

Navigating Climate Change: A Review of Policies in Botswana, Africa, and Beyond

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ABSTRACT

This paper is an insightful perspective analysis of Botswana climate change policies in an effort to establish their effectiveness in relation to regional and international initiatives. For a critical review of both mitigation and adaptation efforts by different countries, the effectiveness is analysed, including their strengths and inadequacies noted, and recommendations made towards enhancing policy coherence and effectiveness. It examines the steps Botswana and other countries have taken to cut greenhouse gas emissions, improve energy efficiency, support the use of renewable energy sources, and implement sustainable land management practices. The paper also delves into Botswana's efforts to build climate resilience, such as creating a National Adaptation Plan and incorporating climate considerations across various sectors.

Keywords: Climate change policies, Policy review, International agreements, Sustainable development, Botswana

INTRODUCTION

Botswana, a landlocked country located in the southern part of Africa, faces significant challenges because of climate change, predominantly rising temperatures, which has a negative effect on the environment, economy, and people of this country (World Bank, 2010). Recognizing the need to solve this matter, Botswana has implemented various policies and strategies to mitigate effects of climate change and enhance resilience in sectors like agriculture (Boyd, 2023). These initiatives are very crucial to Botswana as well as in Africa and at global scales. Encompassing the climate policies of Botswana at regional and global frameworks is vitally important in fostering teamwork and strengthening the global response to climate change.

Botswana's strategies and programmes implemented to combat climate change stretch outside regional considerations to reverberate with inclusion in global climate agendas (Koboto et al., 2012). Participating in international platforms such as the United Nations Framework Convention on Climate Change (UNFCCC), with nations around the world, is one approach which this country is active in shaping and forging negotiations and action for climate. The involvement of Botswana can only highlight its dedication to the global urgency of combating climate change, which will need coordinated actions and collective accountability on a worldwide scale.

Understanding Botswana's climate change plans and their alignment with regional and international frameworks is needed for comprehending the country's contributions to climate action. Exploring the experiences of Botswana, their challenges and success towards climate change policy implementation might give important lessons to other African countries as well as the global community. Scrutinizing the relationship between Botswana's policies and other nations' can help foster cooperation which will fortify the response of the world's community towards climate change at both regional and global levels. Botswana's climate policies reflect its commitment to addressing the effects of climate change within Africa and on an international scale (Koboto et al., 2012). By emphasizing both mitigation and adaptation tactics, Botswana aims to support resilient and sustainable regional development in order to achieve the world's climate objectives.

METHODOLOGY

This study uses a qualitative methodology, utilizing an extensive and comprehensive analysis of climate change policy including a look at their origins, effects, and policies, adaptation techniques, and mitigation plans. A desktop investigation was carried out to compile relevant information about climate policy in Botswana, Africa, and

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other relevant sources worldwide. The goal of this research was to give a thorough grasp of climate policy globally, awareness that the impacts of climate change cut beyond national borders and influence every region of the earth.

CLIMATE CHANGE POLICIES

Overview of Botswana's Climate

Climate exerts a critical influence on human well-being and socio-economic activities, profoundly affecting health, agriculture, and overall livelihoods (UNDP, 2018; Mugari et al., 2020). Botswana's climate vulnerability is relatively correlated to its extreme water scarcity (Crawford, 2016) with five key sectors that stand out as particularly susceptible: water resources, public health, agricultural yields, grassland ecosystems, and forestry. Botswana's climate is semi-arid (Batisani and Yarnal, 2010; Kenabatho et al., 2012; Crawford, 2016; Botswana, 2019; World Bank Group, 2021; Omari Motsumi et al., 2023) which is defined by high temperatures and low unreliable rainfall. There are distinct dry and wet seasons throughout the nation, with variations throughout several districts. The scorching months of May through October are known as the dry season. The daytime highs routinely rise above 30°C and, in some places, even reach above 40°C accompanied by low levels of humidity. Conversely, the rainy season, prevailing from the month of November until April, offers relief with cooler temperatures and occasional rainfall, typically ranging from 250 mm to 650 mm (BES, 2019), the national average annual rainfall stands at 450 mm.

