Enhancing climate change adaptation governance through transforming institutions in Kwa-Zulu Natal Province, South Africa

Received 23 December 2022
Revised 22 April 2023
Accepted 17 July 2023

Richard Kwame Adom, Mulala Danny Simatele, Dillip Kumar Das, Kalumba Ahmed Mukalazi, Mazinyo Sonwabo, Lindelani Mudau, Mikateko Sithole, Serge Kubanza, Coleen Vogel and Leocadia Zhou
(Author affiliations can be found at the end of the article)

Abstract

Purpose – Globally, climate change governance continues to be a significant challenge to policymakers, environmentalists and politicians despite international summits, conferences and programmes designed to find sustainable solutions to the climate change crises. Climate change continues to be viewed primarily as a challenge for the future, whereas many leaders and administrators globally regard it as an environmental issue rather than a challenge that encompasses all aspects of life. In South Africa, these misleading perceptions of climate change continue to prevail both at national and local levels. The government and private organisations do not attach the required levels of urgency needed to address the climate change crisis. While numerous policies and institutions have been established to address these challenges, they lack financial backing, coordination and synergy that cut across the broad objectives of environmental, social and economic agendas. Additionally, weak, eroding trust and manipulating of institutions continue to hinder effective policy implementation and focus-driven governance. This paper aims to explore the structural and governance weaknesses of climate change administration in the KwaZulu-Natal province and South Africa in general.

Design/methodology/approach – This paper used extensive literature reviews and a triangulated approach to investigate the weaknesses of the current governance structure in the context of institutional and capacity constraints.

Findings – The findings uncovered that most institutions and organisations mandated to address climate change challenges operate in silos, lack required investment and capacity and have weak accountability mechanisms with a shallow understanding of climate change governance.

The authors are grateful to the NRF's Global Change Grand Challenges, under the funding instrument, "Global Change Social Sciences Research Programme", Grant no. 129481, for providing financial resources that enabled us to data on which this paper is based.

Conflict of interest: The authors of this paper declared that there is no conflict of interest in writing this manuscript.

International Journal of Climate Change Strategies and Management
Vol. 16 No. 4, 2024
pp. 413-438
Emerald Publishing Limited
1756-8692
DOI 10.1108/IJCCSM-12-2022-0157

Originality/value – This paper recommends better coordination between national, provincial and local governments as well as the private sector towards climate change activities and capacity to ensure that climate change actions are effectively implemented.

Keywords Adaptation, Climate, Governance, Resilience, Policy, South Africa, Sustainable development, Transformation

Paper type Research paper

1. Introduction

The climate crisis affects every sector and country; however, the impacts of climate change are not felt equally (Islam and Winkel, 2017). The impacts are highly contextualised and specific to regional trends (WeBling and Bechler, 2019). Humanitarian consequences of climate change are most severe in poorer countries due to weaker coping capacity and other challenges such as finance and capacity (Hallegatte *et al.*, 2016). Generally, Africa and Asia are the most vulnerable continents and humanitarian consequences of climate change. The impacts on smallholder farms are more pronounced in arid and semi-arid areas and rising sea levels in Southeast Asia's low-lying coastal plains (Malhi *et al.*, 2021). Moreover, Africa and southern Asia emerge as highly vulnerable regions to food insecurity. Climate-motivated migration trends of rural to urban domestic movement are especially pronounced in South Asia, East Africa and Central America (Mpandeli *et al.*, 2020).

In Sub-Saharan Africa, climate change impacted the gross domestic product, which declined by 10% in 2015 (Maino and Emrullahu, 2022). Hallegatte *et al.* (2016) further stated that the deleterious impact of climate change has contributed to global poverty, with Africa being the worst hit continent. A continent where one in every three people lives below the global poverty line, which is less than $1.90 per day. Consequently, the world's poorest people are often hungry, have less access to education, have no light at night and suffer from poor Health (Ray, 2021). Climate change exacerbates existing challenges in developing countries like food and water insecurity, natural resource degradation, income inequality, malnutrition, market volatility and compounding injustices (Mugambiwa and Tirivangosi, 2017). Rising temperatures and severe droughts threaten the incomes and yields of critical food crops, increasing pests, diseases, food costs and malnutrition (Godde *et al.*, 2021). Extreme weather and climate events have resulted in crop failures and loss of livestock, creating price spikes that make nutritious food inaccessible to vulnerable communities (Ray, 2021). Wetter conditions and rising temperatures have also negatively impacted livelihoods, affecting food safety during transport, storage and processing (FAO, 2015). Climate change is also stressing water and sanitation services and resources. Droughts, floods and storms have destroyed water and sanitation systems, putting the economies and lives of over one billion people at risk through a decline in water quality which has contributed to increased water-borne diseases, and led to increased diarrhoea cases, malnutrition and mortality among children (Ahmed *et al.*, 2022). To support this assertion, Atanga and Tankpa (2021) opined that climate change is already threatening food security in many parts of the world; in Asia, the rice fields are being flooded with saltwater, cyclones have wiped out vanilla crops in Madagascar; in Central America, higher temperatures are ripening coffee too early, droughts in Sub-Saharan Africa is withering chickpea crops and risen ocean acidity is killing oyster and scallops in American waters. Collectively, agriculture, forestry, fisheries and aquaculture are buckling under rising temperatures, wildfires, droughts and floods (Lakhani *et al.*, 2022).

South Africa is not immune from the effects of climate change and its negative consequences (Chersich *et al.*, 2018). Climate change in the country is leading to increased temperatures and rainfall variability (Nsubuga and Rautenbach, 2018). Evidence shows that

extreme weather events are becoming prominent due to climate change (Ndlovu *et al.*, 2021; Scholes and Engelbrecht, 2021) pointed out that the country has already experienced a high degree of risk from natural hazards and disasters, in particular droughts, floods and storm-related events, such as high winds, coastal storm surges and hail, all of which are likely to be exacerbated by climate change. Extreme rainfall events already result in costly infrastructure repairs, road closures, limited access to electricity and flooding and pollution as sewage and stormwater systems are overwhelmed (Bouchard *et al.*, 2022). Similarly, Dube *et al.* (2021) disclosed that temperature anomalies are also affecting critical infrastructure, such as roads and rail lines. Rainfall and temperature changes will continue to affect agriculture and food security, and extreme weather events can hamper tourism and the livelihoods that depend on the sector (Dube *et al.*, 2021). Past flooding has already contaminated water supplies. Additionally, decreased rainfall and higher temperatures (including heat waves) have led to significant water restrictions and increased demand for water and energy for cooling across all sectors (Adom *et al.*, 2022). Extreme rainfall continues to erode soils, degrade lands and put ecosystems and the services they provide at risk (Clarke *et al.*, 2022).

Considering the devastating consequences of climate change to sustainable livelihoods across the globe, countries have debated on how to combat climate change since the early 1990s. These negotiations have produced several important accords, including the Kyoto Protocol, Paris Agreement, United Nations Framework Convention on Climate Change (UNFCCC), COP26 in Glasgow and COP27 Sharm el-Sheikh in Egypt. While acknowledging that some progress has been made globally, regionally and at national levels in terms of translating these international policies and regional levels through intermediate regional bodies, the risks communities face, such as extreme floods, droughts and erratic weather events, demonstrate the failures and the weaknesses of the global climate change governance by these structures (Grynspan *et al.*, 2021).

The national climate change governance in South Africa is the product of more than two decades of policy evolution and has been shaped by an elaborate landscape of executive policies, strategies, regulations and institutions (Chersich and Wright, 2019). The 2004 National Climate Change Response Strategy, followed by the National Climate Change Response White Paper, signed and rectified in 2011 and 2012, laid the basis of national climate policy. In 2012, climate change became a vital element of the National Development Plan (Madondo and Nkwana, 2021) and was regarded as the first national policy that was entirely dedicated to climate change adaptation. The policy lays out guiding principles for its application, highlights adaptation and mitigation priorities and proposes the necessary legal, regulatory and governance structure (DWS, 2017). It further defines the roles of various stakeholders and mechanisms for coordinated climate change action in the country. This policy is aligned with South Africa's Vision 2030, which acknowledges climate change as a challenge and lays down clear strategies for dealing with it, including developing strategies and institutions, strengthening coordination systems at national and local levels and capacity building of local governments and decision-makers (CoJ, 2015). Besides this policy, South Africa has other policies that provide options for potential climate adaptation, although they do not explicitly mention climate change. These include the National Environmental Management Act (NEMA) 1998, the National Water Act of 1998, the National Water Resource Strategy of 2004, 2013 and 2020, the National Climate Change Adaptation Strategy NCCAS (2018) and the National Climate Change Response – White Paper (2017). Al these policies provide the guidance and platform to integrate responsible environmental management with climate change adaptation strategies in line with the country's social and economic development targets (Averchenkova *et al.*, 2019). From a mitigation perspective, other policies, like the White Paper on Energy of 1998 and the

Electricity Regulation Act of 2006 and its amendments, also address climate change-related issues through decarbonisation objectives, as they encourage diversification of the energy mix, with introduction and subsequent increase of renewable energy in the country and indicate the need for sustainable use of resources when generating electricity. They are further supported by other policies like the Integrated Resource Plans, which scale up renewables in the energy capacity (DMRE/DPE?). In addition, the framework for just transition under the Presidential Climate Commission ratified in 2020 defines the principles and policy measures for transitioning to greater climate-resiliency to minimise the socioeconomic impacts on populations associated with carbon-intensive activities as the country's transitions to low-carbon energy alternatives which constitute largely renewables.

