2020). However, funding for CBA projects demands significant financial support. These initiatives require adequate resources to implement and sustain adaptation measures. Transitioning to a climate-resilient global economy requires substantial funding (DEA, 2011). Nevertheless, despite international climate finance mechanisms, fragmented support remains a challenge. Developing robust domestic climate finance strategies is crucial to complement these mechanisms (DEA, 2011). A harmonised approach to align domestic strategies with international commitments is essential for strengthening South Africa's climate resilience.

The South African Climate Finance Landscape report for 2023 revealed that while climate finance has increased, it still falls short of meeting estimated needs. South Africa's financial requirements to achieve net-zero emissions by 2050 and meet National Determined Contributions (NDCs) by 2030 are R334 billion and R535 billion annually, respectively, far exceeding the R131 billion

tracked annually from 2019 to 2021 (de Aragão Fernandes et al., 2023). Similarly, the cost of adapting to climate change in South Africa is projected to be over US\$300 billion from 2021 to 2030 (Keen, Lorimer & Vincent, 2022). The call for COP28 to address global and African adaptation finance shortfalls stresses the need for a reform of the financial system, focusing on accessible, high-quality finance for Africa (Reason for Power Shift Africa, 2023).

Climate change adaptation remains underfunded and under-researched compared to mitigation, despite the increasing vulnerabilities of agricultural systems in developing nations like South Africa. Ford et al. (2015) found that mitigation studies outnumber adaptation studies, highlighting a persistent bias in climate research and the need for systematic reporting on adaptation efforts. This gap underscores the urgency of further research on adaptation, particularly in vulnerable regions. The climate finance landscape mirrors this bias, with Xie et al. (2023) noting that Multilateral Development Banks (MDBs) direct most funds to mitigation projects in wealthier nations, neglecting adaptation needs in highly vulnerable regions. Locatelli et al. (2016) and Eisenstadt et al. (2021) support this, emphasising the need for a more equitable distribution of funds. Evidence suggests that rebalancing finance could reduce global climate vulnerability for an additional 1.9 billion people (Xie et al., 2023). However, studies on the implications of this reallocation at the local level, especially for smallholder farmers in South Africa, are scarce.

In South Africa, smallholder farmers, who are heavily impacted by climate shocks, face systemic barriers to accessing climate finance. While mechanisms like the Green Climate Fund (GCF) and Adaptation Fund (AF) aim to support local adaptation, studies show that their implementation is hindered by allocation processes that lack transparency and are inconsistent in distribution (Omukuti et al., 2022; CPI, 2022; Keen et al., 2022). Manuamorn et al. (2020) highlighted that only a small fraction of international adaptation finance reaches local beneficiaries, further exposing the gap in how climate finance impacts communities. This study addresses these gaps by reviewing the effectiveness of climate finance mechanisms in South Africa, with a focus on adaptation finance. It examines how finance can be more effectively channelled to support vulnerable communities, particularly smallholder farmers, by analysing allocation disparities, evaluating community-driven case studies, and proposing frameworks to better align global funding with local needs. The paper also explores the bureaucratic barriers smallholder farmers face in accessing these funds, an underexplored area in current literature. Additionally, it assesses

South Africa's climate finance mechanisms, highlights key international commitments such as COP28, and discusses the implications for agriculture and food security. Additionally, the study considers theoretical perspectives influencing climate finance and adaptation strategies, and how these can be integrated into South Africa's policies to improve financial efficiency and resilience.

2. METHODOLOGY

2.1. Approach

This study utilised a narrative literature review approach to explore the role of international finance in strengthening South Africa's subnational climate change adaptation strategies, with a particular focus on agriculture and food security. The study adopted a narrative review due to its flexibility in synthesising existing research and its ability to explore ideas more broadly, making it particularly useful for discussing policy frameworks, financial mechanisms, and community-driven adaptation efforts.

2.2. Literature Search Strategy

To ensure a broad and relevant review, academic and policy-related sources were identified through searches in major databases, including Google Scholar, Web of Science, Scopus, and ScienceDirect, as well as the Mangosuthu University of Technology online library. The selection of databases was guided by their complementary strengths in covering climate finance and adaptation studies. Web of Science and Scopus were chosen for their comprehensive indexing of high-impact, peer-reviewed research, ensuring access to rigorous scholarly sources. ScienceDirect was included for its strong focus on environmental policy and economics, providing interdisciplinary perspectives on climate-agriculture studies. Aside from accessing traditional academic publications, Google Scholar was also used to capture grey literature, policy briefs, and reports from international organisations. Additionally, the Mangosuthu University of Technology Library provided access to institutional subscriptions. To further enhance coverage of grey literature and policy reports, we also utilised alternative sources, including the World Bank, Food and Agriculture Organisation, and United Nations databases for finance, development, climate, and agriculture policy documents, and ResearchGate for working papers.

The search focused on key topics such as "Climate finance in South Africa," "International funding for climate adaptation," "Agriculture and food security under climate change," "Community-driven climate adaptation initiatives," "Climate change adaptation policies in South Africa," and "COP28 and climate finance commitments." To refine the search, terms such as 'AND' and 'OR' were used to combine keywords effectively. Titles, abstracts, and keywords were screened to ensure relevance, and only sources directly related to the review focus were included.

TABLE 1: Literature Search Strategy

Step	Action
Database Selection	Scopus, Web of Science, Google Scholar, World Bank, Food and Agriculture Organisation, and United Nations databases.
Keywords	"Climate finance in South Africa," "International funding for climate adaptation," "Agriculture and food security under climate change," "Community-driven climate adaptation initiatives," "Climate change adaptation policies in South Africa," and "COP28 and climate finance commitments."
Screening	Titles/abstracts screened for relevance (n=150+)
Final Selection	93 sources (49 peer-reviewed, 44 grey literature)

2.3. Inclusion and Exclusion Criteria

The selected papers were exclusively in English, and to ensure relevance and recency, studies published between 2010 and 2024 were included in the review. To minimise selection bias, a balanced range of sources was included, ensuring representation from diverse perspectives, such as governmental agencies, international organisations, and academic research. The review emphasises conceptual discussions, policy analysis, and discourse from previous studies, rather than a quantitative meta-analysis of results. A total of 93 sources were selected for this review, comprising 49 peer-reviewed journal articles and 44 grey literature sources. The peer-reviewed articles were published across 34 academic journals, ensuring a diverse and credible scholarly foundation. The grey literature includes policy reports, working papers, and institutional documents from organisations such as the Food and Agriculture Organisation (FAO), United

Nations Framework Convention on Climate Change (UNFCCC), South African National Biodiversity Institute (SANBI), The World Bank, and the South African Department of Environmental Affairs (DEA). The inclusion of a substantial number of grey literature sources was necessary to capture the most up-to-date policy developments, institutional perspectives, and context-specific data that may not yet be available in peer-reviewed publications.

