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RESEARCH PAPER

Evaluating the Role of Local Governments in Climate Governance in Sub-Saharan Africa:

A Comparative Study of Mafikeng City (South Africa) and Kisumu City (Kenya)

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Abstract

Local governments in Sub-Saharan Africa (SSA) are increasingly tasked with implementing climate action plans to mitigate emissions and enhance urban resilience. Yet, the effectiveness of governance structures and strategies of these governments in addressing urban climate challenges remains poorly understood. This study compares climate governance approaches in Mafikeng, South Africa, and Kisumu, Kenya—two similarly sized SSA cities facing distinct yet comparable climate risks. A mixed-methods approach was employed to capture both breadth and depth of environmental governance practices. Quantitative data was collected via questionnaires administered to employees in institutions involved in environmental management, while qualitative insights were obtained through key informant interviews with heads of governmental and non-governmental institutions and local structures. Quantitative analyses included descriptive statistics, Mann–Whitney U tests, Chi-square tests, and ordinal logistic regression, while qualitative data were analyzed through content analysis. Kisumu reported significantly greater familiarity with city climate actions, stronger perceptions of effectiveness, higher perceived integration of local knowledge, attention to vulnerable groups, and greater inter-institutional and community coordination compared to Mafikeng. Kisumu's participatory, multi-actor approach enhances visibility, effectiveness, and adaptive capacity, whereas Mafikeng's research-oriented, top-down model shows strong commitment but limited operational visibility, coordination, and community engagement. OLS analysis confirmed that familiarity with climate actions, perceived integration of local knowledge, and coordination mechanisms are key determinants of perceived effectiveness. Financial constraints, coordination gaps, and limited community involvement remain critical challenges, particularly in Mafikeng. Tailored, inclusive, and adaptive strategies integrating local knowledge and participatory governance are recommended for building resilient urban futures in SSA.

Keywords: Local governments, urban climate resilience, sustainable cities, climate change, Mafikeng, Kisumu

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1. Introduction

1.1 Background and Rationale

Climate change has emerged as one of urban areas' most pressing global challenges due to their dense populations and infrastructural vulnerabilities (Kaw et al., 2020; Adom, 2023). Currently, 55% of the global population resides in urban areas, a proportion expected to rise to 68% by 2050, meaning nearly 7 billion people will live in cities (UN-Habitat, 2020). The number of megacities is projected to increase to accommodate this rapidly growing population, reaching 41 by 2030 alone (UN, 2016). This rapid urbanization positions cities at the forefront of addressing various environmental, social, and economic challenges (Zeng et al., 2022). Cities are not only significant contributors to greenhouse gas emissions but are also highly vulnerable to the impacts of climate change, including extreme weather events such as floods and heat waves, which threaten lives and economic growth (UN, 2018). Urban areas in the developing world, particularly Asia and Africa, are expected to account for 90% of the projected 2.5 billion increase in the global urban population by 2050 (Li et al., 2022), are considered the most vulnerable and hence disproportionately affected by climate change impacts (Adom, 2023).

In response to this reality, local governments in these regions have increasingly been tasked with formulating and implementing climate action plans that aim to mitigate emissions and enhance urban resilience (Leck & Simon, 2018). While national and international climate policies receive much attention, local governments play a crucial role in translating these policies into tangible actions at the grassroots level (WHO, 2022). Local governments are uniquely positioned to address climate change because of their proximity to urban communities, their direct control over essential services (such as water, energy, and waste management), and their role in land-use planning and infrastructure development (Devas, 2001; Tanner et al., 2009; Satterthwaite et al., 2018). However, the capacity of local governments to effectively govern climate issues varies significantly based on institutional, financial, and political factors (Leck & Simon, 2013).

A review of the literature reveals that limited studies have assessed the effectiveness of the governance structures and strategies of the local governments in Sub-Saharan Africa in addressing urban climate challenges and promoting resilience. Therefore, with a view to bridging this gap, this study focuses on the comparative climate governance approaches of Mafikeng, South Africa, and Kisumu, Kenya—two Sub-Saharan African cities of similar sizes facing distinct yet comparable urban climate challenges. Kisumu, situated along Lake Victoria, is highly vulnerable to flooding and extreme weather events (Masimbe, 2018; Othoo, 2021), while Mafikeng, located in a semi-arid region, confronts water scarcity and rising temperatures (Mothupi, 2020; Oladele, 2022). Both cities represent

critical contexts for understanding how local governments in Sub-Saharan Africa are adapting to climate challenges, given their differing socio-political context and shared vulnerability to climate variability and extremes. Both city municipalities typically represent rapidly urbanizing medium-to-large provincial headquarters in Sub-Saharan Africa, characterized by high population density, infrastructure deficits, and dependence on vulnerable energy and housing systems. By evaluating the role of local governments in Mafikeng and Kisumu, this study aims to shed light on the successes and barriers that local governments in Sub-Saharan Africa encounter in climate governance, offering insights that can inform the design of more effective and equitable climate action initiatives. Furthermore, as Sub-Saharan Africa continues to urbanize rapidly, understanding the governance structures that support sustainable urban development becomes increasingly important. By examining the climate action strategies of Mafikeng and Kisumu, this research contributes to identifying best practices and areas for improvement that can enhance urban resilience to climate change across Sub-Saharan Africa.

1.2 Research Aim and Objectives

The study aims to assess and compare the effectiveness of the governance structures and strategies employed by the local governments of Mafikeng City (South Africa) and Kisumu City (Kenya) in addressing urban climate challenges and promoting equitable resilience.