Although considerable progress has been made in developing a governance structure for climate change in South Africa, the implementation is often constrained by a lack of harmonised and sectoral planning (Leck and Simon, 2018). Kamarck (2019) further opined that weak institutions in the public and private sectors are fundamental causes of poor implementation of climate action in the country. Averchenkova *et al.* (2019) alluded that although South Africa has put in place one of the most elaborate climate governance systems among developing and emerging countries, enforcing these policies is weakened both horizontally and vertically among the national government departments and between national, provincial and municipal governments, as well as with non-state actors. These policies are operationalised mainly on silo-based approaches and lack effective coordination in raising funds to implement the National Determined Contribution (NDC) and related policies (Chevalier, 2021). The lack of coordination is caused by a combination of factors such as a lack of high-level direction and clear institutional mandates for implementation; a relatively weak agency politically (Department of Environment Affairs mandated to lead), inadequate resources and a lack of robust institutions and capacity for both in public as well as the private sectors (Cerna, 2013; Adom *et al.*, 2021). The lack of capacity to deal with climate change and related policies within the government stems from limited human and financial resources and a shortage of relevant expertise and skills (Ziervogel *et al.*, 2014). Several vital institutions are commonly understaffed. This situation is exacerbated by the growing complexity of work involved in designing and implementing sectoral and multisector decarbonisation and resilience policies. These challenges are more acute at the provincial and local levels. Averchenkova *et al.* (2019) further mentioned that there is a lack of clarity on the roles and responsibilities of individual sectoral agencies concerning climate change policy, which has complicated communication and limits effective engagement among various actors in climate change governance. Popoola *et al.* (2020) and Anvari *et al.* (2022) identified a lack of credible data on current and projected greenhouse gases (GHGs) emissions and weak institutions as significant constraints to climate change governance in the country. From the perspectives of these authors, weak governance and institutions limit individuals' and societies' coping capacities in the face of climate change. In the absence of strong institutions, the negative effects of climate change are worse.

Given these governance failures, South Africa has been exposed to adverse impacts of climate change in water provision, food production, massive unemployment, outbreak of communicable diseases and threats to a sustainable livelihood (Adom *et al.*, 2022). The increased heat stress as a result of climate change has affected crop productivity, leading to hunger and starvation (Masipa, 2017). For instance, due to climate change, less than 9% of the annual rainfall received reaches the country's rivers, whereas barely 5% recharges the groundwater aquifers (Mupangwa *et al.*, 2016). As a result, the country's water security is under serious threat. Currently, most provinces are prone to supply deficits of more than 30% (Adom *et al.*, 2020). Rising water demand and increased pollution across shared water resources

are critical problems. Projected climate change impacts on the water sector in South Africa could exacerbate existing conflicts and further increase inequalities regarding limited access to potable water (Chersich *et al.*, 2018). In addition to coastal flooding due to rising seas, inland river floods are common in South Africa and are projected to worsen. By the 2030s, an additional 100,000 people may be at risk of river floods annually due to climate change, and over a million people are due to face socioeconomic challenges due to flooding (Dube *et al.*, 2021).

As a result of these impacts, some researchers, policymakers and commentators have engaged in these complex issues and proposed alternative strategies to tackle and improve climate change governance in South Africa. For instance, Averchenkova *et al.* (2019) investigated climate change policies and mitigation strategies in South Africa. Their study examined the governance challenges and identified opportunities for addressing them to improve climate policy implementation. Carter and Gulart (2014) explored the impact of climate change on water, energy and food security; their study concluded that climate change would exacerbate the challenges of meeting the population's water, energy and food needs. Therefore, understanding the effects of climate change adaptation measures is required to cope with the changes. Alves *et al.* (2020) evaluated the challenges and barriers in the governance of climate change adaptation. These authors enumerated the various institutional constraints to climate change governance. However, studies investigating how institutional and capacity weaknesses affect climate change governance in South Africa are limited in various literature. Considering these gaps, this paper explores institutional and capacity weaknesses in addressing climate change challenges are explained in Sections 4.2 and 4.4. The rest of the paper is structured as follows: Section 2 provides a literature-based overview of climate change governance in global and South African contexts, the policy and institutional framework of climate change governance, Section 3 provides the materials and methodology of the paper, Section 4 deals with the empirical evidence, whereas Sections 5 and 6 provide the discussions, conclusion and recommendation of the study.

2. Literature review on climate change governance in South Africa

2.1 Definition of key terms

2.1.1 Climate change governance. Climate governance is the measure that ensures the interests of those most affected by climate change are met (World Bank, 2020; Dubash, 2021) also described climate change governance as how different parties within national and international organisations deal with climate actions, honour their obligations and take decisions and be held accountable. Climate change governance involves policies, plans and measures that the state and its citizens put in place to address climate change. Carothers *et al.* (2014) further postulate that Climate governance is an inclusive, transparent participation, power and responsibilities that all stakeholders, civil society, the private sector and governments have a voice.

2.1.2 Multilevel climate change governance. Multi-level climate governance encompasses the structural and institutional setting in which different levels of government distribute roles and responsibilities, coordinate and cooperate on climate action, as well as the specific instruments that are implemented at different levels of government to support and implement local climate action (Janicke, 2017). Its purpose is to promote opportunities and prompt action in addressing climate change at each level of governance (Marquardt, 2017). These decision-making and discussion processes may be formal or informal, flexible and adaptive, and can take place at different levels: local, national, regional or international ((Nasiritouris *et al.*, 2016).

2.1.3 Institutional weaknesses. Brinks *et al.* (2020) define institutional weakness as the gap between the actual and intended effects of the institution. As a by-product of human

creation, institutions are directly affected by the political and administrative elite's behaviour; human elements such as deliberate and accidental render institutions weak. In terms of climate change, weak institutions are manifested in the manner in which governments, private sectors and public institutions are unable or unwilling to perform the roles and responsibilities due to a lack of political authority, governance arrangements, technical incompetence and capacities.

2.1.4 Institutional capacity. Institutional capacity is defined as developing and strengthening the skills, instincts, processes and resources that organisations need to survive, adapt and thrive in a fast-changing world (UN, 2021). An essential ingredient in institutional capacity is transforming institutions to go beyond the tasks of changing mind sets and attitudes. Institutional capacity in climate change governance are structures set up to address climate change issues, such as monitoring, carrying out risk assessments, enhancing knowledge sharing and coordination and creating awareness among the population on climate change issues.

2.2 Climate change institutions and multilevel governance structures in South Africa

Climate change governance structure in South Africa is inherent in the National Climate Change Response Policy (NCCRP), the White Paper of 2011 and the Draft Climate Change Bill of 2018 (Lukey, 2020). These policy documents established a multilevel governance system, which advocated for vertical and horizontal structures (Averchenkova *et al.*, 2019). The vertical governance structure integrates the three spheres of government: national, provincial and local/municipalities in the climate change administration in the country (Giordano *et al.*, 2011). The 1996 Constitution of South Africa guarantees the autonomy of each of these government spheres (Giordano *et al.*, 2011). Similarly, Leck and Simon (2018) disclosed that the NCCRP also provides a clear legal framework for mainstreaming climate change planning and action between the different spheres of government. The National Department of Environment, Forestry and Fisheries (DEFF) is the head and primarily responsible for coordinating and managing all climate change-related information such as mitigation, adaption, monitoring and evaluation programs (Ortega-Cisneros *et al.*, 2021). The DEFF also plays a central role in coordinating and policymaking role as the designated authority for environmental conservation and protection in South Africa (Lukey, 2020). It monitors national environmental information, policies, programs and legislation related to climate change. The department is responsible for providing guidance and ensuring a clear alignment of policies and international obligations regarding climate change (Averchenkova *et al.*, 2019).

At a provincial level, departments responsible for the environment are assigned to lead climate change response action in collaboration with their respective environmental departments and provincial entities (Chersich and Wright, 2019). Most of the lead departments have established provincial climate change structures to provide a platform for provincial stakeholders to jointly learn about climate change and coordinate their responses (Giordano *et al.*, 2011). At the local level, the local government (district, local municipalities and metropolitans) are mandated to support, educate, create public awareness and assist communities in building a better and more sustainable environment and enhancing resilience (Leck and Simon, 2018). Based on the Draft Climate Change Bill of 2018, the local governments have substantial autonomy to develop by-laws and policies that can be scaled up to influence national climate policies (Lukey, 2020).

Besides the vertical governance setup in the country, the NCCRP also promotes horizontal governance of climate change. Horizontal coordination promotes actor-to-actor interactions at the same governance level, such as national sector forums, regional governance bodies, bilateral city-to-city cooperation arrangements and wider (transnational) local government

networks among actors (Chan *et al.*, 2022). In South Africa, horizontal coordination is linkages between national sectoral departments that address mitigation or adaptation measures towards climate (Chersich and Wright, 2019). Transport, water, agriculture, industry, environment, energy and housing each devise policies which limit or increase GHG emissions or favour or hampers adaptation to climate change. Horizontal coordination deals with promoting climate policy initiative (CPI) across the different departments and, thus, strengthening policy coherence.

Despite the country's progress in formulating policies and strategies over the past two decades and widespread acknowledgement that effective implementation of adaptation requires strong horizontal policy coordination and mainstreaming by governments, there have been widespread implementation deficits, right from national to municipality levels (King, 2022). There has been difficulty translating policy goals into concrete adaptation initiatives that address climate change challenges (Fox and Alldred, 2020). Two main constraints stand out as hindrances to policy implementation in South Africa, namely, institutional weaknesses and capacity constraints. Averchenkova *et al.* (2019) and Biesbroek (2021) believed that coordinating adaptation policies vertically and horizontally between departments across agencies and integrating adaptation objectives into these institutions and organisations are the key objectives of the Paris Agreement. However, horizontal policy coordination to address cross-cutting issues such as climate change has been an eternal challenge for public sector organisations (Trollip and Boulle, 2017). Effective policy coordination and implementation are stymied by differences in professional understandings of policy issues, information asymmetries between departments, competition for scarce resources and policy turf battles (Trollip, 2018). Similarly, Morrison-Smith *et al.* (2020) concurred that working horizontally has high costs, such as the need for compromise, more time spent in meetings, increased paperwork, blurred accountability and more complex reporting. Furthermore, institutional and organisational philosophies limit effective planning for climate change programmes (Kauffman and Hill, 2021). These authors opined that climate change is treated as an environmental problem rather than something that can affect all aspects of an enterprise; therefore, its planning is siloed rather than mainstreamed that must be addressed across all activities within organisations in the country. There is also a lack of linkages between national, provincial and local actors, which results in poor implementation climate change adaptation policies in South Africa (Masud *et al.*, 2023). Finding ways to surmount these obstacles is the drive and direction of this paper. The paper explored various literature to answer these key questions: what are the underlying causes of institutional and capacity constraints to policy implementation and what strategies are appropriate to improve policy coordination through the National Adaptation Strategy in South Africa?