The near-equal split between peer-reviewed and grey literature was intended to ensure a comprehensive, policy-relevant review. Grey literature was particularly valuable in providing up-to-date policy data that is often unavailable in academic journals, making it, for instance, essential for tracking commitments made at the 28th Conference of the Parties (COP28) and national climate strategies (United Nations Framework Convention on Climate Change [UNFCCC], World Bank, Intergovernmental Panel on Climate Change [IPCC]). Given the rapidly evolving nature of climate finance and adaptation mechanisms, grey literature helped capture recent policy shifts and implementation strategies that have not yet been analysed in peer-reviewed studies.

- A rigorous appraisal was applied to all sources, especially grey literature. We prioritised documents from: Reputable institutions, such as the United Nations Framework Convention on Climate Change (UNFCCC), the World Bank, the Food and Agriculture Organisation, the United Nations Economic Commission for Africa, the South African National Biodiversity Institute, and the South African National Treasury.
- Government reports ensuring data credibility (e.g., the Department of Forestry, Fisheries and the Environment [DFFE], the National Planning Commission, the Department of Energy, and the South African Reserve Bank, amongst others).
- Evaluated projects, particularly case studies from the Adaptation Fund, which included well-defined monitoring frameworks and impact assessments.

TABLE 2: Inclusion and Exclusion Criteria

Criteria	Inclusion	Exclusion
Timeframe	Studies published from 2010 to the present	Studies published before 2010.
Language	English	Non-English papers without translation.

Source Type	Peer-reviewed articles, reports, policy briefs, government publications.	Blogs, opinion pieces.
Relevance	Focus on agriculture, food security, climate change, climate finance and adaptation.	Studies unrelated to food security, climate change, climate finance and adaptation.
Geographic Scope	South Africa & relevant global cases.	Studies with no relevance to the study context.

3. FINDINGS AND DISCUSSION

3.1. Vulnerabilities of South African Communities to Climate Change with Emphasis on Agriculture and Food Security

South Africa's climate is undergoing significant changes due to rising temperatures, shifting rainfall patterns, and increasing frequency and intensity of extreme weather events (United Nations International Children's Emergency Fund [UNICEF], 2011). The Department of Environmental Affairs (DEA, 2013) provides a detailed analysis of observed climate trends over 50 years, highlighting rising mean annual temperatures, fluctuations in the rate of temperature change, and high interannual rainfall variability. Projections indicate further warming and regional rainfall variations up to 2050 (DEA, 2013). Additionally, DEA (2018) emphasised the predominantly negative impact of climate change on South Africa's economic growth, with future projections anticipating continued disruptions to economic stability, energy generation, employment, and social inequality. South Africa's vulnerability ranking (92 out of 181 countries) on the 2020 Notre Dame-Global Adaptation Index (ND-GAIN) is attributed to a combination of political, geographic, and social factors (WBG, 2021).

Climate-related losses compound existing economic burdens, limiting Africa's capacity to respond effectively to extreme weather events (Power Shift Africa, 2023). These events exacerbate vulnerabilities and expose the inadequate preparedness of African nations to combat climate challenges (Power Shift Africa, 2023). The increasing frequency of extreme weather across Africa underscores the urgent need for enhanced efforts to reduce emissions and implement adaptation strategies to protect vulnerable populations (Adaptation Gap Report, 2023). South Africa faces mounting climate-related challenges affecting ecosystems, economic growth, and livelihoods. The

rising occurrence of extreme weather events, temperature surges, and erratic rainfall patterns directly impacts agriculture, water resources, and public health infrastructure (Department of Forestry, Fisheries and the Environment [DFFE], 2019). These environmental changes threaten natural resources and infrastructure, intensifying the vulnerability of marginalised communities lacking the resources to adapt effectively (DFFE, 2019).

The link between climate change and food security is becoming increasingly evident, particularly in Africa (Masipa, 2017). Recent studies highlight the vulnerability of African nations to climate-related disruptions (Ariom et al., 2022). Despite agriculture being a major livelihood source in sub-Saharan Africa, food insecurity remains prevalent due to climate variability and limited adaptation capacity (Khalif & Nur, 2013). The agricultural sector is under pressure to increase production while simultaneously facing climate-related risks. In many Southern African Development Community (SADC) countries, achieving food security remains a challenge (Mutengwa et al., 2023). Despite technological advancements and development efforts, food security remains elusive (Ozor, Umunnakwe & Acheampong, 2013). In South Africa, climate change exacerbates food insecurity, particularly for rural households (Abegunde et al., 2022). While no definitive measure of food security levels exists (Hendriks & Olivier, 2015), research indicates significant household food insecurity, particularly in rural areas (De Cock et al., 2013; von Bormann & Gulati, 2016). Masipa (2017) emphasised the complexity of food security in South Africa, noting that climate change affects food availability, accessibility, utilisation, and affordability. Additionally, Liebenberg and De Wet (2018) highlighted the increasing importance of food security in South Africa's policy discourse, aligning with the objectives of the National Development Plan (NDP), which prioritises adequate nutrition and food security.