More specifically, the study sought:

- To analyze the institutional frameworks established by local governments in Mafikeng and Kisumu for climate governance.
- To assess the effectiveness of climate action plans implemented by the local governments in addressing urban climate challenges in both cities.
- To identify key success factors and barriers faced by the local governments in implementing climate initiatives effectively and equitably
- To evaluate stakeholder engagement in climate governance processes and its impact on policy outcomes.
- To recommend strategies for enhancing the effectiveness and equity of climate action plans in both urban contexts, based on best practices and lessons learned from the study.

2. Literature Review

2.1 Conceptualizing Urban Climate Resilience

Urban climate resilience has become a central framework for addressing the growing risks and uncertainties posed by climate change in cities. It denotes the capacity of interconnected urban systems, that is, people, infrastructure, institutions, and ecosystems, to anticipate, withstand, adapt, and transform in response to climate-related stresses and shocks (Singh, 2024). The concept has evolved from a narrow, post-disturbance recovery model to a dynamic, multidimensional approach that integrates social, ecological, and governance dimensions (Kapucu et al., 2024). This shift reflects the recognition that effective responses often require not merely restoring systems to their prior state but reconfiguring them to reduce long-term vulnerability and advance sustainability (Masnavi et al., 2019). Contemporary definitions converge on the idea that resilience entails absorbing disturbances, adjusting to evolving climatic conditions, and initiating transformative change where necessary (Kim & Lim, 2016; Masik, 2022). While engineering-based perspectives once prioritised rapid recovery (Vasilevska & Slavković, 2024), ecological and evolutionary interpretations emphasise adaptive capacity, flexibility, and systemic transformation. These perspectives acknowledge that resilience demands shifts in governance structures, planning paradigms, and socio-technical systems, positioning it as a proactive and iterative process rather than a reactive endpoint (Masik, 2022).

A widely accepted analytical framing comprises four interlinked dimensions: exposure, sensitivity, adaptive capacity, and transformation. Exposure captures the extent to which cities face hazards such as floods, droughts, and heatwaves; sensitivity reflects susceptibility to harm shaped by socio-economic and environmental factors; adaptive capacity encompasses the resources and institutions that enable coping and adjustment; and transformation refers to fundamental changes in urban form, governance, and technology that secure long-term resilience (Zeng et al., 2022; Masik, 2022). Because of their interconnectedness, weakness in any one dimension can undermine overall resilience (Zeng et al., 2022).

Global policy frameworks have significantly shaped how urban climate resilience is understood and operationalized. The IPCC's Sixth Assessment Report provides evidence-based risk assessments and adaptation pathways for urban contexts (Klopfer et al., 2021). UN-Habitat's Urban Resilience Framework advocates integrated, cross-sectoral approaches linking science to local governance (Klopfer et al., 2021), while the Sendai Framework for Disaster Risk Reduction emphasizes preparedness, early warning, and risk-informed urban development (Masik, 2022). Although these frameworks offer robust

guidance, their impact depends on local adaptation that reflects context-specific socio-political, cultural, and resource realities. In African cities, the relevance of resilience thinking is heightened by the convergence of rapid urbanization, inadequate infrastructure, and socio-economic inequalities, all of which compound climate risks (Shamsuddin, 2023). Addressing these challenges necessitates strategies that are locally tailored, socially inclusive, and capable of strengthening adaptive capacity while promoting sustainable development.

2.2 Climate Change Impacts and Urban Vulnerabilities in Sub-Saharan Africa

Sub-Saharan Africa (SSA) is one of the world's fastest urbanizing regions, with its population projected to reach nearly 2 billion by 2050 and close to 4 billion by 2100 (UN DESA, 2013). This demographic shift intersects with significant climatic changes, including rising temperatures, more frequent extreme heat events, shifts in rainfall patterns, and heightened aridity, particularly in southern Africa (Serdeczny et al., 2017). Together, these trends are already manifesting in recurrent and severe climate hazards across SSA's urban areas. Flooding is among the most pervasive threats, driven by intense rainfall events and exacerbated by inadequate drainage, unplanned settlement expansion onto floodplains, and impermeable urban surfaces (Adelekan, 2010; Tietjen et al., 2023). Such floods not only damage infrastructure but also heighten health risks through water contamination and poor sanitation (Godfrey et al., 2020). Extreme heat is another growing hazard, intensified by the urban heat island (UHI) effect, particularly in low-income and informal settlements where vegetation cover is sparse and cooling infrastructure is absent (Scott et al., 2017; Obe et al., 2023). Heat stress disproportionately impacts vulnerable groups, including the elderly and outdoor workers, with limited access to healthcare, compounding the risk (Tietjen et al., 2023). Droughts and chronic water scarcity also threaten many SSA cities (Serdeczny et al., 2017), with urban population growth straining already limited water resources (Filho et al., 2018). In regions such as the Horn of Africa and South Africa's Gauteng City-Region, recurrent drought events and infrastructure deficits have led to frequent water service interruptions, undermining both health and livelihoods (Filho et al., 2018; Bischoff-Mattson et al., 2020). Coastal areas face additional risks from sea-level rise, potentially up to one meter under high-emission scenarios (Rong-Shuo & Hong-Jian, 2020).