2.3 Policy frameworks and adaptation strategies to climate change in South Africa

South Africa has enacted numerous policies and sets of legislation to regulate and govern climate change (van der Bank and Karsten, 2020). du Plessis (2017), Chersich and Wright (2019) and van der Bank and Karsten (2020) disclosed that the policies governing the country range from sectoral statutes to global conventions. Chersich and Wright (2019) and van Bronkhorst (2019) stated that South Africa is a signatory to the UNFCCC that ratified the Kyoto Protocol and further adopted the Paris Agreement, which endorsed the need to mitigate the emission of GHG and also consigned a trilateral agreement with India and Brazil Although the country is not formally bound to specific emission targets as recognised by UNFCCC, it has adopted accepted targets prescribed by intended NDC to implement climate change measures (van der Bank and Karsten, 2020). Averchenkova *et al.* (2019) further highlighted that South Africa has become decisively integrated into climate change and related environmental regimes at regional, continental and international levels by either signing or ratifying a bewildering array of protocols, treaties, agreements and frameworks

that guide its policies, programmes and strategies in this regard. Furthermore, the country is a party to Environmental Impact Assessment (EIA), a key strategy for achieving climate goals. Boess *et al.* (2021) stated that an EIA is a tool used to plan and manage activities that promote sustainable development as envisaged by the SDG agenda 13.

The South African Constitution (Act 108 0f 1996) provides an overall legal framework for climate change governance (Averchenkova *et al.*, 2009). The promotion and protection of the country's natural environment and association with global, national sectoral and local dealings with the environment are clearly defined by the constitution du Plessis (2014). Besides the constitution, South Africa has adopted the NCCRP to enhance climate change governance. This policy is a comprehensive plan designed to address both mitigation and adaptation in the short, medium and long-term goal of reducing GHGs emissions (Zipplies and van Schalkwyk, 2008). The policy has two main objectives, firstly, to manage inevitable climate change impacts through interventions that build and sustain social, economic and environmental resilience and emergency response capacity, and secondly, to make a fair contribution to the global effort to stabilise GHG concentration in the atmosphere. Popoola *et al.* (2020), von Heyden *et al.* (2016) and van der Bank and Karsten (2020) posited that the principle of the policy encompasses these key sectors in the country: Agriculture – Conservation of Agricultural Resources Act (1993), Water Affairs and Forestry – National Water Act (1998); White Paper on a National Water Policy for South Africa (1995), Land – Development Facilitation Act (1995) Minerals and Energy – White Paper on SA's Energy Policy (1998), White Paper on Renewable Energy (2003), the White Paper on Environmental Management Policy (1997), White Paper on Energy Policy (1998), Air Quality Act (2004), White Paper for Sustainable Coastal Development (2000), EIA Regulations, National Environmental Management Act (1998), Strategic Framework on Sustainable Development in South Africa and National Disaster Risk Reduction and Management. The underlining objectives driving the key policies on climate change in South Africa are prioritising cooperation among the stakeholders in the climate sectors, promoting research, enhancing investment, adapting to lower-carbon emissions and clean energy as well as energy-efficient technologies to increase productivity, creating new employment opportunities either within the existing sectors or to establish new sub-sectors to enhance sustainable livelihood among the population (Wright, 2022). Despite these laudable objectives, policies, strategies and other institutional frameworks, tools to support mainstreaming climate adaptation in policy, and the political will from governments, implementation has lagged (Runhaar *et al.*, 2018). Olazabal *et al.* (2019) argued that formulating policies on their own does not translate into enhancing climate. This argument was echoed by Mokwena (2009) that climate change governance in South Africa and globally failed to live up to expectations due to the absence of comprehensive mitigation and adaptation strategies and the lack of national legislative provisions that incorporate the perspective of critical actors.

2.4 Institutional and capacity weaknesses of climate change governance in South Africa

Climate change is a complex cross-cutting issue that cannot be the sole responsibility of one government department or organisation (Corfee-Morlot *et al.*, 2009). Additionally, it is a developmental issue due to its dynamic impacts on social, economic, environmental and sustainable livelihoods (Thakur, 2020; Duru *et al.*, 2022) posited that due to the interlinkages of climate change to social, environmental and economic development, effective collaboration of institutions and role-players is key to meeting the objectives of climate change governance. In general terms, capacity in climate governance is the ability to perform functions and solve problems identified within a community that involves climate (OECD, 2021; Rawlins and Kalaba, 2021); it also defined capacity as processes by which individuals or institutions obtain, improve or retain the skills, knowledge, tools, equipment or resources to address climate

challenges effectively and competently. Institutions are bodies or organisations, formal or informal, with the task of undertaking specific functions (Mthembu and Nhamo, 2021). Therefore, institutional capacity in climate governance addresses specific target groups or administrations involved in climate change adaptation, focusing on a particular climate threat or dealing with multisector and multi-threat perspectives (Alaert, 2019). Institutional capacity also focuses on how institutional settings, rules and regulations enable actors to collaborate and address shared problems that address climate change (Koop *et al.*, 2017). Universally, a well-developed and sufficient institutional capacity is the instrument for operationalising climate policies and regulations (Schinko *et al.*, 2017). Matthews (2011) further disclosed that structural organisations and cooperation with relevant agencies and stakeholders; are the foundation for any effective climate change governance.

South Africa's climate change governance is shaped by the country's history and social, economic and environmental circumstances (Giordano *et al.*, 2014). Post-independence in 1994, the country adopted the multi-level system of governance by establishing a mutually dependent relationship of vertical, horizontal and network of different actors at different levels of society (Videira *et al.*, 2020). Multi-level climate governance is a continuous process of communication and collaboration involving a diverse group of national and local governments, international organisations, the private sector, non-governmental organisations (NGOs) and other social actors. It promotes opportunities and prompt action to address climate change (Martin and Fagerberg, 2015). Vertical coordination is the fragmentation between the three spheres of government, namely, national, provincial and local governments, with their environmental administrations and line of responsibility (Nedevska, 2021). The delegation of climate change governance to the lowest and local administrations and municipalities has placed increasing responsibilities and extended their roles from mainly service provision to that of active overseers and custodians of climatic issues (Sibiya *et al.*, 2005). Reisinger *et al.* (2011) further opined that local administration in climate change governance should implement national policies and strategies relating to climate. The local administrations prepare regulations and have both legal and financial resources to implement and enforce regulations. While at the same time having the responsibilities of raising the awareness of local communities, engaging and developing expertise and carrying out risk assessments at the local levels (du Plessis, 2017).

Despite institutions' vital role in enhancing climate action, many constraints hinder these institutions' effectiveness (Giordano *et al.*, 2011). These stem from institutional weaknesses, including insufficient inclusion of grassroots voices, poor coordination among policy actors, ineffective decentralisation and limited attention to capacity constraints, including limited human and financial resources (Tyler and Cohen, 2021). These constraints are exacerbated by the growing complexity of work involved in designing and implementing sectoral and multi-sector decarbonisation and resilience policies (van der Bank and Karsten, 2020). While these challenges generally affect climate change governance at the national level, they are severely felt at provincial and municipal levels, where numerous institutions are understaffed (Chersich and Wright, 2019). Furthermore, a lack of financial resources is required to augment governance capacities to work on climate change in the key agencies and to finance policy implementation and the underlying investments in the low-carbon and climate-resilient transition (Tyler and Cohen, 2021). The underlying cause of inadequate funding is the lack of a comprehensive climate finance strategy to define allocating resources to support climate change work and attract international funding and investment. Furthermore, there is a shortage of skills and capacity among government departments, devolved administrations and private actors to prepare financeable project propositions (Averchenkova *et al.*, 2019). Lack of gender representation is another constraint to climate

change governance (Zhang *et al.*, 2021; Pearse, 2017) posited that explicit and implicit norms and laws had imposed differentiated powers, roles and responsibilities on women and men in climate change governance and girls and women have been prevented from full fear of participation in global and national climate action movements. To support this assertion, Andrijevic and Cuarresner (2020) opined that Gender inequalities are evident in formal institutional responses to climate change; women are underrepresented in governing agencies, and climate policy can negatively affect groups of women. Likewise, Narksompong and Limjirakan (2015) pointed out that youth have traditionally been underrepresented in the decision-making process and offered few opportunities to have their voices regarding issues on climate change governance in South Africa. Table 1 summarises the underlying causes of weak institutions.

3. Materials and methodology

This paper used extensive works of literature and field surveys to explore the significance of robust and resilient institutions in addressing climate change challenges in South Africa.

3.1 The study area

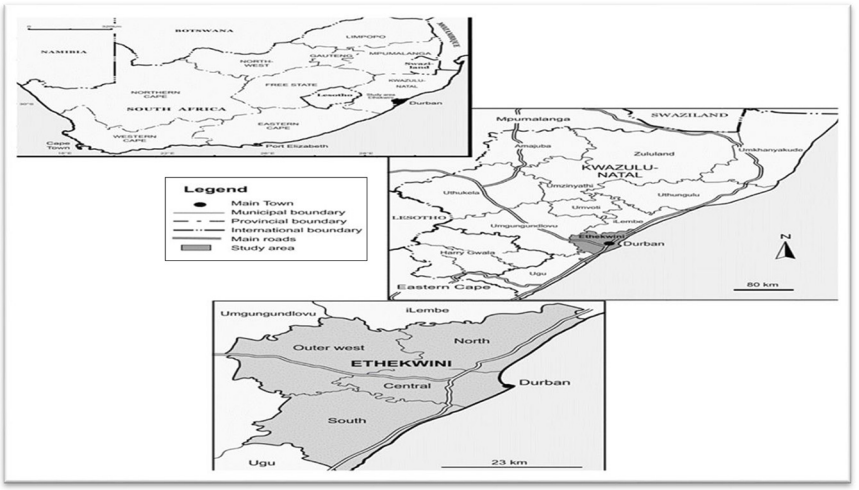
Data for this study were collected from EThekwini Metropolitan Municipality in the Kwa-Zulu Natal Province. Figure 1 shows the map of the study site.