Climate Change Policies: Botswana

Studies carried out by different government agencies and experts in the field (Abucar and Molutsi, 1993; JNS, 1994; Dube and Sekhwela, 2007; The World Bank, 2010; Hambira and Saarinen, 2015; Juana et al., 2016; UNDP, 2017; Spear et al., 2018; Madebwe, 2019; Mugari, Masundire and Bolaane, 2020; Batisani et al., 2021) underscores Botswana's elevated susceptibility to changes in the climate. This susceptibility encompasses significant economic factors and is expected to increase in the absence of efficient adaptation and mitigation strategies. In spite of this, Climate change is not now a top national priority for the government. This absence of prioritization has led to, lack of utilization of climate change policy, legislation, and strategy to solve the effects. Still, the possibility of future climate change and the related environmental risks are recognised in the Plan for National

Development 10 (Government, 2022). A few industries from the highly affected sectors; gender, agriculture, water, health and energy, have adopted strategies for climate adaptation and mitigating measures, such as government backing for solar energy systems in the energy industry (Fabre and Magombo, 2009; Crawford, 2016; Botswana, 2019; World Bank Group, 2021). Climate policy is essential for guiding response efforts to reduce or mitigate the consequences of changing climate (Ayers, Huq and Westminster, 2008; UNESCO, 2023). A lot of industrialized nations are currently developing broad programmes to combat climate change (Crawford, 2016; OECD, 2018; World Bank Group, 2021; Bhattacharya, Kharas and McArthur, 2023).

Nevertheless, as per Hambura and Saarinen (2015), they have not yet made them sector specific. In contrast, as one of the developing nations, Botswana has outperformed other nations. The nation of Botswana acknowledged the necessity of addressing climate change and has made a number of efforts to create and put climate policy into action. In order to increase resilience to climate change, climate policy is required by encouraging low-emission climate practices and incorporating climate change concerns into different industries. The nation's commitment to addressing the challenges caused by climate change does not begin today. International protocols or environmental as table 1 indicates Botswana as a signatory at world level while Table 2 indicates the local policies adopted over the years.

In light of the information in Table 3, inferences on the suitability of the climate policies were successful or not. The forestry and land-use change major negative value emissions (Net Carbon Sink: -42,941 Gg CO₂ eq) show that the land-use policies of Botswana are taking up more carbon than they are releasing. This implies effective laws or procedures for helping to sequester carbon in forest conservation, afforestation, or replanting projects and mitigating climate change. Additionally, the data show that the nation is still generating GHS from the sectors of trash, agriculture, and energy. This is due to the nation's heavy reliance on fossil fuels energy and lack of basic understanding of waste management and sustainable agriculture managerial techniques. The GHG emissions are increasing with time also because of an increase in the future energy demand (UNDP, 2021). It is clear that in order to combat this, the government has put in place policies (Table 2) that encourage the use of renewable energy, energy-saving techniques, and lowering dependence on fuels high in carbon and adoption of sustainable farming methods, waste measures for recycling

and management. Although substantial, the 7,434.223 Gg CO₂ eq total emissions are only largely and partially countered by the significant negative value of emissions from forestry and changes in land use, producing a -35,506.777 Gg CO₂ eq in total. This indicates that, all things considered, Botswana is serving as a carbon sink which is a good result in the framework of international efforts to tackle climate change prolonged efforts to improve mitigation strategies and climate change legislation across a range of industries can help increase Botswana's resistance to climate change and its part in the global climate movement.

In 2014, Botswana initiated a thorough climate change policy drafted by a team led by Dr. Oduetse Koboto, a consultant from the United Nations Development Programme (UNDP), cooperated with members from UNDP and the Ministry of Environment, Wildlife, and Tourism (MEWT) (UNDP, 2017). The policy prioritises adaptation amongst different sectors, including agriculture, water, human health, biodiversity, ecosystems, forest management, reducing risks, mitigation, sustainable energy, transport emissions, and waste management. It advocates for integrated strategies such as Climate SMART Agriculture, sustainable water management, studies on climate change's health impacts, biodiversity conservation, forest rehabilitation, risk mitigation plans, mandatory mitigation plans, introduction of carbon budgets and markets, investment in green technologies, reforms in transportation, and integrated waste management practices. These measures aim to enhance Botswana's resilience on climate change, mitigate greenhouse gas emissions, and enhance sustainable development across multiple sectors.