The severity of climate hazards in SSA cities is compounded by deep-rooted socio-economic, infrastructural, and governance challenges. Poverty remains a key driver, limiting adaptive capacity and constraining access to resources that could mitigate climate risks (Filho et al., 2019). Informal settlements, which house a significant proportion of the urban population, are often located in hazard-prone areas such as steep hillsides,

floodplains, and near waste sites, exposing residents to both direct and indirect impacts of climate events (Satterthwaite et al., 2020). These settlements frequently lack climate-resilient infrastructure, including paved roads, drainage systems, piped water, and a reliable energy supply (UN ESCAP, 2021). Infrastructural deficits exacerbate vulnerability. Aging or non-existent drainage systems fail under heavy rainfall, increasing flood exposure (Bukvic et al., 2018), while limited health facilities hinder effective responses to heat-related illnesses (Godfrey et al., 2020). Governance gaps further compound these risks. Local governments often have restricted political authority, limited financial resources, and inadequate access to climate data, reducing their capacity to develop and enforce effective adaptation measures (Simon & Leck, 2015; Simane et al., 2016; Filho et al., 2018). The disconnect between national climate policies and local implementation, exemplified by weak coordination between national agencies and municipal authorities, undermines resilience planning and leaves many communities without institutional support (Simon & Leck, 2015).

The interaction between poverty, informality, and infrastructural deficits creates a web of vulnerabilities that amplifies climate impacts across SSA cities. In informal settlements, the lack of drainage infrastructure means that even moderate rainfall can cause destructive flooding, particularly when combined with poor solid waste management that clogs existing systems (Lamond et al., 2012). Residents often rely on daily wage labor, making them economically vulnerable to climate disruptions. Heat stress disproportionately affects those engaged in outdoor work (Lee et al., 2025), while limited access to electricity constrains adaptation options such as fans or refrigeration (Mazzone et al., 2024). These intersectional risks are further compounded by weak governance frameworks, which fail to integrate climate adaptation into broader urban development strategies. The absence of meaningful participatory planning mechanisms limits the involvement of affected communities in resilience-building efforts, perpetuating a cycle of vulnerability (Parsons et al., 2025). As climate hazards intensify, the convergence of social inequities, infrastructural gaps, and institutional weaknesses underscores the urgency of developing context-specific, multi-scalar resilience strategies that address both the immediate and structural drivers of risk.

2.3 Strategies, Barriers, and Enablers of Urban Climate Resilience

The review of literature reveals that urban climate resilience is most effectively fostered through integrated strategies that span policy instruments, urban planning, ecosystem-based adaptation, infrastructure upgrades, and community-based approaches. Studies emphasize that embedding climate considerations into urban planning, through risk-informed development plans, climate-sensitive building codes, zoning to avoid high-risk

areas, and comprehensive adaptation plans, creates the institutional foundation for resilience (Hardoy & Ruete, 2013; Therrien et al., 2020). Policy mechanisms such as tax incentives, insurance products reflecting climate risk, and innovative financing models further encourage the adoption of resilient infrastructure and adaptive practices (Mendes-Da-Silva et al., 2022; Hachem-Vermette, 2024). Ecosystem-based adaptation emerges as a particularly cost-effective strategy, with interventions like reforestation, wetland restoration, and urban green infrastructure delivering multiple benefits, including stormwater regulation, heat mitigation, biodiversity enhancement, and carbon sequestration (Castillo-Uzcanga et al., 2018; Tsoka et al., 2021; Tiwari et al., 2022). Infrastructure resilience, meanwhile, is strengthened through both engineered solutions—such as flood barriers, upgraded stormwater systems, and heat-resistant construction materials—and socially embedded measures that address underlying vulnerabilities (Oukes et al., 2022; Liu et al., 2022; Rezvani et al., 2023; Lv & Sarker, 2024). Complementing these are community-based initiatives that leverage local knowledge, build social capital, and ensure that interventions align with local contexts and needs (Archer, 2016; Zhang et al., 2020). Collectively, these strategies illustrate that sustainable urban climate resilience is best achieved through a holistic approach that integrates physical, ecological, institutional, and social dimensions. In the SSA context, this integrated approach has been notably advanced in cities such as Durban (South Africa), Kigali (Rwanda), and Kisumu (Kenya), where climate resilience initiatives have combined ecosystem-based adaptation, participatory governance, and infrastructural upgrading to address both environmental and social vulnerabilities (Kiribou et al., 2024).

The effective implementation of these urban climate resilience strategies is often constrained by several interrelated barriers. Financial and technical resource limitations remain among the most persistent challenges, particularly in rapidly urbanizing contexts where infrastructure gaps and inadequate resilience measures exacerbate disaster risks (Kehinde, 2014; Allarané et al., 2024). Institutional fragmentation and weak coordination mechanisms hinder cross-sectoral collaboration, with conflicting short-term political or economic priorities often undermining long-term resilience objectives (Sharma & Singh, 2016; Baldin & Sinning, 2022). Governance challenges, including unclear stakeholder responsibilities, incomplete decentralization, and mismatches between control and accountability, further weaken adaptive capacity (Taylor, 2016; Mark, 2022). Knowledge and data gaps, ranging from insufficient localized climate risk assessments to poor post-disaster documentation, limit evidence-based decision-making and slow the uptake of innovative solutions (Liu et al., 2016; Nalau & Becken, 2018). Social and political barriers, such as alienation of local actors, competing community priorities, and lack of public engagement in planning processes, reduce both the legitimacy and effectiveness of resilience

interventions (Goldstein et al., 2015; Therrien et al., 2020; Ganeshu et al., 2023). Additionally, fragmented professional practices, inadequate communication with vulnerable populations, and the prevalence of misinformation impede public preparedness and coordinated response (Alhmoudi & Aziz, 2016; Therrien et al., 2020; Aniche et al., 2024). Collectively, these barriers highlight the systemic, multi-scalar nature of the challenges facing urban climate resilience efforts.