The adverse effects of climate change on agricultural productivity and food security underscore the urgency of implementing sustainable development strategies (Balasundram et al., 2023). The connection between climate change and agricultural production highlights the vulnerability of food systems to climatic shifts (Ozdemir, 2022; Abbass et al., 2022). These disruptions not only hinder agricultural output but also lead to irregular production patterns, negatively impacting global food security (Ozdemir, 2022; Abbass et al., 2022). The consequences of climate change disproportionately affect vulnerable communities, exacerbating food shortages and economic instability (Durán-Sandoval et al., 2023). Addressing climate change in the agricultural sector is

crucial, given its role in food security and economic stability (Barati et al., 2023). The ongoing climate crisis highlights the need for sustainable agricultural strategies (Song et al., 2022). While climate change is a global issue, its impacts vary by region and sector, with agriculture being particularly affected (Van et al., 2022). The accelerating pace of climate change necessitates urgent efforts to mitigate its effects and enhance adaptation measures (Van et al., 2022). Recognising the severity of climate vulnerabilities, South Africa acknowledges the need for decisive climate action. The Presidential Climate Commission (2022) stressed the economic necessity of addressing climate change and called for transformative strategies across all sectors.

3.2. Trends in Climate Finance for Adaptation

3.2.1. COP28 Funding Commitment for Climate Change Mitigation and Adaptation.

The 2023 United Nations Climate Change Conference (COP28) took place from 30 November to 12 December 2023 in Dubai, UAE, where the 28th Conference of the Parties (COP) convened. COP is the highest decision-making body of the UN Framework Convention on Climate Change (UNFCCC), which includes all member states that assess reports on greenhouse gas emissions and climate actions (COP 28 UAE Handbook, 2023). In an open letter to member parties, the COP28 President-Designate (2023) stressed the importance of transforming climate finance and placing nature, people, and livelihoods at the heart of climate action.

Since COP21, the focus has been on implementing the Paris Agreement's goals of temperature control, adaptation, resilience building, and aligning financial flows with low emissions (Townend & Aberg, 2023). Governments have worked to establish the Global Goal on Adaptation (GGA), which aims to enhance resilience against the growing impacts of climate change (Rumbaitis Del Rio & Toth, 2023). COP28, which originated from the 2015 Paris Agreement, was critical to advancing this agenda. COP27 (2022) established a loss and damage fund for developing nations, signalling global financial reform (Power Shift Africa, 2023), but progress in adaptation finance remained slow (Burnett & Edwards, 2023). Despite the launch of the GGA framework, many nations, including the UK, were reluctant to commit funds (Burnett & Edwards, 2023).

Ahead of COP28, the COP28 President-Designate emphasised the need to address long-standing financial commitments to restore trust and foster momentum (Power Shift Africa, 2023). Developed nations were urged to replenish the Green Climate Fund (GCF) and commit to doubling

adaptation finance by 2025, as agreed at COP26. Additionally, multilateral development banks (MDBs) and Development Finance Institutions (DFIs) were urged to prioritise scaling adaptation finance. COP28 was expected to close financial gaps in global adaptation finance, focusing on debt relief and grants for vulnerable regions like Africa (Power Shift Africa, 2023). Positive developments emerged during COP28, with new pledges totalling \$174.2 million for the Special Climate Change Fund and the Least Developed Countries Fund. The Adaptation Fund received nearly \$160 million, and over \$650 million was pledged for the Loss and Damage Fund, reflecting substantial financial backing (UNFCCC, 2023a) [Figure 1].

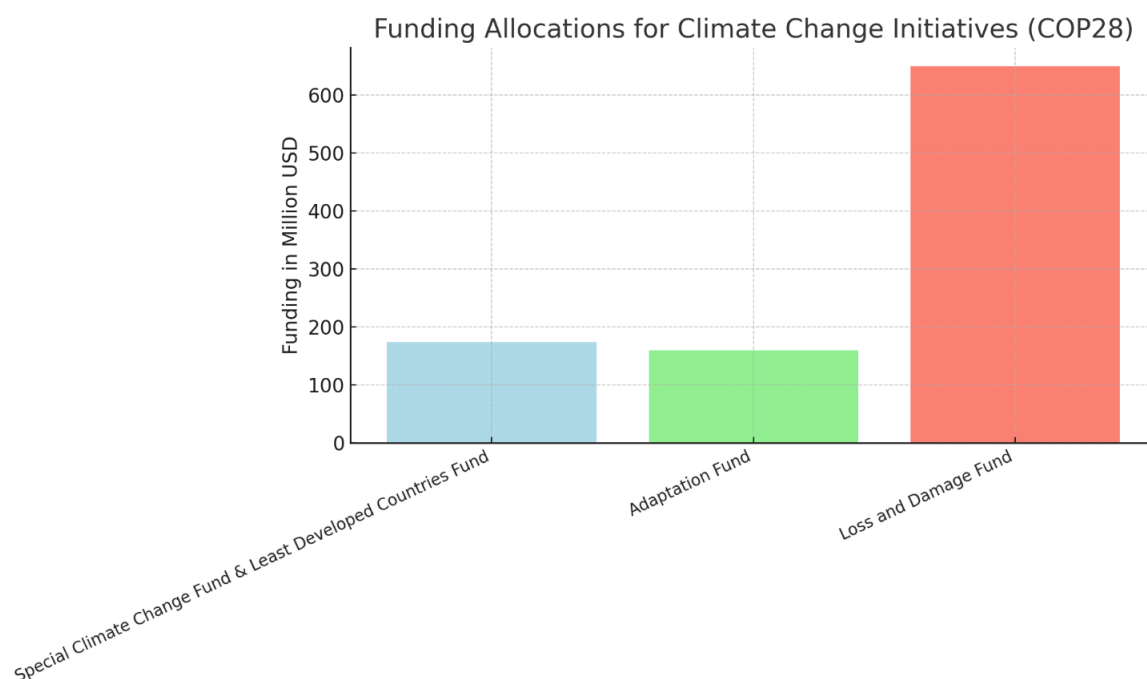


FIGURE 1: Pledges to UN climate funds at COP28 (UNFCCC, 2023a)

The increased investment in climate change mitigation at COP28 provides hope for Africa, a continent highly vulnerable to climate impacts. Funds such as the Adaptation Fund, Least Developed Countries Fund, and Special Climate Change Fund are critical, but their adequacy must be assessed against Africa's diverse and substantial climate challenges. Global adaptation needs exceed initial estimates by over 50%, resulting in a financial gap of US\$ 194-366 billion annually (Adaptation Fund, 2023a). Africa's financial needs for 2020-2030 are estimated at \$1.3-1.6 trillion, with a yearly shortfall of \$99.9-127.2 billion (ECA, 2023). To make a real difference, higher and

more consistent commitments are necessary, along with effective and fair distribution of these funds to the regions most affected by climate change. While increased funding is a step forward, a long-term commitment is essential to address climate change in Africa.