The choice of this municipality is based on its geographical location and historical and socio-economical relevance to the country. But more importantly, this municipality has mixed phenomena of combating climate change. On the one hand, this municipality is known for its best and most proactive policies and programmes for combating climate

Institutional and capacity weaknesses	Explanation
Limited inclusion and participation in local institutions	Absence of transparency and inclusivity in governance structures and organisations
Political interference and corruption	Policy or action interferes with national or individual interests, inadequate involvement of stakeholders and interested parties, manipulations to suit peculiar interests
Strategic constraints	The dearth of clear-cut strategies and objectives, weak coordination of policies and activities among role-players and stakeholders
Planning insufficiencies	Lack of integrated planning, the nonexistence of both short and long-term planning, unachievable objectives and goals
Financial impediments	Inadequate funding both from national and private agencies and unwillingness to pay for climate services, and high operational and infrastructural costs
Skills and expertise	Shortage of qualified and professional staff, but at the same time overstaffed, lack of decision-making process, weak comprehension of complex and all-inclusive nature of decisions of strategies and lack of morale in the water sector
Information and communication impediments	The paucity of precise, consistent and adequate data and information, contradictory messages, poor coordination and dissemination of information and strategies
Lack of gender and youth representation	Women and youth are severely underrepresented, and their views are earnestly undermined in decision-making on climate change issues

Source: Adapted from Ampaire (2016)

Table 1. Institutional and capacity constraints to climate change governance in South Africa



Source: Cartographic Unit, University of Witwatersrand's Department of Geography and Environmental Studies, 2022

Figure 1.
The map of EThekwini Metropolitan Municipality

change in the country and the continent, yet the municipality is most vulnerable to climate disasters in South Africa and the entire continent (Mokwena, 2009). EThekwini Municipality is the first African city and the twelfth C40 city to deliver a climate action plan that aims to transition towards carbon neutrality and climate resilience while at the same time ensuring the benefits of these transitions are distributed equally (Taylor *et al.*, 2014). While acknowledging its sound programmes on climate change, the municipality is engulfed with significant social, economic, environmental and dual governance challenges (Taylor *et al.*, 2014). Unlike South Africa, the municipality's annual projected rainfall is 850 mm, much higher than the country's average of 450 mm (du Plessis (2017). Nevertheless, the municipality is still affected by periods of droughts. Climate change is projected to alter rainfall patterns in the municipality by intensifying rainfall variability. While average annual rainfall is expected to increase overall, it will be experienced through more intense storm events, resulting in more intense, frequent flooding (Botai *et al.*, 2018). A case in point is the 2019 and 2022 floods that ravaged houses, roads and bridges, killing over 400 people and destroying 19,113 homes with 128,743 people becoming homeless (Nicolson, 2022).

3.2 Sampling techniques and sample population

Data for this study were collected using a purposive sampling technique. Purposive sampling is an intentional selection of informants based on their ability to elucidate a specific theme, concept or phenomenon (Robinson, 2014). This approach was used to select respondents from senior to junior employees from the Environmental Planning and Climate Protection Department (EPCPD) and Energy Office of the EThekwini Metropolitan Municipality of Kwa-Zulu Natal Province. These institutions and personnel were chosen based on their responsibility of managing the municipality's climate change protection programmes and formulating and executing the municipality's mitigation and adaptation strategies. Similarly, it assisted in picking informants who have in-depth knowledge about climate change adaptation practices and have special expertise in climate change policies. Similar criteria were used to collect data from the Provincial Department of Environment and Tourism and the Federation

of Sustainable Environment (FSE), an NGO that is directly involved in climate change in the province. Accordingly, 10 individuals were thoroughly interviewed while 90 were handed questionnaires to answer questions comprising educational levels, positions or ranks, knowledge or expertise, years of experience and willingness to participate in the study were used to identify respondents for this study.

3.3 Data collection methods

This study used a concurrent mixed-method approach of interpretivism (qualitative) and positivism (quantitative) philosophies to obtain pragmatic insight and understanding of climate change governance in EThekwini Municipality and South Africa in general. A mixed research approach combines qualitative and quantitative research methods in a single research study (Creswell, 2003). It involves collecting and analysing qualitative and quantitative data to understand the phenomenon better and answer the research questions (Mershon, 2021). The central premise of using mixed methods research is that it strengthens each data type while neutralising any weaknesses (Fortem, 2020). This method was deemed appropriate for this study because it allowed the researchers to obtain different categories of data to address the aims and objectives of the study. A proportional distribution technique was used to distribute the questionnaires and contact the selected individuals. Creswell (2003) defined a proportional distribution as a sampling technique where the number of questionnaires and interviews carried out are based on the total number of people residing or employed in an organisation. This is to say that the larger the population, the more questionnaires are distributed. Based on the proportional distribution ratio, 40 questionnaires were sent to the staff of EPCPD, 30 to the Provincial Department of Environment and Tourism and 20 to FSE, based in Durban. The focus of the questions centred on the demographic information of employees in the institutions established to address climate change challenges. The same procedure was used to select the number of interviewees for the study. A total of five respondents, made of three senior managers and two junior rank employees, were selected from EPCPD from EThekwini Municipality, three senior employees from the Provincial Department of Environment and Tourism and two from FSE purposively selected for the interviews. Questions from these groups focused on constraints to climate change governance and strategies to enhance the governance of climate. Data was also obtained from different secondary sources. These include journals, book chapters, previous studies, government gazettes and conference proceedings. The secondary data emphasise policies and strategies for combating climate change in South Africa and the municipality.

3.4 Data analysis

The qualitative and quantitative data obtained were analysed simultaneously. Before carrying out the analysis, the quantitative data obtained from the field were coded, arranged and inputted in a coherent setup of Special Package using descriptive statistics of SPSS Windows Version 21. This technique assisted in data being captured and analysed and created frequency tables and graphs that guaranteed quick and easy interpretations of the data. The qualitative data obtained from interviews and secondary sources were analysed using thematic analysis. Thematic analysis is a method for qualitative data that entails searching across a data set to identify, analyse and report repeated patterns (Kiger and Varpio, 2020). The thematic analysis for this study provided a framework that enabled the transcripts of the interviews to be organised into themes of similarities. The data were then analysed using case summaries and thematic content derivative approach. This approach was based on grouping perspectives that have similar backgrounds or sentiments. Post the

grouping phases, both the quantitative and qualitative analyses were combined to explain, confirm, refute and enrich the paper.

4. Empirical evidence and analysis

The findings and analysis of this paper are structured to address the objectives set out in the study, which include underlying causes of institutional and capacity weaknesses to climate change and the alternative strategies for enhancing climate change governance in South Africa.

4.1 Factors constraining climate change governance

Human capital is the key to the success of any organisation or institution; therefore, to test the robustness and resilience of institutions in addressing climate challenges, the human capital of the municipality was assessed by looking at the demographics of human resources, with results depicted in Figure 2.

Figure 2 depicts that men dominate most of the institutions in charge of climate governance; of the 90 respondents surveyed, 61, representing 68%, are males compared to 32% females. Most of the employees, representing 44%, are between the ages of 40 and 49, followed by 22% between 30 and 39 years of age, with the minority above 60. In terms of experience, the majority of the respondents have vast experience in climate change governance; a total of 52 respondents, translating to 58%, have significant experience of over 20 years working in the climate change environment compared to 42% that had below 20 years of work experience. This paper examined the educational levels of respondents; of the 90 respondents engaged, eight or (9%) had a Matric qualification, 18 (20%) where is possession of a Diploma, 40 (44%) held bachelor's Degrees, whereas 20 respondents representing 22%, held different forms of postgraduate qualifications. Intrinsically linked to qualification are courses linked to climate change; the results show that 10 or (11%) of the participants had no studies linked to climate change, 40 (44%) had had courses somewhat related to climate, 20 (22%) had modules in climate while only 5 of the respondents representing 6% had taken studies in climate change. The results of the survey confirm the views of an environmentalist who was engaged in an interview; he posited that:

Gender	Male Respondents						Female Respondents				TOTAL	PER.%
	61	68%					29	32%			90	100%
Ages of Respondents	**20 -29**		**30 -39**		**40 -49**		**50 -59**		**60+**			
	10	11%	20	22%	40	44%	14	15%	6	7%	90	100%
Experience of Respondents	**0-5 yrs**		**6-10 yrs**		**11-15 yrs**		**16-20 yrs**		**20+ yrs**			
	5	6%	15	16%	18	20%	25	27%	27	30%	90	100%
Qualifications of Respondents	**Matric**		**Diploma**		**Bachelor**		**Honours**		**Master/PhD**			
	8	9%	18	20%	44	44%	15	16%	5	6%	90	100%
Qualification in climate studies	**No studies**		**Part of study**		**A module**		**Studied as course**		**Specialised**			
	10	11%	40	44%	15	16%	20	22%	5	6%	90	100%

Source: Authors' own creation

Figure 2. Demographic characteristics of respondents

> Demographic characteristics such as age, gender, qualification and expertise influence the understanding of vulnerability and climate change impacts, adaptations in different contexts, responsibility for greenhouse gas emissions, inequalities in climate governance, knowledge and social responsibilities required to address climate change phenomena. Per.com 2022 A.

Another interviewee from the Provincial Department of Environment and Tourism augmented this view. She stated that:

> Education, for instance, is a highly effective tool for enhancing climate change governance. It can potentially reduce the climate change literacy gap among different demographic groups and the gap between various income brackets in the municipality and the country. Advanced education or qualifications in climate change enhances holistic understanding and expertise in predicting, forecasting, preparing and devising effective coping strategies towards climate change. Per.com 2022 B.

While different views were shared, there is consistent evidence that most employees are in their positions due to political affiliation and other factors.

4.2 Underlying causes of institutional and capacity weaknesses to climate change governance

In spite of the significant role that institutions play in enhancing climate action, many constraints hinder these institutions' effectiveness. Considering these inferences, our study explores this by asking respondents to classify 11 sets of listed variables from "Minor, Moderate and Severe Constraints" and how they impact climate administration in the municipality. Figure 3 portrays the responses obtained from the field survey.