To overcome these barriers and enhance resilience-building efforts, existing literature highlights a range of enabling factors that promote integrated and adaptive approaches. Supportive policy frameworks, such as climate-sensitive legislation, enforceable building codes, and the mainstreaming of adaptation into urban planning, create institutional conditions for sustained action (Therrien et al., 2020; Allarané et al., 2024). Multi-stakeholder partnerships, involving local governments, communities, the private sector, and civil society, enhance coordination, resource mobilization, and trust-building (Kapucu, 2007; Archer, 2016; Therrien et al., 2020). Local innovation and bottom-up initiatives, often facilitated through urban living labs and flexible institutional directives, encourage context-specific experimentation and iterative learning (Sellberg et al., 2015; Rincón et al., 2021). Strong community engagement, including participatory risk assessments, school-based preparedness programs, and government-supported community groups, builds social capital and enhances collective response capacity (Burnside-Lawry & Carvalho, 2015; Archer, 2016). Adaptive management approaches that emphasize continuous learning, cross-sectoral communication, and the strategic use of post-crisis “windows of opportunity” can accelerate resilience implementation (Reed et al., 2013; Lv & Sarker, 2024). Furthermore, pre-disaster recovery planning, prioritization of critical infrastructure, and access to pre-established financing mechanisms provide operational readiness for rapid recovery (Liu et al., 2016). Together, these enablers illustrate that urban climate resilience is most effectively advanced through a combination of institutional support, collaborative governance, empowered communities, and adaptive, evidence-based planning.

3. Methodology

3.1 Study Area Description

This study was conducted in two selected urban canters in Sub-Saharan Africa, Kisumu in western Kenya and Mafikeng in South Africa’s North West Province (Figure 1), selected for their contrasting socio-political contexts and shared vulnerability to climate variability and change. The two city municipalities typically represent rapidly urbanizing medium to large provincial headquarters in Sub-Saharan Africa, characterized by high population

density, infrastructure deficits, and dependence on vulnerable energy and housing systems.

Kisumu, located on the northeastern shores of Lake Victoria, is Kenya's third-largest city and an important commercial hub within the East African Community. It covers approximately 417 km² and had a population of about 567,963 in 2019 (Ocholla et al., 2022). The city experiences a bimodal rainfall pattern, with long rains from March to May and shorter rains in November and December, making it sensitive to shifting seasonal patterns, heavy rainfall events, and rising temperatures (Opisa et al., 2022). Approximately 64% of its population resides in informal settlements occupying only 8% of the city's land area, while poverty rates stand at 49%, well above the national average of 29%, amplifying exposure and limiting adaptive capacity to climate-related hazards (Masimbe, 2018).

Mafikeng, the capital of the North West Province in South Africa, also serves as the administrative center of the Ngaka Modiri-Molema District Municipality (Magocha, 2024). In 2022, it had a population of approximately 354,504 (Magocha, 2024). The city has a warm climate, with mean annual temperatures ranging from 18.3°C to 25.1°C, and experiences high inter-annual variability in rainfall and temperature, influenced by regional climatic drivers and global teleconnection patterns (Mulamattathil et al., 2015). This variability, coupled with declining rainfall trends, poses challenges for water resource management, biodiversity conservation, and urban resilience (Mothupi, 2020; Oladele, 2022). As in Kisumu, socioeconomic factors, including service delivery backlogs and uneven access to infrastructure, intersect with environmental stressors, heightening vulnerability to climate change impacts.

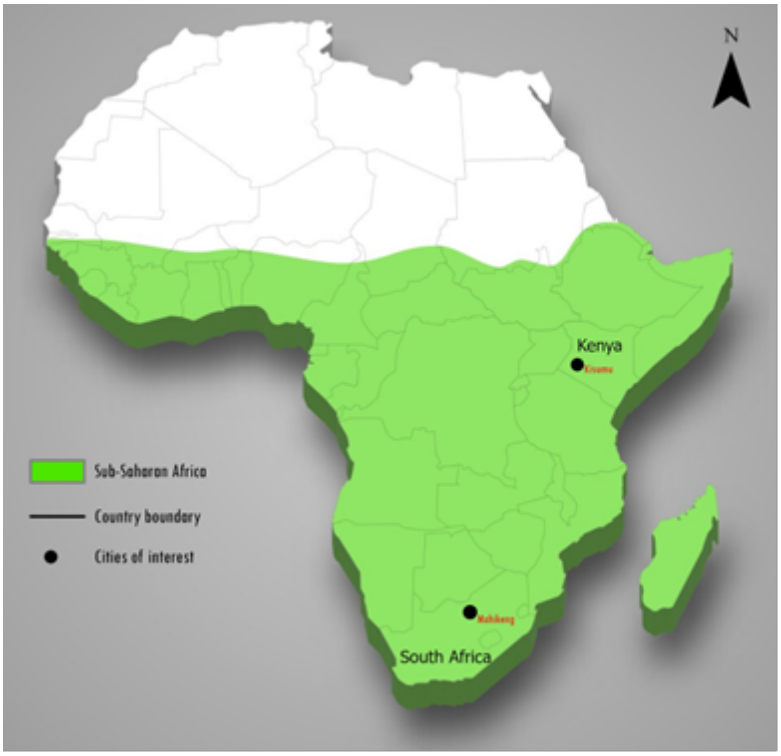

Figure 1: Map of Sub-Saharan Africa showing the study sites: Kisumu city (Kenya) and Mafikeng city (South Africa)

3.2 Sampling and Data Collection Procedures

For both Mafikeng and Kisumu, data collection was carried out in two phases. The first phase involved the use of structured questionnaires (quantitative data), while the second phase involved semi-structured interviews with key informants (qualitative data). In the first phase of data collection, pre-tested structured questionnaires were administered to randomly sampled employees of the key institutions identified for the study, 15 in Mafikeng and 21 in Kisumu. These questionnaires focused on the demographic profile of the employees, the effectiveness of climate action plans implemented by local governments, and the key success factors and barriers these local governments faced in implementing climate initiatives effectively and equitably. Before administering the questionnaire-based surveys, field enumerators were trained in the necessary protocols for administering questionnaires. Discussions were also held with relevant administrative officials to explain the study's purpose and goals and to obtain permission to interview junior staff members.