COP28 funding offers promising opportunities for African nations, including South Africa, to enhance their climate adaptation efforts. South Africa has robust domestic resources for climate change, but international funds linked to COP28 commitments are critical for scaling up adaptation projects. The South African Green Paper highlights the importance of various stakeholders in supporting these efforts, with initiatives like the South African Renewables Initiative (SARi) illustrating the evolving domestic climate finance landscape (DEA, 2011). Despite a growing reliance on international finance, the South African Climate Finance Landscape 2021 shows that 91% of tracked finance now comes from domestic sources (Cassim et al., 2021). The National Climate Change Response White Paper (2011) stresses the need to mobilise both domestic and international finance, recognising the role of international and corporate grant providers (Montmasson-Clair, 2013). This paper advocates for enhancing access to COP28 funding to support community-level adaptation initiatives in South Africa, with a focus on improving climate adaptation and food security.

3.2.2. Allocation, Management, and Utilisation of Climate Finance in South Africa

Chukwudum (2024) examined the allocation, management, and utilisation of climate finance in sub-Saharan Africa, including South Africa. Climate finance in the region is allocated through Central Funding Units (CFUs), which distribute funds across multiple countries, and Boundary Funding Units (BFUs), which serve fewer nations. As the largest carbon emitter in Africa, South Africa receives the highest share of climate finance, predominantly from CFUs, with a strong focus on mitigation projects. However, Chukwudum (2024) highlighted that 63% of multilateral funding units have disbursed less than 50% of approved funds, delaying the implementation of climate-resilient initiatives. Although South Africa's strategic position within the climate finance network facilitates better access to funds, its reliance on CFUs poses challenges, including bureaucratic bottlenecks and delays in fund disbursement. Climate finance in South Africa is primarily directed toward mitigation, adaptation, and REDD+ projects, with mitigation receiving priority due to the country's high greenhouse gas emissions. The study emphasised the need for equitable allocation

and improved coordination to address disparities and enhance the effective utilisation of climate finance across the continent.

Similarly, de Aragão Fernandes et al. (2023) provided a detailed analysis of South Africa's climate finance landscape, highlighting a significant imbalance between mitigation and adaptation funding. Between 2019 and 2021, R131 billion per annum was allocated to climate-related investments; however, this remains well below the estimated R334R535 billion needed annually to meet the country's climate targets. The private sector contributes 86% of total climate finance, primarily through commercial banks and institutional investors, while the public sector accounts for 14%, with funding sourced from development finance institutions (DFIs), government budgets, and international donor agencies (de Aragão Fernandes et al., 2023). Debt financing dominates, comprising 75% of total funding, while grants and concessional loans, which are essential for early-stage and high-risk projects, remain scarce. The clean energy sector attracts the largest share of investment (63% of total finance), while critical adaptation initiatives, such as water security and climate-resilient agriculture, remain significantly underfunded.

Adaptation finance at the local government level faces even greater challenges. Keen et al. (2022) reported that only 4% of international climate finance (2016-2019) was allocated to adaptation projects in South Africa, leaving municipalities severely underfunded. Structural and systemic barriers, including limited technical capacity, inadequate financial tracking systems, and bureaucratic inefficiencies, hinder local governments' effective access to both international and domestic adaptation funds. Crucial adaptation needs, such as water supply, disaster preparedness, and urban resilience, continue to be overlooked in funding allocations (Keen et al., 2022). To address these challenges, recommendations include expanding concessional finance, strengthening municipal capacity to access climate finance, improving risk-sharing mechanisms, and enhancing financial tracking through Climate Budget Tagging (CBT). Additionally, greater emphasis on public-private partnerships (PPPs) and blended finance could unlock investment in underserved sectors, such as transport and urban infrastructure. Without urgent action to scale both mitigation and adaptation finance, South Africa risks failing to meet its climate commitments, exacerbating socio-economic vulnerabilities, and limiting progress toward a just and resilient transition (de Aragão Fernandes et al., 2023; Keen et al., 2022).

3.2.3. South Africa's Climate Finance Mechanisms for Enhancing Climate Adaptation

Climate change poses a significant threat to South Africa, requiring a robust financial framework to enhance the country's resilience. In 2010, the UNFCCC introduced the National Adaptation Plans (NAPs) to assist countries in identifying and addressing medium- to long-term adaptation needs. These plans provide a framework for coordinating national adaptation efforts and measuring progress both locally and globally (UNFCCC, 2022). As of 14 October 2021, South Africa submitted its National Climate Change Adaptation Strategy (NCCAS) through NAP Central, aligning with the NAP objectives to strengthen adaptive capacity and integrate climate adaptation into various policies and development strategies (UNFCCC, 2022). The NCCAS sets out a comprehensive vision for climate resilience, fulfilling international commitments such as those outlined in the Paris Agreement and forming the foundation for South Africa's National Adaptation Plan (DFFE, 2019). The NAP highlights the country's commitment to prioritising people's needs, rights, and equitable development while identifying key adaptation priorities, with a particular emphasis on securing sufficient financial resources to implement climate change responses (DFFE, 2019). South Africa has focused on inclusive development and securing climate finance, aligning with its ambition to access higher levels of funding to address both mitigation and adaptation needs in line with global agreements. The country's updated first NDC aims to secure a substantial increase in climate finance, targeting USD 8 billion annually by 2030, with resources equally distributed between adaptation and mitigation (South Africa First NDC, 2021).

Global funds such as the Adaptation Fund and Green Climate Fund have significantly contributed to climate adaptation projects in South Africa, delivering tangible benefits to vulnerable communities (SANBI, 2023). Additionally, South Africa has gained direct access to the Adaptation Fund through the Enhanced Direct Access Modality, which has emerged as a critical mechanism for improving financial accessibility for vulnerable groups (Adaptation Fund, 2023a; TANGO International, 2015). This approach has the potential to enhance the efficient distribution of substantial adaptation finance at scale (TANGO International, 2015). Recent reports indicate that the Adaptation Fund has allocated approximately R109 million (USD 10 million) for use in South Africa (SANBI, 2023). Furthermore, South Africa's National Climate Change Response Policy (NCCRP) explicitly calls for the financial services sector to play a role in shaping the

country's climate and green finance architecture, alongside project developers and policy-makers (Cassim et al., 2021).