A breakdown of Figure 3 shows that all the 11 variables assessed are predominately rated under severe constraints. This means that each of the variables is a significant obstacle to climate change governance in the municipality and the country. For instance, out of 90 respondents who responded on financial limitation, 78 of them equating 87% associated lack of financial support as a significant barrier to climate change governance, only 4 (4%) and 8 (9%) regarded this variable as minor and moderate constraints, respectively. Similarly, 75 of the respondents representing 83%, linked lack of research,

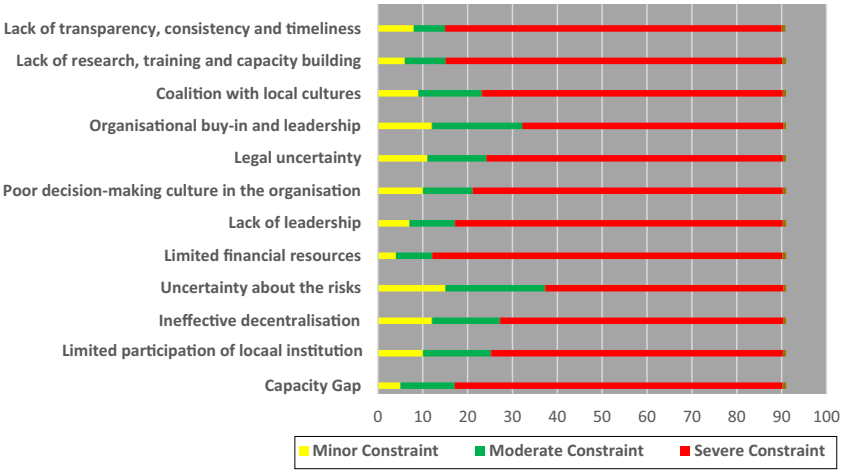


Figure 3.
Underlying constraints to climate change governance

Source: Authors' own creation

training capacity building and lack of transparency, consistency and timeliness as significant obstacles to climate governance. This statistical breakdown is consistent with the interviews conducted. For instance, a Director in the EPCPD who was engaged in an interview stated that:

> There is a wide range of constraints to climate governance in this region and South Africa. These range from people's lack of belief that climate change is a serious threat that must be addressed to a lack of financial resources and leadership. Specifically, this interviewee disclosed that the municipality is often challenged by limited financial, technical and human resources to plan for complex and contested issues such as predicting, forecasting and adapting to climate change. In most instances, the municipality has many competing issues that take more immediate priority. Leaving the municipality without sufficient resources to undertake comprehensive programs of adaptation from planning to implementation. Per.com 2022 C.

These observations were reiterated by an employee from the FSE who was engaged in an interview. She stated that:

> Lack of locally relevant and practical information about potential climate impacts compounded by a lack of technical expertise to interpret climate change projections, risk and hazard analysis and vulnerability assessment remained a significant barrier. This interviewee further mentioned that competing priorities, lack of interest in climate-related issues, and no specialised division to tackle climate change matters are significant barriers in the municipality. Improving climate change governance requires precise, accurate, and up-to-date information on private and public organisations, who pays for what, the status of infrastructure and who is held accountable for what. In practice, EThekwini municipality and many municipalities are lagging behind in this regard. Per.com 2022 D.

A Senior Lecturer of climate change from the University of Kwa-Zulu Natal contributing to the study said:

> Leadership shapes the decision-making culture of the municipality. This applies to both formal and informal institutions as people that champion climate actions. Good leaders inspire creativity and action, while poor and indecisive leadership make action difficult or impossible. Designing and implementing climate policies to reach SDG targets requires expertise and knowledge from proactive leadership. Unfortunately, many leaders in the country's municipalities do not have the appropriate skills and expertise to carry out these technical responsibilities of climate change governance. Per.com 2022 E.

A common view that cuts across most respondents suggests that national and local level climate change institutional capacity and knowledge are fragile. Most of the respondents believe that adaptation responses are considered low due to limited knowledge and expertise in dealing with climate change impacts.

4.4 Enhancement of institutions and capacity towards climate change governance

Based on perspectives of factors contributing to institutions and capacity weaknesses in climate change governance in EThekwini Municipality and South Africa, our study probed into strategies to strengthen institutions' functionality and capacity to improve climate governance. Respondents were asked what strategies should be implemented to improve climate change governance from an of listed variables from which they had to associate them as either "Least", "Moderate", "Priority" or "High priorities." Figure 4 depicts the answers from the respondents.

The survey results suggest that most of the respondents view enumerated strategies as either a priority or a high priority in improving climate change governance. This overwhelming response suggests that the population does not favour the current strategies in the municipality. For instance, 67 out of 90 respondents, equating 74%, concurred that there must be a reinforcement of strategic leadership, 17% see it as a priority only 2% regard this variable as not a priority. Similar results were uncovered in terms of human

capacity development; 94% regard the variable as either a high priority or priority, whereas only 6% have an opposing view. A series of interviews conducted buttressed the statistical information. For instance, a Director from the Provincial Department of Environment and Tourism who was engaged in an interview stated that:

> Climate change governance requires raising awareness and building strategic capacity both at institutional levels and within individual leaders. Establishing leadership for climate change should include creating dedicated committees that will focus on long-term strategic planning, defines climate-sensitive national priorities; promoting an intra-governmental coordinating committee, regular reporting to the communities and higher institutions, understand societal needs and evaluate the degree to which the national strategy is being translated into plans, budgets, and monitoring systems and regularly review the capacity of the institutions involved in climate change policy coordination. Per.com 2022 F.

Another interviewee from EPCPD who was conducted to share his opinion on this issue mentioned that:

> It is critical to strengthen the capacities of the climate change section in line departments and municipalities, mainly to improve the links between planning and budgeting and to support the preparation and implementation of climate change budget programmes. Development partners should work alongside national departments to build integrated strategies and capacities for disaster risk management, from comprehensive risk assessments to financial sustainability and predicting warning and response strategies. He further mentioned that is a need to institute healthier vertical coordination mechanisms from the national through provincials to the local level and horizontal communication among ministries, departments and agencies (MDAs) at each governance level. Establish technological and digital technologies to ensure communication improves among different levels of governance. Per.com 2022 G.

5. Discussions

The discussion of this paper was structured and sequenced to establish a holistic understanding of climate change governance in the municipality, South Africa and Africa under two key objectives: underlying causes of institutional and capacity weaknesses of climate change governance and strategies for enhancing governance of climate. Two key issues were advanced as underlying factors contributing to institutional and capacity weaknesses in

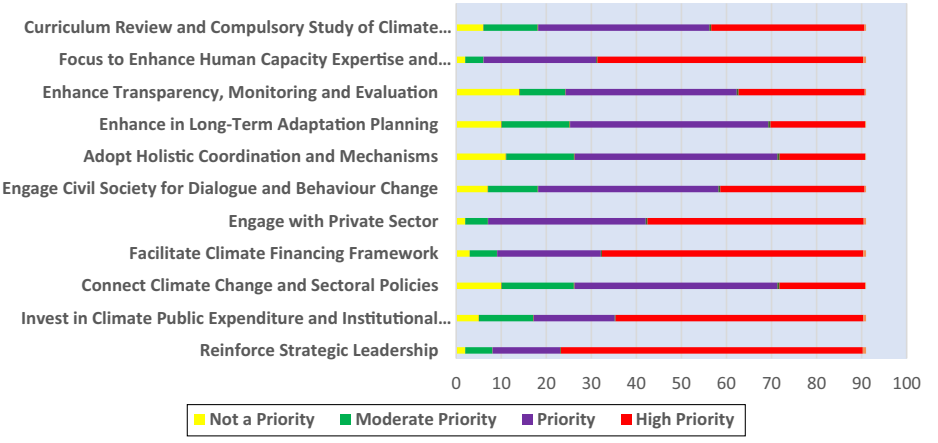


Figure 4.
Strategies to improve climate change governance

Source: Authors' own creation

climate change governance: the demographic setup of the institutions and resource constraints to climate governance. The majority of employees in the institutions of climate governance are between the ages of 30 and 50 and are male-dominant. This is contrary to the population distribution of South Africa. Within the country, young people under the age of 30 years form one-third of the entire population of South Africa (StatsSA, 2018). Their future will be adversely impacted by climate change; hence, they need to be at the forefront, with their voices driving the climate change agenda in the country. However, that is not the case in South Africa. The young population are completely alienated from decision-making both at the national and local levels. Our findings established that the disproportional representation of this age group undermines any effective climate change governance. Governance encompasses broader public participation in decision-making, particularly among the growing population segments. These findings are augmented by Narksompong and Limjirakan (2015) and Forino *et al.* (2015), that young people are key stakeholders in climate change governance and adaptation as well as future decision-makers; therefore, their engagement locally and nationally is vital for building resilience and developing effective climate policies and governance. Closely related to the age bias is gender discrimination; we established that women are hugely underrepresented in politics and strategic decision-making generally, as well as climate governance more specifically. Even though women tend to be affected more negatively by climate policies such as expansions of public transport, carbon pricing and taxes because these policies often overlook the needs of women and underserved groups, these findings confirmed the views of Kovaleva *et al.* (2022) who argued that men and women have unequal access to decision-making power, knowledge, skills, assets and networks, which translates into gender-differentiated exposure to climate change. Essentially, climate change has exacerbated gendered vulnerabilities and compounded intersecting forms of discrimination against women. However, policies aimed at developing the adaptive capacity at the community level, especially among agricultural and pastoral communities, often fail to recognise and respond to the gendered nature of women's experiences (Pearse, 2014). Furthermore, there is a need to develop systematic training and retaining initiatives in skills for climate jobs aimed at specific groups – youth, the elderly, people with disabilities, indigenous people, women, migrants, unemployed people and those living in the countryside. Including women in apprenticeship and skills training in climate, jobs are critical to overcoming disparities in the labour market and skills shortages in climate change governance. Our study further explored the impact of education, experiences and knowledge in climate studies on climate governance. The majority of the employees have over 25 years of working experience in climate change institutions and are well educated, holding at least a bachelor's or postgraduate qualification. However, less than 10% of the total employees have studied or have qualifications directly related to climate change. This statistical information suggests that while a significant number of employees possess adequate experience and higher qualifications, they do not necessarily have the skills and knowledge to perform climate change-related work, such as predicting climate-related disasters. These findings are like observations shared by Averchenkova *et al.* (2019) that there is limited expertise and skills personnel to deal with climate-related programmes such as predicting, forecasting, risk analysis and disaster management within private and public organisations in South Africa. It was established that the lack of qualified and professionally trained personnel in these institutions is the fundamental cause of climate change governance failures in South Africa. To work in these institutions, it may not be mandatory to have any competence in climate change or environmental knowledge. However, given the growing impacts of climate change on the country, it is prudent to reconsider training and educational systems to enhance institutional and human capacity in climate change governance. In addition, a careful assessment of skills needs and comprehensive capacity-building programs with a primary

focus on nurturing experts and professionals in the country's universities, colleges and other educational institutions.