The second phase focused on interviewing key informants—heads of governmental departments, non-governmental institutions, and local structures established to address climate challenges—on current institutional structures for climate action initiatives, policies, stakeholder interactions, and implementation-related challenges. A two-stage

sampling process involving both purposive and snowball sampling methods was employed to identify these key informants. In the first stage, stakeholder analysis was carried out based on a review of available secondary documents to identify the key agencies/institutions involved in addressing climate challenges in each jurisdiction. This analysis yielded the initial batch of key informants, comprising senior managers and employees of the identified institutions and stakeholders. In the second stage, a snowballing approach was used to expand the list of key informants, whereby the initial batch of identified informants recommended other key stakeholders for interviews. In the end, this process yielded 14 key informants in Mafikeng and 18 in Kisumu for qualitative data collection. During the interview stage, documents with relevant information, such as press releases, published and unpublished studies, maps, reports, master plans, government gazettes, policy documents, and minutes of relevant stakeholder meetings, were requested and collected from various governance actors. These documents complemented the analyzed primary data in assessing the institutional capacities for planning, implementing, and evaluating climate adaptation and mitigation measures.

3.3 Data Processing and Analytical Procedures

3.3.1 Quantitative Data

In collecting quantitative data, trained enumerators deployed the mobile-based *KoboCollect* App in administering the survey questionnaires. This software enables users to create forms for collecting data on mobile devices, deploy these forms offline to gather data in the field, and subsequently transmit the collected data to a central online database. The full dataset was then downloaded from the website as an Excel file for data cleaning, organization, and management.

The data was then analyzed using Python programming in Google Colab. Descriptive statistics were first generated and presented in graphs and tables to provide an overview of respondent characteristics and general trends. The study then employed a combination of non-parametric and multivariate statistical techniques to examine similarities and differences between Kisumu (Kenya) and Mafikeng (South Africa) regarding the factors influencing effective climate action (CA) implementation. The analytical framework comprised three key analyses: the Mann–Whitney U test, the Chi-square test of independence, and ordinal logistic regression. These tests were conducted using Python in Colab and were applied systematically to allow for both city-specific and cross-city comparative insights.

Firstly, a series of Mann-Whitney U tests were conducted to assess whether perceptions of various urban climate resilience variables significantly differ

between Kisumu and Mafikeng cities. The Mann–Whitney U test was deemed appropriate because the perception variables were measured on ordinal scales and the data did not meet the normality assumption required for parametric tests, making this non-parametric approach suitable for comparing two independent groups (Karch, 2021).

Secondly, the Chi-square test of independence was employed to explore whether demographic and professional attributes shape climate resilience perceptions in each city. This test was selected because it is designed to assess the association between categorical variables (Msuha & Mdendemi, 2019), making it well-suited to examine the relationships between demographic/professional characteristics and the nine key perception variables, including familiarity with climate actions, perceived effectiveness, integration of community needs, adaptiveness, and inter-organizational coordination.

Finally, an Ordinal Logistic Regression (OLR) was conducted for each city to understand what shapes these perceptions within each city. The dependent variable was the self-reported *effectiveness of city climate actions*, while the independent variables included demographic characteristics (education level, experience level, nature of role) and institutional dimensions such as familiarity with climate policies, integration of local knowledge, consideration for vulnerable groups, and inter-institutional coordination mechanisms. OLR was selected because the dependent variable is ordinal in nature, and this method appropriately accounts for the ordered structure of the outcome while estimating the influence of both demographic and institutional factors (Harrell Jr, 2015).

It is important to acknowledge that the relatively small sample sizes in this study (Mafikeng = 15 and Kisumu = 21) may limit the statistical power and generalizability of all statistical analyses conducted in this study: Ordinal Logistic Regression, Chi-square tests, and Mann–Whitney U tests. Small sample sizes can reduce the ability to detect significant effects and may affect the reliability of p-values. To mitigate these limitations, the statistical analyses were treated as exploratory, with careful selection of predictor variables to avoid overfitting, and reporting of effect sizes alongside p-values to provide a measure of practical significance. Despite these constraints, the results provide valuable directional insights into how demographic and institutional factors influence perceptions of climate action effectiveness, complementing qualitative findings and supporting the broader interpretation of urban climate resilience dynamics.

3.3.2 Qualitative Data

In collecting qualitative datasets, key informant interviews were recorded with participants' consent using digital audio recorders and supplemented with field notes. Recordings were transcribed verbatim and imported into ATLAS.ti (version 23) for analysis

using an inductive thematic approach, allowing themes to emerge directly from the data. Open coding was first applied to break transcripts into meaningful units, followed by axial coding to group related codes into broader categories, which were refined into overarching themes aligned with the research questions. Representative quotations for each theme were extracted from the transcripts to illustrate and substantiate the quantitative findings, ensuring that the qualitative data effectively supported and contextualized the numerical results. Analytical insights were documented using the software's memoing function, ensuring a systematic and transparent process.