3.3. Community-Driven Adaptation: A Key Pathway

Climate change is no longer a distant threat but a present reality that demands immediate action from all sectors of society. Ngcaba (2016) conveyed the remarks of the former National Coordinator of the Global Environment Facility (GEF) Small Grants Programme (SGP) in South Africa, highlighting the importance of local ownership in addressing global environmental issues and advocating for direct community benefits.

Empowering communities through engagement not only increases ownership of adaptation practices but also ensures alignment with local values and traditions (Roy & Sims, 2021). The UNFCCC, through its Local Communities and Indigenous Peoples Platform (LCIPP), has also recognised the significant role of community engagement in tackling climate challenges (UNFCCC, 2023b). Power Shift Africa (2023) reiterates the importance of prioritising human rights, indigenous knowledge, and transformative adaptation in Africa's climate vision. This emphasises the need to integrate community engagement strategies into adaptation measures, particularly in the agricultural sector.

Wijerathna-Yapa and Pathirana (2022) emphasised the significance of community engagement in achieving sustainable food systems amidst climate challenges. Community involvement is not merely an aspect but a fundamental pillar, alongside environmental sustainability and technological innovation. Related studies (Abbass et al., 2022; Durán-Sandoval et al., 2023) stressed the urgency of local adaptation policies and the integration of community-driven solutions to combat climate change-induced agricultural challenges, highlighting the critical role of communities in climate action. Sutton and Tobin (2011) also emphasised the need to engage various stakeholders, including local communities, in climate mitigation and adaptation strategies. A study by Restrepo-Mieth et al. (2023) highlighted the bidirectional flow of information between communities and governments, stressing the importance of integrating local knowledge into adaptation plans and community input in designing interventions that protect livelihoods.

Effective climate action requires a multi-level approach, with communities playing a central role. Stone, Montes de Oca, and Christie (2022) advocated for 'commoning'—the collective self-

governance of resources as a means of mobilising communities to address climate challenges. Fritze, Williamson, and Wiseman (2009) argued that community engagement approaches are essential for successful climate mitigation and adaptation, reinforcing the need for social justice, inclusion, and democratic governance. Walker (2014) also emphasised the importance of inclusive decision-making processes, advocating proactive inclusion of diverse stakeholders, including community members, to foster trust and build networks for sustainable solutions. Community engagement goes beyond simply informing or consulting; it requires active participation in decision-making (Restrepo-Mieth et al., 2023). Recognising the importance of communities in climate action underscores the need to integrate local knowledge and experiences with top-down policies to enhance policy acceptance (Ambrosio-Albala & Delgado-Serrano, 2018). This partnership is crucial not only for policy formulation but also for bridging the gap between science and policy, while involving NGOs and civil society organisations embedded within these communities (Ambrosio-Albala & Delgado-Serrano, 2018).

Dodman and Mitlin (2013) identified Community-Based Adaptation (CBA) as a significant intervention within the broader development framework. Recognising that adaptation occurs predominantly at the local level highlights the importance of community-based approaches (McNeeley & Lazrus, 2014). CBA operates at the grassroots level, empowering communities to cope with a changing climate through participatory approaches and indigenous knowledge to reduce vulnerability (Ayers & Forsyth, 2009). Its effectiveness lies in starting with community-identified needs, emphasising poverty reduction, and promoting active participation throughout the adaptation process (Reid, 2009). This focus on CBA has become a common response in international development efforts targeting vulnerable nations (Kirkby, Williams & Huq, 2015). The success of CBA largely depends on its emphasis on addressing pre-existing marginalisation within communities and on ensuring equitable implementation (Clarke et al., 2019). However, as CBA continues to evolve, it requires re-conceptualisation, moving beyond a static understanding of "community" to address socio-political complexities and inequalities (McNamara & Buggy, 2017). Such adaptations are necessary to meet the dynamic challenges posed by climate change while aligning with broader sustainable development goals. The increasing focus on CBA reflects a shift from traditional top-down approaches, acknowledging the importance of local knowledge, social impacts, and pro-poor outcomes (Reid, 2009).

The literature identifies various challenges in implementing CBA. In addition to the difficulties associated with expanding community-based approaches to ensure local ownership and address diverse priorities, as indicated by Wright et al. (2017), other challenges include organisational, knowledge-related, communication, and financial barriers, particularly in developing countries, as highlighted by Masud-All-Kamal and Nursey-Bray (2021).

3.3.1. Case Studies of Community-Driven Climate Adaptation Initiatives in South Africa: Harnessing Global Funding for Local Resilience

South Africa has been actively involved in various climate change adaptation initiatives, drawing on funding from entities such as the Global Environment Facility (GEF) and the Adaptation Fund (AF). These case studies highlight the effectiveness of community-driven approaches to climate adaptation, showcasing how local communities have harnessed international financial resources to address climate change risks.

One notable example is the GEF-funded "Table Mountain Conservation Project," which secured USD 12 million and marked the start of South Africa's efforts to integrate environmental projects with economic and social growth (Ngcaba, 2016). Since 2016, the GEF has supported 97 national and regional projects with funding totalling USD 821.70 million, attracting co-financing of USD 4.74 billion, illustrating the power of global partnerships in driving local climate initiatives.

In addition, the establishment of the Community Adaptation Small Grants Facility (CA SGF) by the Adaptation Fund in 2014 further empowered local communities to respond to climate change. This initiative, facilitated by South Africa's National Implementing Entity (NIE), the South African National Biodiversity Institute (SANBI), has supported vulnerable communities in regions such as the Namakwa and Mopani Districts. With a funding allocation of USD 2.44 million, the project enabled local responses to climate-induced risks, such as droughts and storm-related disasters (Adaptation Fund, 2016). Grants averaging USD 100,000 enabled the CA SGF project to directly involve communities in designing and implementing adaptation strategies tailored to their unique vulnerabilities. These strategies incorporated local knowledge, gender considerations, and specific climate change impacts, demonstrating the success of community-driven adaptation.