Special attention was also given to resource gaps and institutional constraints to climate change governance. Several bottlenecks hinder the country's effective governance of climate change. A stand-alone constraint mentioned by a significant number of respondents and several academic literature, including Ampaire *et al.* (2016), Bracking *et al.* (2021) and Mello *et al.* (2022), is the lack of financial resources to enhance climate change governance in the country. It was established that a limited budget by the national government and donor agencies affects the overall operations of institutions to execute their plans. This includes limiting the technical capability of employees to effectively predict and analyse the threat and potential impacts of climate change and to develop viable adaptation strategies. These findings are also shared by Anvari *et al.* (2022) and Ampaire *et al.* (2016) that climate change budget allocation relies on financial support from bilateral and multilateral donor arrangements. These public and private sector funds are often insufficient to implement climate change action plans for the country effectively. Other interwoven constraints identified by this paper as institutional capacity weaknesses include poor institutional coordination, limited inclusion and participation of local and informal institutions, ineffective decentralisation, lack of leadership, lack of transparency, consistency and timelines, a coalition with local cultures and lack of qualified and competent staff. We established that weak institutional coordination has significantly hindered climate change governance at the country's national and local levels. This outcome is also expressed by Adom *et al.* (2022), that the unconnected climate change issue into key sectors of the economy, such as trade and industry, water and agriculture, have contributed to a weak understanding of the threat of climate change on livelihoods and is an abstract concept to communities. Strengthening institution coordination by coherently connecting sectoral objectives and coordinating climate change activities between national and local levels will ensure climate change actions are effectively implemented. Similarly, Ampaire *et al.* (2016) expressed that poor coordination of climate change activities from the national level to the local level remains a significant challenge. Interestingly, we observed that these constraints mentioned do not affect climate governance in a mutually exclusive manner. Our analysis shows that structural issues such as limited financial support, lack of technical capacity and leadership, overlapping sectorial objectives, lack of synergy between the diverse sectors, lack of transparency and inclusivity, poor communication and interactions between government institutions and local communities and lack of training and research conglomerate affecting the general governance of climate in South Africa. These sentiments are also shared by Averchenkova *et al.* (2019) that the capacity to deal with climate governance within the government stems from limited human and financial data and a shortage of experts and skills in several key institutions. This situation is exacerbated by the growing complexity of work involved in designing and implementing sectoral and multi-sector programmes of climate change governance Averchenkova *et al.* (2019).

We uncovered that although numerous factors hindered climate administration, inadequate funding and investment stand out as significant obstacles hindering every aspect of climate change governance, from research, creating awareness and forecasting to disaster management. It was established that while numerous strategies have been outlined to generate funding through national and provincial budgets, bilateral and multilateral sources, private sector financing, payment for ecosystem services and polluter pays principle, the funding needs to address climate governance far outweighed the funds obtained from the available sources. These findings were also observed by Ampaire *et al.* (2016) and Biesbroek *et al.* (2021), that lack of a comprehensive climate finance strategy that

clearly defines the allocation of resources to support climate change work and developmental plan that attract international funding and investment is a significant barrier to any effective governance of climate change. To avert this, it is our view that the South African government expand its climate change funding sources from a few selected donor sources and different external institutional agencies such as European Union, European Bank for Reconstruction and Development, European Investment Bank, World Bank and Global Climate Change Alliance while at the same time mobilising funding from the national fiscal, private sector and non-governmental agencies all to boost climate change governance. A common perspective we picked from the survey was that the current municipality strategy of climate change governance is related to short-term and reactive local emergency responses. Enhancing climate change governance will require long-term investment in planning and broader public participation of key stakeholders in climate change activities. Similar views are also expressed by Qu (2022) that addressing the challenges of climate governance requires reallocation of capital, mobilisation of new financial resources and the strategic realignment of existing resources (public and private and blended finance options) over the short-, medium- and long-term.

Besides funding, our findings established that interrelated constraints such as lack of capacity in the form of skills, weak policy and institutional coordination, poor leadership and inadequate data and information are significant barriers to effective governance of climate. It was uncovered that the climate change administration at national and local levels is currently geared towards short-term and reactive occurrences mainly due to a lack of expertise to predict, analyse and advise. To improve climate change governance capacity, building programmes and investments such as training events, mentorship, collaborative research on climate adaptation and responses, curriculum review with more emphasis on technical issues, big data analysis, digital programming and other software studies are needed to ensure that the country and municipalities are abreast with climate change happenings. These views are also shared by Zea-Reyes *et al.* (2021) that enhancing climate change governance in the country will require capacity-building workshops and educational programs to increase the knowledge and awareness of climate change. Public educational programs in schools, universities, technical and vocational education and training, as well as in neighbourhood spaces, could be an important tool to break down barriers and improve understanding of climate change issues among the public and raise awareness of the connections between climate change risks and impacts and issues of waste management and land use planning (Zea-Reyes *et al.*, 2021). Furthermore, investing in building strong collaboration between key stakeholders in the climate environment is the key to breaking down the obstacle of public–private partnerships. It was proven that the mistrust between the government and private sector hindered the country's effective governance of climate change. To avert this, it is suggested that space must be created where all parties can collaborate outside bureaucratic processes without being entrenched into formal positions of the constituencies they represent. Averchenkova *et al.* (2019) and Ampaire *et al.* (2016) shared similar views that there is a need to institute better vertical coordination mechanisms from the national through provincial to the local level and horizontal communication among ministries, departments and agencies at each governance level by strengthening institutional coordination, linking sectoral objectives and coordination of climate change activities between national and local levels with the focus that ensures that climate change actions are effectively implemented. Additionally, Fawzy *et al.* (2020) suggested that a combination of centralised and decentralised approaches to policy coordination can be used to promote and improve sectoral, local and national levels of governance. Sectoral plans for climate administration, supported by government incentives, will directly improve climate

change management and minimise environmental depletion from energy, transport, construction and waste management. The private sector and trade unions play essential roles in this regard. Finally, our findings uncovered that inadequate data and information sharing is another serious obstacle to climate change governance. It was established that due to scattered data across various sources, both from the scientific environment and institutional data, understanding climatic conditions such as projections, vulnerability, disaster management and coping mechanisms remained a significant challenge. It was established that to enhance information sharing and communication, it is critical to engage all stakeholders, especially the marginalised groups, women and minorities, in all stages from "planning, development, monitoring and evaluation of climate activities." The participation strategy that fosters lifelong consent, with a collective understanding, buy-in, proprietorship and taking account of climate and environmental activities; all these initiatives are imperative in the climate change governance in South Africa.

6. Conclusion and recommendation

In this paper, we advance the underlying roles of robust and resilience institutions in climate change adaptation governance in South Africa. Specifically, we focused on underlying causes of institutional and capacity weaknesses in climate administration. Our finding established that lack of funding and investment in climate change is a barrier that affects any operation of climate change governance. The conclusion drawn was that the government alone could not provide all the financial resources needed to address climate issues effectively. It is, therefore, recommended that there should be policy reforms in which private climate financing will play a pivotal role in this regard. This policy should include appropriate costing of climate risks, innovative financing instruments, broadening the investor base and expanding the involvement of bilateral, multilateral development banks and other financial setups such as insurance companies, philanthropic capital and other institutional investors. Further financing mechanisms, such as pooled financing facilities, revolving funds and urban infrastructure funds, impose hefty penalties on individuals and organisations that contravene climate regulations. The study also found that capacity in terms of qualified, skilled and professional personnel stands as a huge hindrance to any effective climate change governance in the country. Currently, no available data exists on the actual number of skilled personnel in the institutions and the human resource capacity required to tackle climate-related challenges. There is neither a structure for recruiting and training new employees nor for upgrading existing skills. To address these challenges, we suggest that the government should review the skills of human capacities in the various institutions grounded on the strengths and weaknesses of each employee; this should serve as a foundation for effective capacity-building policy and training programmes for the municipality and the country as a whole. Furthermore, to address weak institutional coordination, we suggest that there should be a continuous process of integrating climate change adaptation into policymaking, budgeting, implementation and monitoring processes from national, provincial and local levels. This should be done by strengthening institutional coordination, connecting sectoral objectives coherently and better harmonisation of climate change activities between national, provincial and local administration as well as other stakeholders: government, businesses, NGOs and communities to ensure climate change actions are effectively implemented.

References

Adom, R.K., Simatele, M.D. and Reid, M. (2022), "The threats of climate change to water and food security in South Africa", *American Journal of Environment and Climate*, Vol. 1 No. 2, pp. 6-10.

Ahmed, A., Akanbang, B.A., Poku-Boansi, M. and Derbile, E.K. (2022), "Policy coherence between climate change adaptation and urban policies in Ghana: implications for adaptation planning in African cities", *International Journal of Urban Sustainable Development*, Vol. 14 No. 1, pp. 77-90.

Alaert, G.J. (2019), "Financing for water - water for financing: a global review of policy and practice", *MDPI Sustainability*, Vol. 11 No. 3, pp. 8-16.

Alves, F., Filho, W., Casaleiro, P. and Nagy, G. (2020), "Climate change policies and agenda: facing implementation challenges and guiding responses", *Environmental Science and Policy*, Vol. 104 No. 104, pp. 190-198.

Ampaire, E.L., *et al*., (2016), "Institutional challenges to climate change adaptation: a case study on policy action gaps in Uganda", *Environmental Science and Policy*, Vol. 75 No. 2017, pp. 81-90.

Andrijevic, M. and Cuarresner, C. (2020), "Overcoming gender inequality for climate resilient development", *Nature Communication*, Vol. 2020 No. 62, pp. 2-10.

Anvari, V., Arndt, C., Hartley, F. and Makrelov, K. (2022), *A Climate Change Modelling Framework for Financial Stress Testing in Southern Africa*, South African Reserve Bank, Pretoria.

Atanga, R. and Tankpa, V. (2021), "Climate change, food disaster risk and food security nexus in Northern Ghana", *Front.Sust.Food Syst*, Vol. 5 No. 2021, pp. 3-10.