3.4 Ethical Considerations

To ensure that the research adhered to the highest ethical standards, protecting the rights, dignity, and well-being of all participants, ethical clearances were obtained from relevant institutional review boards before the commencement of the study in both Mafikeng, South Africa, and Kisumu, Kenya. Ethical clearance for the part of the study conducted in Mafikeng was sought from the Faculty for Natural and Agricultural Sciences Research Ethics Committee (FNASREC) at North-West University. For the portion of the research conducted in Kisumu, ethical approval was sought from the National Commission for Science, Technology, and Innovation (NACOSTI) in Kenya. All participants were provided with clear information regarding the study, including its purpose, procedures, and their rights, including the right to withdraw at any stage of the study without any negative consequences. Written informed consent was obtained before participation. Any data collected was anonymized to protect participants' identities, securely stored, accessible only to authorized personnel, and used solely for this research. Ethical reviews ensured that any potential risks to participants were thoroughly assessed and that appropriate measures were implemented to mitigate them before the study commenced. Ethical considerations were monitored throughout the study, with regular reviews to ensure compliance with best practices.

4. Results and Findings

4.1 Demographic Profile of Respondents

The demographic composition of local government officials and professionals involved in climate governance was profiled to provide crucial context for interpreting institutional capacity, policy orientations, and the potential for inclusive climate action in both Mafikeng and Kisumu (Figure 2). The profile revealed a marked gender disparity between the two cities. In Mafikeng, female respondents constituted 60%, suggesting a strong presence of women in local climate governance roles. In contrast, Kisumu exhibited a male-dominated respondent profile (66.7%), with women comprising only 33.3%. Mafikeng's gender distribution may signal more progressive gender integration within its

municipal environmental structures, aligning with broader equity and inclusivity goals in climate governance. Kisumu's male dominance could reflect either structural barriers to entry for women in environmental governance or existing gendered occupational roles within local government.

The age distribution reveals that Mafikeng's climate governance professionals skew older, with nearly 60% above the age of 45, while Kisumu has a younger professional cohort, with over 70% aged between 25 and 44. This younger demographic in Kisumu may bring innovation and digital-savviness, potentially fostering more adaptive, tech-driven climate initiatives. In contrast, Mafikeng's older workforce might benefit from accumulated institutional knowledge and experience, which can be advantageous in long-term strategic planning but may pose a challenge in adapting to emerging climate governance paradigms that demand agility and innovation. In terms of education, both cities demonstrate a high level of academic attainment among respondents, with over 90% holding at least a bachelor's degree. Mafikeng shows a slightly more advanced academic profile, with 33.3% of respondents holding postgraduate degrees (Master's and Doctorate) compared to 28.6% in Kisumu. Notably, Kisumu had no doctorate holders, while Mafikeng had 6.7%. This difference may influence the depth of technical and policy analysis conducted within local climate governance processes.

Mafikeng exhibits a more experienced workforce, with 33.3% of respondents having over 10 years of experience, compared to only 14.3% in Kisumu. Conversely, Kisumu has a stronger presence in the mid-career bracket (4–10 years), making up 66.7% of the sample, suggesting a relatively newer cohort likely bringing contemporary training and methods to the fore. Mafikeng's longer tenure could imply more stable institutional memory and continuity in climate programs, while Kisumu's fresher perspectives could enhance responsiveness and openness to innovative practices. In terms of specialization, Mafikeng professionals were heavily concentrated in general environmental management (53.3%) and research and development (26.7%), whereas Kisumu respondents were more diversified, with significant representation in project planning and management (28.6%), climate policy and planning (23.8%), and stakeholder engagement (4.8%). The greater diversity in Kisumu's professional roles could enhance integrated, cross-sectoral climate action and suggest a broader skills base for multi-dimensional governance approaches.

The distribution of role types also highlights institutional differences. Both cities had a similar proportion of technical staff (Mafikeng: 53.3%, Kisumu: 57.1%), indicating a shared emphasis on technically informed interventions. However, Mafikeng had a significantly higher share of administrative staff (40%), while Kisumu included more field officers (19.1%), suggesting stronger operational implementation capacity in Kisumu and possibly greater field-level engagement with community stakeholders.