In the Namakwa District, the CA SGF initiative mobilised approximately R1.17 million, benefiting enterprises across sectors such as manufacturing, tourism, and agriculture (Merrill & Soal, 2021).

An assessment of the project revealed key factors contributing to its success, including community-driven design, diverse adaptation strategies, and local influence on project implementation. These examples emphasise the importance of community-led initiatives in fostering resilience and promoting sustainable development in vulnerable regions.

International funding plays a critical role in South Africa's adaptation efforts, particularly at the subnational level. While local initiatives are crucial, the scale and urgency of climate adaptation demands significant financial support from international sources. International funds not only provide financial resources but also offer technical expertise and knowledge-sharing, which are essential for effective adaptation strategies. Diversifying funding sources and improving the accessibility of international climate finance are crucial to ensuring the success of community-driven climate adaptation projects in South Africa.

The case studies reviewed demonstrate that community-driven climate adaptation initiatives in South Africa, supported by global funding mechanisms such as the GEF and AF, can lead to successful, locally tailored climate resilience strategies. The lessons learned from these projects can inform future climate adaptation strategies and highlight the importance of strengthening financial flows and support systems for grassroots-level action.

3.4. Challenges in Securing Climate Finance for Africa's Climate Transition

The barriers to financing climate action projects in Africa are multifaceted and significant. As discussed by Mohieldin, Kenewendo, and Wambui (2023), limited national budgets hinder governments from allocating sufficient resources towards climate mitigation, adaptation, and resilience, as competing priorities such as health and education often take precedence. Political instability further increases the cost of climate transitions. High debt burdens in many African countries divert resources away from climate action, making it difficult to invest in long-term climate solutions. Additionally, inconsistent policies, governance issues, and uncertainty about regulatory frameworks create a risk environment that deters potential investors. Perceptions of high risk, compounded by limited financial intermediaries, increase the cost of capital and further limit access to climate finance. The complexity of international climate finance mechanisms, often influenced by political dynamics, complicates access for developing nations. Likewise, foreign currency fluctuations heighten the perceived risks of investing in Africa, raising financing costs.

Furthermore, despite its potential, the private sector's involvement in climate finance remains underutilised, hindered by stringent commercial requirements and complex access procedures (Mohieldin et al., 2023).

At the subnational level, additional barriers to accessing climate finance persist. The United Nations (n.d.) identified the complexity of application processes as a significant hurdle. Many funding mechanisms require highly technical proposals aligned with global climate frameworks, which local communities and smallholder farmers often lack the capacity to develop. Chiriatic and Naran (2020) emphasised the severe underfunding of small-scale agriculture, despite its crucial role in food security. The International Fund for Agricultural Development (IFAD) reports that only a small percentage of global climate finance targets small-scale producers, even though smallholder farmers require USD 240 billion annually, yet only USD 10 billion is allocated. This disparity stems from a lack of bankable projects, limited private-sector investment, and challenges in securing loans due to issues such as collateral and land tenure. Additionally, limited awareness of climate-smart agricultural practices inhibits resilience-building efforts (Chiriatic & Naran, 2020).

Cassim et al. (2021) discussed specific barriers to the growth of climate finance in South Africa. These include the lack of a clear definition of climate finance, which makes it difficult to track and report financial flows. Both the public and private sectors lack the awareness and expertise needed to allocate and monitor climate finance effectively, leading to inefficient investment. Early-stage climate projects, especially outside the energy sector, face challenges in securing funding due to high perceived risks. Furthermore, high transaction costs and delays in regulatory approvals create barriers for small and long-term projects, while retail investment in climate-friendly products remains minimal due to regulatory constraints (Cassim et al., 2021).

Additionally, Soanes et al. (2017) highlighted that less than 10% of international climate funds reach local communities, with most adaptation finance concentrated at national and multilateral levels. Keen et al. (2022) further emphasised that local governments often struggle to access these funds due to mismatches between available resources and the specific needs of adaptation projects. Limited technical expertise, financial constraints, and inadequate local infrastructure exacerbate these challenges. Overcoming these barriers requires external funding, partnerships with experienced organisations, and internal capacity-building through training and access to resources. To address these challenges, the South African National Biodiversity Institute (SANBI) has piloted

the Enhanced Direct Access Mechanism to help vulnerable communities access climate finance. However, despite these efforts, institutional constraints persist, limiting the scalability of such projects. This shows the urgent need for more effective mechanisms to channel international climate finance directly to local communities, ensuring that resources are effectively utilised to build resilience (Keen et al., 2022).

Another significant challenge in South Africa is the lack of comprehensive climate finance data, which is crucial for supporting national climate policy, mobilising investment, and promoting resilient economic growth (Cassim et al., 2021). Data gaps, along with a disparity in funding allocation between mitigation and adaptation, further complicate efforts to address climate change. While mitigation projects receive a substantial share of funding, adaptation projects, particularly in agriculture and water conservation, receive far less (de Aragão Fernandes et al., 2023). This mismatch highlights the need for better tracking, coordination between funders and implementers, and targeted efforts to strengthen local adaptation initiatives. While international climate finance mechanisms have contributed significantly to climate adaptation efforts in South Africa, bridging funding, data, and capacity gaps is essential to maximising their impact. Strengthening local government capacity, promoting collaboration, and ensuring efficient use of funds are key to addressing the ongoing challenges and achieving sustainable climate action (Keen et al., 2022).

3.5. Implications for Agriculture and Food Security

An urgent transformation of food systems, particularly within the smallholder production sector, is essential to accelerate progress towards both food security and sustainable development (Zougmore, Läderach & Campbell, 2021). In response to these challenges, there is a growing consensus among policy-makers and development practitioners to promote the widespread adoption of sustainable agricultural practices, particularly among small-scale farmers. The aim is to enhance agriculture and food systems, thereby improving resilience to climate change and securing food security (Abegunde et al., 2019; Wekesa, Ayuya & Lagat, 2018). Effective food security encompasses sustainable food production, viable livelihoods, and income generation (Hendriks & Olivier, 2015). Addressing food insecurity in Africa requires a transformative shift in agricultural practices, accompanied by proactive management of climate variability (Khalif & Nur, 2013). Strategies to achieve food security must focus on strengthening rural households'

resilience to climate shocks and improving their capacity to adapt to changing climatic conditions (Ghosh, 2019). Pereira and Drimie (2016) highlighted the urgent need for innovative solutions to combat hunger and household food insecurity in South Africa, particularly in rural areas, emphasising the need for swift interventions and implementation of changes. To address these challenges, agriculture and food systems must become more resilient, adapt to climate change, and contribute to its mitigation (FAO, 2013).