Climate Change Policies: Africa

Africa, which is the continent most vulnerable to climate change, has called urgently for actions to support the effort to arrest this major global challenge, despite the

continent's lesser contribution (UNEP, 2023). The major share of CO₂ emissions in the energy field comes from the combustion of fossil fuels either for power generation or to fuel vehicles and machines (EIA, 2023). Another notable source is the carbon-intensive cement industry which represents a consistent case of source composition; several nations are grappling with such problems in the face of specific policies. In South Africa, for example, the carbon tax policy provides for industrial emissions, including those emanating from cement production; the policy envisions the uptake of cleaner technologies and practices (South African Revenue Service, 2023).

Botswana's Frameworks pertaining to climate have as a result undergone change while adhering strictly to this regional promise to strengthen climate resilience, support sustainable development, and safeguard ecosystems, people, and wildlife in Botswana. This will be done in an effort to make sure it can meaningfully participate in the group effort to mitigate the negative effects of climate change and that these are codified in robust climate policies that are subject to compliance with those established within the Sustainable Development Goals and Agenda 2063 of the African Union.

Climate Change Policies: Global Context

Countries have established international policies to guide their efforts in mitigating climate change, building capacity, and promoting sustainability. Cement production is a significant focus in these policies due to its high CO₂ emissions. For instance, the European Union's Emissions Trading System (ETS) includes cement manufacturers, incentivizing reductions in emissions through market mechanisms (European Commission, 2024). Similarly, China has introduced stringent emission standards and promotes the use of alternative materials in cement production to reduce its carbon footprint.

Table 1. Showing the Environmental conventions where Botswana was once a signatory. Adapted from (The World Bank, 2010)

Convention	Ratification date
The Vienna Convention for the protection of preservation of the Ozone layer	04/12/1991
The Protocol on Montreal on the Substances that deplete the Ozone layer	4/12/1991
The London Amendment to the Montreal Protocol	13/5/1997
The Copenhagen Modification to the Montreal Protocol	13/5/1997
The United Nations Framework Convention on Climate Change (UNFCCC)	27/4/1994
Kyoto Agreement	7/8/ 2003

Table 2. Botswana Climate Policies with years of adoption (World Bank Group, 2021).

Policy/ Adoption year	Policy explanation
National Climate Change Policy (energy policy draft) 2014	Outlines measures for both adaptation and mitigation adaptation, focusing on sectors like energy, agriculture, water, health, and risk mitigation.
National Adaptation Plan (NAP) Framework Policy 2020	Identifies priority areas for action, including sustainable water use, agriculture, health, and disaster risk reduction
Climate-Smart Agriculture (CSA) Initiatives 2020	Initiatives that integrate climate adaptation and mitigation measures into agricultural practices and policies.
Climate Change Strategy and Action Plan 2018	Strategies to enhance resilience and reduce vulnerability to climate-related hazards such as floods, droughts, and storms.
Botswana Climate Change Response Policy (BCCRP) 2016	Strategies to enhance resilience and reduce vulnerability to climate-related hazards such as floods, droughts, and storms.

Table 3. Showing the Greenhouse gas (GHG) inventory of Botswana for 2000 (MEWT, 2009).