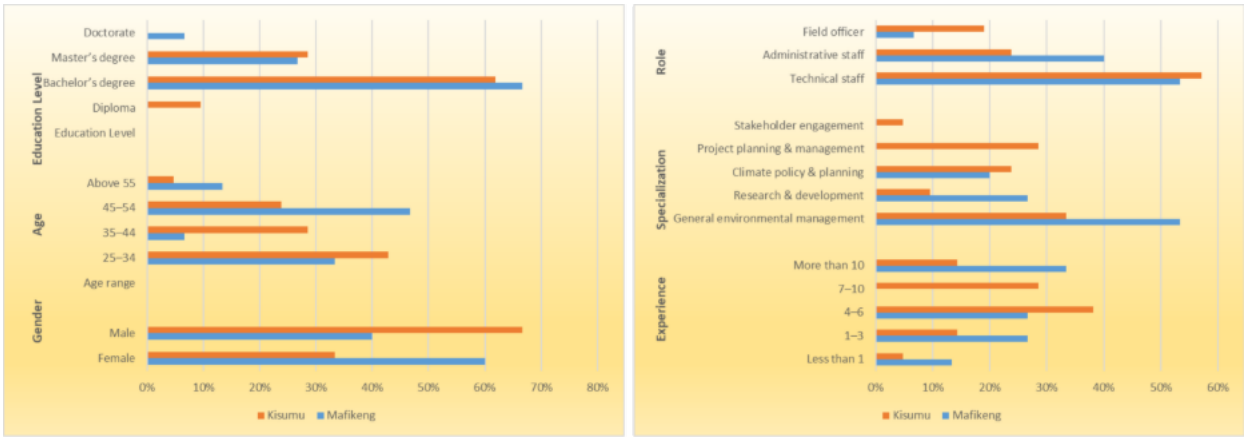

Figure 2: Demographic profile of the study respondents

4.2 Effectiveness of Climate Action Plans

4.2.1 Overview of the Legislative and Institutional Frameworks for Climate Actions in Mafikeng and Kisumu

Tables 1 and 2 present a comparative summary of the legislative and institutional frameworks cited by respondents as guiding climate change actions in Kisumu and Mafikeng. Kisumu's climate governance is anchored in Kenya's *Climate Change Act (2016, amended 2023)*, which establishes both national and devolved obligations, including carbon markets. At the subnational level, the *Kisumu County Climate Change Act (2020)* provides a robust framework through the County Climate Change Fund (CCCF), climate change ward committees (CCWCs), and integration of climate priorities into county planning. Planning instruments such as the *Kisumu County Integrated Climate Change Action Plan (KCICCAP 2023–2027)* align county actions with Kenya's NCCAP and NDCs, supported by a dedicated county climate fund to finance local projects. By contrast, Mahikeng is guided primarily by South Africa's *Climate Change Act (2024)*, which took effect in 2025 and mandates climate risk assessments, adaptation and response plans, and sectoral emissions targets. Subnational frameworks remain underdeveloped, with a provincial climate forum yet to be operational, though the *North West Climate Change Response Strategy and Implementation Plan (2024)* provides guidance. Municipalities such as Mafikeng integrate climate priorities through their IDPs, with funding largely reliant on national/provincial transfers and the national carbon tax.

Institutionally, Kisumu benefits from a decentralized and participatory system. At the national level, climate policy is coordinated by the *National Climate Change Council (NCCC)* and implemented by the *Climate Change Directorate (CCD)* and NEMA. Locally, the *County Climate Change Unit (CCCU)* within the Department of Environment oversees

county climate actions, supported by the *CCCF Board* for financing and *Ward Climate Change Committees (WCCCs)* to ensure grassroots participation. These arrangements are operationalized through the *KCICCAP (2023–2027)* and mainstreamed across county departments. In contrast, Mahikeng's framework is more centralized. National oversight is provided by the *Presidential Climate Commission (PCC)* and the *Department of Forestry, Fisheries, and the Environment (DFFE)*, which leads technical implementation, with municipalities tasked to integrate climate measures within their IDPs. While the recently finalized *North West Climate Change Response Strategy (2024)* strengthens provincial guidance, the planned provincial climate forum has yet to be formed. Financing is integrated into municipal IDPs without a dedicated climate fund, and specialized roles such as the Air Quality Management Unit support compliance with national emissions regulations.

Table 1: Comparative summary of the legislative frameworks for climate actions in the two cities

Aspect	Kisumu City (Kenya)	Mahikeng City (South Africa)
Core national law	*Climate Change Act (2016, amended 2023)* – establishes national and county obligations, mainstreaming, and carbon markets.	*Climate Change Act, 2024* (in force March 2025) – mandates climate risk assessments, adaptation/response plans, and sectoral emissions targets.
Subnational framework	*Kisumu County Climate Change Act (2020)* – creates the **County Climate Change Fund (CCCF)**, ward committees, and mandates climate integration in county planning.	No provincial-level climate change laws; Provincial Climate Change Forum to be established under the *Climate Change Act, 2024*.
Municipal framework	The municipality integrates climate priorities into its **Integrated Development Plan (IDP)** as required under the national Act and county Act.	Municipalities integrate climate priorities into their **Integrated Development Plan (IDP)** as required under the national Act and provincial guidance.
Planning instruments	*Kisumu County Integrated Climate Change Action Plan (KCICCAP 2023–2027)* – aligns local actions with Kenya's national climate change adaptation plan (NCCAP) and NDCs.	*North West Climate Change Response Strategy and Implementation Plan (2024)* – provides the provincial-level guidance for implementing the national climate change response.
Finance mechanisms	Dedicated **CCCF** at the county level to channel funds to ward and community projects; alignment with NCCAP funding streams.	No dedicated municipal climate fund; municipalities access national/provincial transfers and integrate budgets within the IDP; national **Carbon Tax (2019)** raises revenue for mitigation.
Emissions regulation	National focus on **carbon markets** (2023 amendment); the county's role is enabling projects and mainstreaming mitigation.	National **carbon budgets** and **carbon tax** regulate emissions; municipalities focus on compliance support and reporting.
Air quality & environment	Managed through broader environmental frameworks (**Environmental Management and Coordination Act (EMCA) of 1999 & Forest**	Governed by the **Air Quality Act (2004)** and **NEMA (1998)**, giving municipalities

	Conservation and Management Act (FCMA) of 2016); not embedded in county climate law.	powers over air quality monitoring and enforcement.
Overall orientation	Strong **county-level governance** with community participation and dedicated funding mechanisms.	Strong **national-level regulation** with municipal compliance duties through IDPs, risk assessments, and air quality management.

4.2.2 Perceived Climate Challenges in Mafikeng and Kisumu

Local government officials' perceptions of the most pressing climate-related challenges provide critical insight into the pressures shaping municipal adaptation priorities. Respondents in both Mafikeng and Kisumu identified multiple stressors, yet the severity and ranking of these challenges reveal place-based vulnerabilities and differentiated climate risk profiles (Table 3).