In practice, adapting to climate change in agriculture requires more than maintaining the status quo. It necessitates the development of resilient and adaptable strategies that can not only withstand the changing conditions brought about by climate change but also improve the sector's performance in the face of these challenges (FAO, 2013). The shifting landscape of climate change demands a dynamic transformation within agricultural production systems. This imperative shift is critical to safeguarding global food security, sustaining economic activities, and protecting the livelihoods of farming communities across various nations, particularly those that are less developed or still developing (Ghosh, 2019). This transformation includes rethinking land management practices, water usage, and soil nutrient management to improve efficiency and sustainability. The objective is to increase agricultural productivity and resilience, ensuring a stable food supply. Such a transformation is essential for maintaining food availability and stability (Ghosh, 2019).

However, the situation remains challenging, as investments in agricultural adaptation, despite capturing a significant share of private sector investments (de Aragão Fernandes, 2023), often fail to reach local levels. Ongoing engagement with local communities involved in agricultural production is important for the success of agricultural climate change adaptation initiatives. The active involvement of these communities is crucial for the effective implementation of such initiatives. However, these efforts require substantial funding, particularly when encouraging farmers to adopt climate-smart agriculture and digital farming practices. Funded community engagement initiatives are critical, not only for promoting sustainable agricultural production but also for enhancing local and national food security. To achieve these objectives effectively, South Africa must devise strategies to secure additional international climate finance. This funding is essential to support local community engagement and the adoption of innovative agricultural practices. Harnessing commitments made at COP28 could offer South Africa a viable opportunity

to access the necessary financial resources. If these commitments are utilised efficiently, they could play a significant role in enabling the implementation of climate-resilient agricultural strategies at the grassroots level, thereby contributing to broader national goals of sustainable development and environmental conservation.

3.6. Theoretical Perspectives that Influence Climate Finance and Adaptation Strategies

Given the financial constraints in accessing climate adaptation funds at the local level, a structured approach to financial inclusion and subnational climate finance is necessary. This section integrates key theoretical frameworks that provide a foundation for understanding the financial mechanisms available for climate change adaptation in South Africa, particularly in the agricultural sector. These frameworks—the Country-Driven, Multi-Stakeholder Climate Finance Framework (Glemarec, Waissbein & Bayraktar, 2010), the Climate Investment Planning and Mobilisation Framework (NDC Partnership & Green Climate Fund, 2024), and the Subnational Climate Finance Framework (NDC Partnership, 2023) - offer guidance on mobilising and structuring international and domestic finance to strengthen resilience in vulnerable communities. This section provides a conceptual basis for assessing the accessibility, efficiency, and implementation of climate finance at the grassroots level, laying the groundwork for the subsequent discussion on COP28 funding commitments and South Africa's climate finance mechanisms.

a) Country-Driven, Multi-Stakeholder Climate Finance Framework (Glemarec et al., 2010)

This framework emphasises national ownership of climate finance mechanisms, ensuring that financial strategies align with national development goals and adaptation priorities. It integrates low-emissions, climate-resilient development strategies with human development objectives, aiming to enhance financial accessibility for developing nations.

Key components include:

- Financial and technical support platforms to scale up climate finance and bridge funding gaps.
- Nationally Appropriate Mitigation Actions (NAMAs) and National Adaptation Plans (NAPs) to ensure equitable access to international public finance.

- Monitoring, Reporting, and Verification (MRV) systems to track climate finance flows, ensuring transparency and long-term effectiveness.

b) Climate Investment Planning and Mobilisation Framework (NDC Partnership & Green Climate Fund, 2024)

This framework provides a systematic six-stage process for investment planning and financial mobilisation, ensuring that adaptation finance is effectively structured and implemented. It incorporates public, private, and blended finance models to enhance financial accessibility at multiple levels.

Key stages include:

- *Investment Planning*: Building institutional capacity and engaging key stakeholders, such as financial institutions, development agencies, and government ministries.
- *Prioritisation of Climate Investments*: Using climate risk assessments and cost-benefit analyses to allocate resources strategically.
- *Financing Strategy Development*: Identifying financial partners, de-risking mechanisms, and structuring blended finance deals.
- *Finance Mobilisation*: Aligning investment programmes with funding sources, unlocking private capital, and securing concessional finance.
- *Project Development & Approval*: Ensuring projects meet international financing criteria to secure funds efficiently.
- *Project Implementation & Monitoring*: Tracking fund disbursement using Climate Budget Tagging (CBT) to enhance transparency and accountability.

c) Subnational Climate Finance Framework (NDC Partnership, 2023)

This framework is particularly significant for South Africa's climate adaptation efforts at the grassroots level, as it addresses key structural barriers that prevent local and municipal governments from accessing climate finance. Recognising that climate adaptation is most effective at the local level, the framework integrates financial solutions tailored to empower municipalities and subnational actors to implement climate resilience strategies.

Key features include:

Identifying and Addressing Structural Barriers:

- **Limited borrowing power of subnational governments:** Many local governments lack the legal authority to issue bonds or take out loans for climate projects.
- **Creditworthiness issues:** Many municipalities do not meet the credit rating requirements to access private finance.
- **Weak investment pipelines:** Many local governments lack the expertise to develop bankable climate projects.
- **Unequal resource allocation:** Larger cities receive the majority of climate finance, while smaller municipalities remain underfunded.
- **High transaction costs:** Small projects often struggle to secure funding due to the administrative burden of international financing applications.