Industry	Emissions Gg CO ₂ eq	Sink Gg CO ₂ eq
Energy	5 537.9	-
Agriculture	1 785	-
Waste	111.3	-
Land-use change and forestry	-	- 42 941
Total emissions	7 434.2	-
Net Total (after subtracting sink)	- 35 506.8	-

Table 4. African Climate Change Policies with years they were adopted. (CAADP 2013, SADC 2003, AREI 2015, African Union Framework on Climate Change 2014, ARC 2012)

Policy	Year it was adopted	Signatory countries
Comprehensive Africa Agriculture Development Program (CAADP) - African Union	Adopted at the African Union Assembly in 2013.	All 55 African Union member states
Southern African Development Community (SADC) Regional Agricultural Policy	Adopted in 2003	All 16 SADC member states
African Union's Africa Renewable Energy Initiative (AREI)	Launched at the United Nations Climate Change Conference (COP21) in Paris in 2015, with the endorsement of African heads of state and governments.	50 countries
African Union's Continental Framework on Climate Change	Adopted in 2014	All 55 AU member states
African Risk Capacity (ARC)	Established in 2012 and has since provided climate risk insurance to several African countries.	34 African States
African Union's African Adaptation Initiative (AAI)	Adopted at COP21 in Paris in 2015	54 African states
SADC Climate Change Strategy and Action Plan	Adopted by the Southern African Development Community (SADC) in 2015	All SADC member states
ECOWAS Climate Change Policy	Adopted by ECOWAS Authority of Heads of State and Government in 2013	15 ECOWAS member States
ECOWAS Renewable Energy Policy	Adopted by the ECOWAS Authority of Heads of State and Government in 2013	15 ECOWAS member states

Table 5: Key Global Climate Change Policies and Years Adopted (UNFCCC Annual Report, 2022). The table below outlines 5 critical global policies that form the foundation climate change policies, including their years of adoption and the number of signatory countries out of a total of 197.

Policy	Year of adoption	No of signed countries/parties
Kyoto Protocol	1997	192
Paris Agreement	2015	196
Montreal Protocol	1987	197
Copenhagen Accord	2009	140
Glasgow Climate Pact	2021	197

ANALYSIS OF CLIMATE CHANGE POLICIES

Botswana

Botswana's current solar energy policies aim to adapt and mitigate climate change impacts. The policies focus on various sectors including energy, agriculture, water resources, health, and disaster risk reduction. Botswana has committed to reducing its reliance on coal-generated energy, which currently accounts for 80% of its overall demand. The country plans to reach 25% of total energy consumption from renewable sources by 2030. Additionally, Botswana is exploring opportunities in the gas industry to provide clean thermal energy solutions. The launch of Solar PV IPP Projects (235 MW), particularly the Mmadinare and Jwaneng solar plants, is a significant step towards achieving these goals and these projects are projected to produce 100 MW of energy each by 2025. Botswana has also made strides in agriculture through the Climate-Smart Agriculture (CSA) Initiatives policy. Particularly to improve genetic features of the livestock breeds such as the Musi breed which took genetic upgrades of 7 varieties to make it tolerate drought conditions. Another success was to use genes of crops with the mentioned traits: drought resistance; tolerance to extreme temperatures; early maturity to produce a local Kalahari early Pearl, Kanye Standard and 65D hybrid seeds (African Development Bank, 2023).

In its latest move to tackle climate change, Botswana has made a framework for the National Adaptation plan which will help in building the nation's adaptive capacity and resilience and facilitate the integration of climate change adaptation into relevant policies. It addresses the medium and long-term adaptation needs. It also stipulates the approaches and guiding principles to be used. It further provides direction in the coordination, implementation and resource mobilization of the NAP process. I urge all relevant sectors and actors to use this Framework as a guide in pursuing climate change adaptation planning.

Africa

Africa has developed climate change-specific policies tailored to its member states, aiming to mitigate the continent's vulnerability to climate change impacts, transition to cleaner energy alternatives, and modernize agricultural practices for enhanced productivity. One such initiative is the African Renewable Energy Initiative (AREI), which was embraced by numerous countries in 2015. AREI seeks to promote renewable energy adoption throughout Africa to improve energy accessibility,

security, and climate change mitigation efforts. Kenya stands out as a commendable example in implementing AREI. The country has substantially expanded its renewable energy capacity, with geothermal and wind sources contributing to over 70 percent of its electricity generation. This shift has not only reduced reliance on fossil fuels but also improved energy access and facilitated greenhouse gas emissions reduction. Kenya aims to achieve 100 percent renewable power by 2030 and to foster green industries by 2040, as per the International Renewable Energy Agency (IRENA).