Averchenkova, A., Gannon, K.E. and Curran, P. (2019), *Governance of Climate Change Policy: A Case Study of South Africa*, Centre for Climate Change and Economic Policy, Leeds University, Leeds.

Biesbroek, R. (2021), "Policy integration and climate change adaptation", *Current Opinion in Environmental Sustainability*, Vol. 52 No. 2020, pp. 75-81.

Boess, E.R., *et al*., (2021), "Using sustainable development goals to develop EIA scoping practices: the case of Denmark", *Impact Assessment and Project Appraisal*, Vol. 39 No. 6, pp. 463-477.

Botai, C.M., Botai, J.O. and Adeola, A.M. (2018), "Spatial distribution of temporal precipitation contrast in South Africa", *S. Afri J Sci*, Vol. 4 No. 7, p. 9.

Bouchard, J.P., Pretorius, T.B. and Kramers-Olen, A.L. (2022), "Global warming and pschotraumatology of natural disaster: the case of the deadly rains and floods of April 2022 in South Africa", *Annales Medico-Psychologiques*, Vol. 181 No. 3, pp. 234-239.

Bracking, S. and Leffel, B. (2021), "Climate finance governance: fit for purpose", *WIREs Climate Change*, Vol. 12 No. 4, pp. 8-12.

Brinks, D., Levitsky, S. and Muvillo, M.N. (2020), "The political origins of institutional weaknesses", *The Politics of Institutional Weakness in Latin America*, University of Taxas, Austin.

Carothers, C., Brown, C.L., Moerlein, K.J. and Lopez, J.A. (2014), "Measuring perceptions of climate change in Northern Alaska: pairing ethnography with cultural consensus analysis", *Ecology and Society*, Vol. 19 No. 4, p. 27.

Carter, S. and Gulart, M. (2014), *Climate Change, the Food Energy Water Nexus and Food Scarcity in South Africa: Understanding the Food Energy Water Nexus*, WWF-SA, Pretoria.

Cerna, L. (2013), *The Nature of Policy Change and Implication: A Review of Different Theoretical Approach*, OECD, Paris.

Chan, S., Hale, T., Deneault, A. and Shivastava, M. (2022), "Assessing the effectiveness of orchestrated climate action from five years of summits", *Nature Ecology and Evolution*, Vol. 12 No. 2022, pp. 628-633.

Chersich, M.F. and Wright, C.Y. (2019), "Climate change adaptation in South Africa: a case study on the role of health", *Globalisation and Health*, Vol. 2019 No. 15, pp. 5-8.

Chevalier, R. (2020), "Enhancing nationally determined contribution across SADC region", South African Institute of International Affairs, Pretoria.

Clarke, B., Otto, F., Stuart-Smith. and Harrington, L. (2022), "Extreme weather impacts of climate change: an attribution perspectives", *Environ. Res.C Limate*, Vol. 2022 No. 1, pp. 2-10.

CoJ (2015), *Climate Change Strategic Framework*, City of Johannesburg EcoMetrix Africa, Johannesburg.

Corfee-Morlot, J., *et al*., (2009), *Cities, Climate Change and Multilevel Governance*, OECD Environmental Working Paper, Paris.

Creswell, J.W. (2003), *Research Design: Quantitative, Qualitative and Mixed Methods Approaches*, 2nd ed., Thousand Oak, CA.

Du Plessis, K.A. (2017), "An investigation into the evidence of seasonal rainfall pattern shifts in Western Cape South Africa", *Journal of the South African Institution of Civil Engineering*, Vol. 59 No. 4, pp. 47-50.

Dubash, N.K. (2021), "Varieties of climate change governance: the emergence and functioning of climate institutions", *Environmental Politics*, Vol. 30 No. sup1, pp. 8-15.

Dube, K., Nhamo, G. and Chikodzi, D. (2021), "Flooding trends and their impacts on coastal communities of western cape province, South Africa", *GeoJournal*, Vol. 87 No. S4, pp. 3-5.

Duru, J., Aro, J. and Oladipo, E.R. (2022), "The effects of climate change on the livelihood of rural women: a case study of ilorin South, Nigeria", *Bulletin of the National Research Centre*, Vol. 46 No. 1, pp. 5-10.

DWS (2017), *Water and Sanitation Sector Policy on Climate Change*, Department of Water and Sanitation, Pretoria.

FAO (2015), *Climate Change and Food Security: risks and Responses*, Food and Agriculture Organisation, Rome.

Fawzy, S., Osman, H., Doran, J. and Rooney, D.W. (2020), "Strategies for mitigation of climate change: a review", *Environmental Chemistry Letters*, Vol. 18 No. 6, pp. 2069-2094.

Forino, G., von Meding, J. and Brewer, G.J. (2015), "A conceptual governance framework for climate change adaptation and disaster risk reduction integration", *International Journal of Disaster Risk Science*, Vol. 6 No. 4, pp. 372-384.

Fortem, M.J. (2020), *Exploring Strategies to Transition to Big Data Techniques from DW Technologies*, Walden University College of Management, Walden.

Fox, N.J. and Alldred, P. (2020), "Re-assembling climate change policy", *The British Journal of Sociology*, Vol. 71 No. 2, pp. 269-283.

Giordano, T., Hall, L., Gilder, A. and Parraman, M. (2011), *Governance of Climate Change in South Africa*, Department of Environmental Affairs, Pretoria.

GIS and Cartographic Unit (2022), *Map Design*, Carttographic Unit, University of Witwatersrand, Department of Geography, Arhaeology and Environmental Studies, Johannesburg.

Godde, C.M., *et al*., (2021), "Impacts of climate channge on livestock food supply chain: a review of the evidence", *Global Food Security*, Vol. 28 No. 2021, pp. 13-15.

Grynspan, R., Mene, W. and Amoako, K.Y. (2021), *Reaping the Potential Benefits of the African Continental Free Trade Area for Inclusive Growth*, UNCTAD, New York, NY.

Islam, S.N. and Winkel, J. (2017), *Climate Change and Social Inequality*, s.l.: Department of Economic and Social Affairs.

Janicke, M. (2017), "The multi-level system of global climate governance – the model and its current state", *Environmental Policy and Governance*, Vol. 27 No. 2, pp. 113-118.

Kamarck, E. (2019), *The Challenging Politics of Climate Change*, Centre for Effective Public Management, Washington, DC.

Kauffman, N. and Hill, K. (2021), "Climate change, adaptation planning and institutional integration: a literature review and framework", *Sustainability*, Vol. 13 No. 19, pp. 6-12.

Kiger, M.E. and Varpio, L. (2020), "Thematic analysis of qualitative data. AMEE guide no. 131", *Medical Teacher*, Vol. 42 No. 8, pp. 1-9.

King, J.P. (2022), "2022 Sixteen way to adapt: a comparison of state-level climate change adaptation strategies in the federal state of Germany", *Regional Environmental Change*, Vol. 40 No. 2022, pp. 8-12.

Koop, S.H., *et al*., (2017), "Assessing the capacities to address challenges of water, waste and climate change", *Water Resources Management*, Vol. 31 No. 11, pp. 3427-3443.

Kovaleva, M., Filho, W.L., Borgemeister, C. and Kalumgu, J.W. (2022), "Understanding needs and potential for gender-balanced empowerment and leadership in climate change adaptation mitigation in Africa", *Sustainability*, Vol. 14 No. 15, pp. 8-10.

Lakhani, N., Chang, A., Liu. and Witherspoon. R. (2022), *Our Food System Isn't Ready for the Climate Crisis*, The Guardian, UK.

Leck, H. and Simon, D. (2018), "Local authority response to climate change in South Africa: transboundary governance challenges", *Sustainability*, Vol. 10 No. 7, p. 2542.

Lukey, P. (2020), *The South African National Climate Change Response Policy - an Evidence-Based Policymaking Case Study*, Department of Environment, Forestry and Fisheries, Pretoria.

Madondo, M. and Nkwana, H.M. (2021), *Exploring South Africa's National Climate Change Response White Paper 2011: Challenges and Prospects for Public Policy*, School of Public Management and Administration, University of South Africa, Pretoria.

Maino, R. and Emrullahu, D. (2022), *Climate Change in Sub-Saharan Africa's Fragile State: Evidence from Panel Estimation*, IMF, CO.

Malhi, G.S., Kaur, M. and Kaushik, P. (2021), "Impact of climate change on agriculture and its mitigation strategies: a review", *Sustainability*, Vol. 13 No. 3, pp. 3-8.

Masud, S. and Khan, A. (2013), *Policy Implementation Barriers in Climate Change Adaptation: The Case of Pakistan*, Environmental Policy and Governance, Pakistan.

Martin, B.R. and Fagerberg, J. (2015), *The Triple Challenge for Europe: Economic Development, Climate Change Governance*, Oxford University Press, Clarendon, UK.

Masipa, T.S. (2017), "The impacts of climate change on food security in South Africa: current realities and challenges", *Jamba*, Vol. 9 No. 1, pp. 3-5.

Matthews, A.K., *et al.* (2022), "Strategies to address structural and institutional barriers to success among students of colour in nursing programs", *Journal of Professional Nursing*, No. 40, pp. 96-104.

Mello, C.R. *et al.* (2021), "Climate change impacts on water resources of the largest hydropower plant reservoir in Southern Brazil", *Water*, Vol. 13 No. 11, pp. 3-5.

Mershon, C. (2021), "Challenging the wisdom on preferential proportion representation", *Journal of Theoretical Politics*, Vol. 32 No. 1, pp. 168-182.

Morrisson-Smith, S. and Ruiz, J. (2020), *Challenges and Barriers in Virtual Teams: A Literature Review*, Benard College, New York, NY.

Mpandeli, S., *et al*., (2020), "Migration under climate change in Southern Africa: a nexus planning perspective", *Sustainability*, Vol. 12 No. 11, pp. 3-10.

Mthembu, D. and Nhamo, G. (2021), "Landing the climate SDG into South Africa's development trajectory: mitigation policies, strategies and institutional setup", *Sustainability*, Vol. 13 No. 5, pp. 5-10.

Mugambiwa, S. and Tirivangosi, H.M. (2017), "Climate change: a threat towards achieving sustainable development goal number two (end hunger, achieve food security and improve nutrition and promote sustainable development", *JAMBA*, Vol. 9 No. 2017, pp. 3-10.