Proposed Solutions:

- Fiscal decentralisation policies to enable subnational governments to borrow and issue bonds for climate projects.
- Mechanisms to improve municipal credit ratings, enhancing their attractiveness to private investors.
- Capacity-building initiatives to train local governments in climate finance management and project development.
- Project aggregation strategies to bundle multiple small-scale initiatives into larger, investment-ready portfolios, attracting institutional investors.

Key Mechanisms for Strengthening Subnational Climate Finance:

a) **Leveraging National Development Banks (NDBs):**

- NDBs act as intermediaries, offering concessional loans and guarantees to municipalities.
- They facilitate co-financing with international climate funds, bridging the gap between local and global funding sources. Examples include the South African National Treasury's support for green bonds issued by municipalities.

b) **Creating Local Climate Finance Instruments:**

- Municipal green bonds and local climate funds can mobilise private-sector investment for adaptation projects.

- Blended finance models that integrate public and private capital help mitigate investment risks.

c) Enhancing Vertical Integration:

- National and local finance strategies must align to ensure efficient fund disbursement.
- Encourages the integration of municipal climate action plans into national policy frameworks.

d) Facilitating Access to International Climate Finance:

- Simplifies application processes for local governments to access Green Climate Fund (GCF), Adaptation Fund, and Global Environment Facility (GEF) grants.
- Provides technical assistance to help municipalities navigate complex funding mechanisms.

e) Encouraging Public-Private Partnerships (PPPs):

- Mobilises private investment through de-risking strategies, such as public loan guarantees and tax incentives.
- Encourages carbon credit markets and performance-based financing for climate adaptation projects.

f) Implementation Strategy and Future Directions:

- *Phase 1:* Establishing a technical support system for local governments to strengthen credit access and financial literacy.
- *Phase 2:* Mobilising climate finance by enhancing NDBs' role and promoting subnational financial mechanisms.
- *Phase 3:* Scaling up local climate projects by aligning municipal strategies with national and international climate finance frameworks.

This framework is particularly relevant in South Africa, where subnational climate finance remains underdeveloped. Studies indicate that less than 10% of international climate funds reach local municipalities, limiting their capacity to implement community-driven adaptation strategies (Soanes et al., 2017). The framework, therefore, emphasises the need for greater financial decentralisation, enhanced direct funding mechanisms, and local capacity-building to improve climate adaptation outcomes at the grassroots level.

3.6.1. Integrating Frameworks into South Africa's Climate Adaptation Strategies

A comprehensive climate finance approach requires integrating the strengths of these three frameworks to maximise financial inclusion, institutional efficiency, and direct access to adaptation funds. The following strategies can enhance South Africa's ability to harness international finance for agriculture and food security resilience:

1. Expanding Financial Inclusion:

- Strengthen blended finance mechanisms, combining public, private, and concessional funding sources.
- Utilise local finance instruments, such as green bonds, to attract private investment in community adaptation initiatives.

2. Enhancing Subnational Climate Adaptation:

- Promote direct access mechanisms that enable local governments and communities to receive funds without excessive bureaucratic delays.
- Establish dedicated municipal adaptation funds to support smallholder farmers and agricultural cooperatives.

3. Ensuring Efficient Fund Utilisation:

- Implement climate budget tagging (CBT) and MRV systems to track fund allocation and expenditure.
- Strengthen financial oversight mechanisms to ensure transparent and accountable use of adaptation finance.

Applying these frameworks in South Africa can help bridge the climate finance gap, ensuring that international funds effectively support community-driven adaptation efforts in agriculture. Strengthening institutional coordination, enhancing financial accessibility for local governments, and harnessing direct access mechanisms will enable South Africa to maximise international climate finance for resilience-building and food security initiatives.

4. CONCLUSION AND RECOMMENDATIONS

The multifaceted challenges posed by climate change in South Africa demand comprehensive strategies and concerted efforts across sectors to ensure resilience and sustainable adaptation. A crucial element of these strategies is increasing the financial capability to implement effective

adaptation practices, particularly in the agricultural sector. While innovative, climate-smart agricultural practices are essential for achieving food security, challenges in accessing and directing funds to local levels remain significant, limiting grassroots impact.

Accessing international climate finance requires a comprehensive, structured approach. As outlined in frameworks such as the Country-Driven, Multi-Stakeholder Climate Finance Framework, the Climate Investment Planning and Mobilisation Framework, and the Subnational Climate Finance Framework, there are clear pathways to mobilise and structure both international and domestic finance to enhance resilience at the local level. These frameworks provide valuable guidance for strengthening financial inclusion, addressing barriers to subnational finance, and ensuring efficient fund disbursement. South Africa must align its climate adaptation goals with the objectives of international funds, such as the COP28 Fund, to unlock resources for grassroots adaptation.

Creating compelling proposals and establishing efficient channels for fund disbursement are crucial steps to ensure that these resources reach the intended local communities engaged in agricultural adaptation efforts. Furthermore, collaboration between governmental bodies, NGOs, and local community groups is vital. This collaborative approach enhances the credibility of proposals and ensures that the funds are optimally utilised for impactful climate adaptation initiatives within the agricultural sector. South Africa's pursuit of international climate finance, possibly through the COP28 Fund commitments, holds immense potential to drive meaningful change in agricultural adaptation. Prioritising community engagement and innovative agricultural practices supported by such financing could significantly enhance the country's resilience to climate change while advancing its agricultural sustainability and food security objectives.

For this to succeed, South Africa must establish sustainable frameworks and partnerships that facilitate access to international funding, ensuring that resources effectively reach local communities engaged in agricultural adaptation efforts. Incorporating financial mechanisms, such as blended finance and local capacity-building initiatives, will also be crucial to bridging the gap between national-level funding and on-the-ground implementation. Furthermore, expanding financial inclusion by making locally accessible climate finance instruments, such as green bonds, available can attract private-sector investment for community adaptation initiatives. Strengthening financial oversight and tracking mechanisms, such as Climate Budget Tagging, will ensure

transparency and accountability in the utilisation of funds. Promoting direct access mechanisms, reducing bureaucratic delays, and creating dedicated municipal adaptation funds will further empower local governments and communities to take charge of their climate resilience.

4.1. Limitations

While this review may provide useful perspectives, it is not exhaustive due to the absence of a systematic selection process. Future research may benefit from a systematic review or meta-analysis to provide a more structured synthesis of evidence.

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