With renewables constituting nearly 90 percent of energy generated and consumed in 2021, Kenya emerges as a frontrunner in Africa's clean energy transition, according to the International Energy Agency (IEA). Additionally, Kenya has made significant strides in attaining universal electricity access, doubling access from 32 percent in 2013 to 75 percent in 2022, thereby transitioning away from biofuels for energy use. Kenya also has the Climate Change Act, enacted in 2016 to provide a regulatory framework for enhanced response to climate change, including mitigation efforts in industrial sectors (Wambua, 2019). The act emphasizes the importance of adopting sustainable practices and technologies in heavy industries like cement manufacturing. South Africa is another country making efforts to reduce emissions. Implemented in 2019, South Africa's Carbon Tax Act imposes a tax on greenhouse gas emissions from various sectors, including cement. This policy aims to encourage industries to adopt cleaner technologies and reduce their carbon footprint. The tax rate started at R120 (approximately \$8) per ton of CO₂-eq, with allowances and exemptions to help industries transition (Loewald, 2024).

Another significant regional initiative is the Comprehensive Africa Agriculture Development Programme (CAADP), which aims to achieve an annual agricultural growth rate of at least 6 percent and allocate a minimum of 10 percent of national budgets to agriculture among participating countries.

Global scale

The cement industry and fossil fuels are one of the largest contributors to global carbon dioxide emissions, with the cement industry accounting for approximately 7-8% of total emissions (Andrew, 2018). The production process is highly energy-intensive and relies heavily on fossil fuels, which releases a significant amount of CO₂. The demand for cement is growing due to rapid

urbanization and infrastructure development, exacerbating the environmental impact.

Countries have established international policies to guide their efforts in reducing emissions and mitigating climate change, building capacity, and promoting sustainability. The European Union Emissions Trading System (EU ETS) is a cornerstone of the EU's policy to combat climate change (European Commission, 2024). It is the world's first major carbon market and remains the largest one. The system caps the total level of greenhouse gas emissions from installations covered by the system and reduces the cap over time. Cement producers must hold allowances for their emissions, incentivizing the reduction of CO₂ output through efficiency improvements and technological innovation. Another prominent policy is the Global Economic Policy for Renewable Energy Promotion, which has been embraced by numerous nations, shaping their domestic frameworks accordingly. For instance, Germany's *Energiewende* (Energy Transition) Policy, initiated in 2010, aimed to significantly increase renewable energy generation, with a target for renewables to constitute over 40% of electricity production by 2020. Remarkably, Germany not only achieved this goal but also reduced greenhouse gas emissions by over 35% compared to 1990 levels, as reported by the World Economic Forum Energy Transition 2023 report. The policy has stimulated investments in renewable energy infrastructure, fostering job creation and economic growth.

Denmark, having adopted renewable energy policies since the 1970s, ratified the Global Economic Policy for Renewable Energy Promotion, leveraging initiatives such as feed-in tariffs and wind power promotion. Consequently, Denmark has emerged as a global leader in wind energy, with wind power playing a substantial role in its electricity generation. The country remains committed to research and development to further advance renewable energy technologies. In the United States, the adoption of the Global Economic Policy for Renewable Energy Promotion led to the establishment of Renewable Portfolio Standards (RPS) policies, mandating a specific percentage of electricity generation from renewable sources. Many states have made significant strides in increasing renewable energy capacity since implementing RPS policies, with renewables contributing nearly 20% of total electricity generation in the US as of 2020, according to the U.S. Energy Information Administration (EIA). However, challenges persist in achieving more ambitious renewable energy objectives, including policy uncertainties and infrastructure constraints.

Furthermore, the Paris Agreement has been embraced globally, serving as a foundation for countries to develop their policy frameworks, including agriculture-related measures in their Nationally Determined Contributions (NDCs) to mitigate greenhouse gas emissions and bolster resilience to climate change in the agricultural sector. Brazil, for instance, has committed to reducing greenhouse gas emissions by 37% by 2025 and over 53.1% of emissions from deforestation by 2030 under the Paris Agreement, implementing policies to combat deforestation in the Amazon rainforest and promote sustainable land use practices.