Mupangwa, W., Walker, S., Masvaya, E. and Magombeyi, M. (2016), "Rainfall and potential of reduced tillage systems to conserve soil water in semi-arid cropping systems of Southern Africa", *AIMS Agriculture and Food*, Vol. 1 No. 1, pp. 85-101.

Narksompong, J. and Limjirakan, S. (2015), "Youth participation in climate change for sustainable engagement", *Review of European, Comparative and International Environmental Law*, Vol. 24 No. 2, pp. 171-181.

Nasiritouris, N., Hjerpe, M. and Linner, B. (2016), "The roles of non-state actors in climate change governance: understanding agency through governance profile", *International Environmental Agreements: Politics, Law and Economics*, Vol. 16 No. 1, pp. 109-126.

NCCAS (2018), "National climate change adaptation strategy, Republic of South Africa", NDP, Pretoria.

Ndlovu, M., *et al*., (2021), "An assessment of the impacts of climate variability and change in KwaZulu-Natal province of South Africa", *Atmosphere*, Vol. 12 No. 4, pp. 3-10.

Nedevska, J. (2021), "An attack on the separation of powers? Strategic climate change litigation in the eyes of US judges", *Sustainability*, Vol. 13 No. 15, p. 8335.

Nicolson, G. (2022), *Tragedy in KZN as Floods Cause Devastation, Mostly for the Poor in Informal Settlements*, Daily Maverick, Durban.

Nsubuga, F.W. and Rautenbach, H. (2018), "Climate change and variability: a review of Uganda", *International Journal of Climate Change and Sustainable Management*, Vol. 10 No. 5, pp. 753-760.

OECD (2021), "Implementing the OECD recommendation on policy coherence for sustainable development: Guidance note", *COM/DCD/DAC/GOV/PGC*, Vol. 2021 No. 1, pp. 11-20.

Olazabal, M., *et al*., (2019), "Are local climate adaptation policies credible? A conceptual and operational assessment framework", *International Journal of Urban Sustainable Development*, Vol. 11 No. 3, pp. 277-296.

Ortega-Cisneros, K., Cochrance, K.L., Rivers, H. and Sauer, W.H. (2021), "Assessing South Africa's potential to address climate change impacts and adaptation in fisheries sector", *Frontiers in Marine Science*, Vol. 8 No. 2021, pp. 6-12.

Pearse, R. (2017), "Gender and climate", *WIREs Climate Change*, Vol. 8 No. 2, pp. 2-16.

Popoola, O.O., Gbolaham, Y. and Monde, N. (2020), "Information sources and constraints to climate change adaptation among smallholder farmers in Amathole district municipality, Eastern Cape province, South Africa", *Sustainability*, Vol. 12 No. 14, p. 5846.

Qu, H. (2022), *How South Africa Can Advance Reforms to Achieve Its Goal*, IMF African Department, Pretoria.

Rawlins, J. and Kalaba, F.K. (2021), "Adaptation to climate: opportunities and challenges from Zambia", *African Handbook of Climate Change*, Vol. 2021 No. 6, p. 167.

Ray, C.A. (2021), *The Impact of Climate Change on Africa's Economies*, Africa Program at Foreign Policy Research Institute, Cambodia.

Reisinger, A., Wratt, D. and Allan, S. (2011), "The role of local government in adapting to climate change: lessons from New Zealand", *Climate Change Adaptation in Developing Nations*, Vol. 42 No. 3, pp. 303-309.

Robinson, O.C. (2014), "Sampling in interview-based qualitative research: a theoretical and practical guide", *Qualitative Research in Psychology*, Vol. 11 No. 1, pp. 3-10.

Runhaar, H., *et al*., (2018), "Mainstreaming climate adaptation: taking stock of what works from empirical research worldwide", *Regional Environmental Change*, Vol. 18 No. 4, pp. 1201-1210.

Schinko, T., Drouet, L. and Vrontsi, Z. (2017), "Ecoroung-wide effects of coastal flooding due to sea level rise: a multi-model simultaneous residual impacts", *Environmental Research Communication*, Vol. 2020 No. 2, pp. 2-8.

Scholes, R. and Engelbrecht, F. (2021), *Climate Impacts in Southern Africa during 21st Century, Johannesburg: Earthjustice and Centre for Environmental Rights*, Global Change Institute, University of Witwatersrand.

Sibiya, N.P., Das, D.K., Voger, C., Mazinyo, S., Zhou, L., Kalumba, M.A., Sithole, M., Adom, R.K. and Simatele, M.D. (2023), "Overcoming bureaucratic resistance: an analysis of barriers to climate change adaptation in South Africa", *Climate*, Vol. 11 No. 7, pp. 8-9.

Taylor, A., Cartwright, A. and Sutherland, C. (2014), *Institutional Pathways for Local Climate Adaptation: A Comparison of Three African Municipalities*, Department of the University of Cape Town, Cape Town.

Thakur, R. (2020), "Breaking through the global politics of climate change policy", *The Washington Quarterly*, Vol. 43 No. 2, pp. 12-15.

Trollip, H. and Boulle, M. (2017), *Challenges Associated with Implementing Climate Change Mitigation Policy in South Africa*, Energy Research Centre. University of Cape Town, Cape Town.

Tyler, E. and Cohen, B. (2021), "A complex systems view of climate and development issues in Southern African coal power expansion", *Journal of Energy in Southern Africa*, Vol. 32 No. 1, pp. 6-18.

van der Bank, M. and Karsten, J. (2020), "Climate change and South Africa: a critical analysis of the Earthlife Africa Johannesburg and another V Minister of Energy 65662/16", *Air, Soil, and Water Research*, Vol. 2020 No. 13, pp. 1-11.

Videira, N., Costal, M.M. and Giordano, R. (2020), "A method for enhancing capacity for local governance for climate change adaptation", *Earth's Future*, Vol. 8 No. 7, pp. 5-10.

von Heyden, C., Pegram, G. and Chapman, A. (2016), *Transboundary Water: Climate Change and Development Impacts on Southern African Water Resources: A Synthesis*, Regional Climate Change Programme, Pretoria.

WeBling, K. and Bechler, N. (2019), "Where do regional influences matter? The impact of socio-spatial indicators on transition from secondary schools to university", *Review of Regional Research*, Vol. 39 No. 2, pp. 163-170.

World Bank (2020), *Climate Change Governance*, World Bank, Washington.

Wright, J. (2022), *Technological Development to Address Climate Change in South Africa and Their Potential Economic Impacts*, Working Paper, Pretoria: South African Reserve Bank.

Zea-Reyes, L., Olivotto, V. and Bergh. (2021), "Understanding institutional barriers in the climate change adaptation planning process of city of Beirut: various cycles and opportunities", *Mitigation and Adaptation Strategies for Global Change*, Vol. 26 No. 6, pp. 2-10.

Ziervogel, G., New, M. and van Garderen, E.A. (2014), "Climate change impacts and adaptation in South Africa", *WIREs Climate Change*, Vol. 5 No. 5, pp. 605-620.

Zipplies, R. and van Schalkwyk. (2008), *Bending the Curve: Your Guide to Tackling Climate Change in South Africa*, Department of Environmental Affairs, Cape Town.

Further reading

Chevalier, R. (2021), *Enhancing Nationally Determined Contribution across SADC Region*, South African Institute of International Affairs, Pretoria.

Fakir, Y., *et al.*, (2021), "Projection of irrigation water demand based on the simulation of synthetic crop coefficients and climate change", *Hydrology and Earth System Sciences*, Vol. 25 No. 2, pp. 637-651.

Hallegate, S., Bangalore, M., Bonzanigo, L. and Fay, M. (2016), *Shock Waves: Managing the Impacts of Climate Change on Poverty*, International Bank for Reconstruction and Development. World Bank, Washington.

Kavaleva, M., Filho, W.L., Borgemeister, C. and Kalumgu, J.W. (2022), "Understanding needs and potential for gender-balanced empowerment and leadership in climate change adaptation mitigation in Africa", *Sustainability*, Vol. 14 No. 15, pp. 8-10.

Marquarrdt, J. (2017), "Conceptualizing power in multi-level climate governance", *Journal of Clearner Production*, Vol. 154 No. 2017, pp. 167-175.

Mokwana, L. (2009), *Municipal Response to Climate Change in South Africa: The Case of EThekwini, the City of Cape Town and the City of Johannesburg*, Centre for Policy Studies, Johannesburg.

Resinger, A., Wratt, D. and Allan, S. (2011), "The role of local government in adapting to climate change: lessons from New Zealand", *Climate Change Adaptation in Developing Nations*, Vol. 42 No. 3, pp. 303-309.

Tollip, H. and Boulle, M. (2017), *Challenges Associated with Implementing Climate Change Mitigation Policy in South Africa*, Energy Research Centre. University of Cape Town, Cape Town.

van Bronhorst, B. (2019), *Is Climate Environmental Stressor for Conflicts*?, World Bank, Washington, DC.

van der Bank, M. and Karsten, J. (2017), "Climate change and South Africa: a critical analysis of the Earth life Africa Johannesburg and another V minister of energy 65662/16", *Air, Soil, and Water Research*, Vol. 2020 No. 13, pp. 1-11.

Author affiliations

Richard Kwame Adom, Department of Geography, Faculty of Science, University of the Witwatersrand Johannesburg, Johannesburg, South Africa

Mulala Danny Simatele, Faculty of Science, University of the Witwatersrand Johannesburg, Johannesburg, South Africa

Dillip Kumar Das, Faculty of Science and Agriculture, University of KwaZulu-Natal, Durban, South Africa

Kalumba Ahmed Mukalazi and Mazinyo Sonwabo, Faculty of Science and Agriculture, University of Fort Hare, Alice, South Africa

Lindelani Mudau and Mikateko Sithole, Department of Food, Forestry and Environment, Bisho, South Africa

Serge Kubanza and Coleen Vogel, Faculty of Science, University of the Witwatersrand Johannesburg, Johannesburg, South Africa, and

Leocadia Zhou, Faculty of Social Sciences and Humanities, University of Fort Hare, Alice, South Africa

Corresponding author

Richard Kwame Adom can be contacted at: richardquame1@gmail.com