Similarly, China has set ambitious targets within its Paris Agreement commitments, aiming for CO₂ emissions to peak before 2030 and achieving carbon neutrality by 2060. The country has implemented various measures in the agricultural sector to address emissions, including improving soil health, increasing the use of organic fertilizers, and reducing methane emissions from rice cultivation and livestock farming. China has also expanded its low-carbon initiatives, with numerous pilot cities, industrial parks, and communities dedicated to reducing carbon emissions. Additionally, advancements in farming practices, such as selecting heat, drought, and low-light-resistant crop varieties, coupled with expanded irrigation areas, demonstrate China's commitment to mitigating climate change impacts in agriculture.

CONCLUSION

Analysing national, regional, and international climate change policies demonstrates that nations are realising more and more how important it is to combat climate change through policy interventions. For instance, Botswana has made impressive strides towards switching to renewable energy sources, namely solar energy. Implementing climate-smart agricultural activities to increase resilience and sustainability. The creation of the National Adaptation Plan framework represents a proactive approach to developing adaptive capability and incorporating climate change adaptation into relevant policies. Similarly, in Africa, measures such as the African Renewable Energy Initiative and the Comprehensive Africa Agriculture Development Programme highlight the continent's commitment to transitioning to cleaner energy sources and boosting sustainable agriculture. Globally, initiatives such as the Global Economic Policy for Renewable Energy Promotion and the Paris Agreement highlight countries' combined efforts to reduce greenhouse gas emissions and strengthen resilience to climate change.

However, problems remain, including the need for improved policy implementation, resource mobilisation, and international cooperation to meet ambitious climate targets.

To effectively address the climate issue, governments must prioritise taking action on climate change, make investments in infrastructure for renewable energy, encourage sustainable behaviour, and form international coalitions. To capitalise on past successes and accelerate climate action, local authorities should prioritise putting climate change legislation into effect and maintaining strong regional and international cooperation. The following suggestions are recommended in order to help strengthen climate change legislation to achieve climate goals:

To enhance the implementation of existing climate policies, authorities should put first their successful execution plans, checking that they align with national development priorities and allocate adequate resources for this purpose. Including knowledge-sharing and capacity-building seminars and activities in the plan is also of great importance in improving technical competency and increase climate change awareness among local residents, policymakers, and stakeholders.

Strengthen International Cooperation: Countries should strengthen their regional and international frameworks for collaboration and knowledge-sharing in order to optimize on best practices, generate capital, and transfer technology for climate action. Governments should accelerate the transition to renewable energy sources through policy incentives, investment frameworks, and regulatory reforms in order to reduce reliance on fossil fuels and reduce greenhouse gas emissions. **Promote Sustainable Agriculture:** Agricultural policy should prioritise sustainable practices, soil conservation, agroforestry, and climate-smart technology to improve resilience, food security, and rural livelihoods while reducing agricultural emissions.

Invest in Climate Resilience: To ensure resilience to the effects of climate change, governments should prioritise investments in climate resilience infrastructure, early warning systems, risk mitigation strategies, and community-based adaptation projects.

DECLARATIONS

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Data availability

The datasets used and/or analyzed during the current study available from the corresponding author on reasonable request.

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Authors' contribution

Dr. Mmoloki Makoba, Ms. Tshenolo Larona Chaba, and Mr. Question Jaden Ramontsho collaborated in gathering and examining literature for this paper. Furthermore, Dr Mmoloki Makoba undertook the task of composing the abstract, introduction and contributed valuable feedback and revisions during the writing stages. Tshenolo L Chaba authored the sections on Overview of Botswana's climate, Climate Policies in Botswana, conclusion, recommendation, and analyzed Botswana's policies. Meanwhile, Question J Ramontsho composed the sections on Africa and Global policies and conducted the evaluation of African and Global Policies.

Competing interests

The authors declare no competing interests in this research and publication.

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