Storms and flooding emerged as the most pressing climate challenge in both cities. In Kisumu, this concern was nearly unanimous, with 18 of 20 respondents ranking it first, yielding a high weighted index of 0.933. Mafikeng, though to a lesser extent, also ranked it first with a moderate index of 0.773, suggesting increasing exposure to extreme weather events. This shared concern highlights the growing frequency and intensity of hydroclimatic extremes across urban Africa, exacerbated by poor drainage infrastructure, urban expansion into flood-prone areas, and limited anticipatory planning. One respondent from Kisumu, an ecosystems conservator, noted: *"For the last 5 years that I have been here, every year we must face flood problems during heavy rains… These floodings force people out of their homes to rescue centers, because they are so devastating."* Reflecting on the cause of the persistent flooding, another respondent observed *"… flooding. It's common here. We get heavy rains, and rivers like Sondu and Nyando overflow, or there's backflow from Lake Victoria."*

However, the secondary climate stressors diverge notably. In Mafikeng, the second most critical issue is water scarcity (0.760), followed by heatwaves (0.627) and droughts (0.453), a reflection of the semi-arid, inland geography of the city and its chronic water supply challenges. These findings are echoed by one of the respondents, who explained: *"Mafikeng is prone to droughts and water problems… because it is like a desert. Because of this, we've been observing intense dust storms over the years. You just see this huge brown cloud of dust coming."* Another Mafikeng respondent added that *"we have serious heat waves that come and go every summer… but they are often worse in November/December. Like last November, it was between 45 and 50° for two weeks straight, leading to drought and severe water shortages,"* highlighting the severity of summer extremes due to acute aridity.

In contrast, Kisumu, located along Lake Victoria, identified land degradation (0.495) and lake level rise (0.448) as next in importance. This highlights Kisumu's lakefront vulnerabilities, where informal settlements, erosion, and encroachment into wetlands heighten exposure to both inundation and ecosystem degradation. A Kisumu environmental manager described the situation: *"Rising lake levels and erratic rainfall, especially around Nyando floodplains, have displaced communities and damaged infrastructure."* They further noted how solid waste accumulation exacerbates flooding: *"Plastic pollution clogs drainage systems… Our Waste-to-Jobs program is helping formalize the recycling sector to aid in getting rid of this plastic pollution issue."*

Additionally, drought appears as a mid-level concern in both cities (Rank 4), though it is more acutely felt in Mafikeng, where it is part of a broader water security narrative. This is consistent with accounts from Mafikeng's housing and environmental officials, who described *"extreme drought"* and *"water shortages,"* often linked with intense heatwaves. Commenting on the occurrence of drought situation in Kisumu city, one official stated: *"Besides that [flooding], we also experience dry spells. When there's not enough rainfall, river levels drop dramatically. That leads to water shortages in the city, and residents have to buy water from vendors at high prices."* Kisumu's respondents also flagged urban heat islands (0.362) as an emerging issue, likely tied to rapid urbanization, declining tree cover, and unregulated building practices, indicative of the urban climate-ecology interface. As one Kisumu respondent remarked: *"Heatwaves are common here… it might be the effect of the urban heat islands and that's the reason why we're planting trees to help cool the city."* Another added: "*We are witnessing rising temperatures; it's getting hotter even during the rainy season. Studies I have read show Kisumu may warm by 1.8°C in the near future under a 'business as usual" emissions scenario*."

Air quality was not flagged as a major concern in both cities. However, in Kisumu, interviews revealed slightly conflicting perspectives among officials. One climate change officer remarked, *"Deforestation and increased vehicle emissions have pushed our AQI beyond WHO limits at times."* In contrast, an environmental manager stated, *"Air quality in Kisumu is still stable. We have a mobile air quality lab shared with other counties—just last month it was stationed at United Mall here. …the results from our monitoring points indicate that conditionsl remain within acceptable levels for now."*

Table 3: Weighted ranking of the top five most significant climate challenges facing Mafikeng and Kisumu cities

City	Climate Challenge	Distribution of Respondents per Rank					Weight	Index	Rank
		1	2	3	4	5			
Mafikeng	Storms & Flooding	6	4	3	1	1	58	0.773	1

	Water scarcity	5	5	3	1	1	57	0.760	2
	Heatwaves	2	3	6	3	1	47	0.627	3
	Droughts	0	2	4	5	4	34	0.453	4
	Land degradation/desertification	0	1	2	5	7	27	0.360	5
Kisumu	Storms & Flooding	18	2	1	0	0	98	0.933	1
	Land degradation/desertification	1	4	5	5	6	52	0.495	2
	Sea level rise	0	5	7	5	4	47	0.448	3
	Droughts	0	6	5	5	5	46	0.438	4
	Urban heat islands	2	4	3	6	6	38	0.362	5

4.2.3 The Role of Municipalities in Climate Adaptation

There is a strong consensus across both cities that municipalities have a critical role to play in building urban climate resilience, though the strength of that conviction varies (Figure 3). In Mafikeng, 100% of respondents agreed (80% strongly, 20% agree) that the municipality can support adaptation. This unanimous support reflects a high level of normative acceptance of local government's mandate in climate action, perhaps influenced by policy frameworks that explicitly position local governments at the center of South Africa's climate adaptation agenda, such as the National Climate Change Adaptation Strategy. By comparison, Kisumu showed more nuanced responses, with 76.2% in agreement (57.1% strongly, 19.1% agree), and a notable 19% expressing neutrality or disagreement. While this still reflects general confidence in local climate governance, it suggests variability in trust or visibility of local government performance, possibly shaped by past implementation gaps or limited outreach.

A sharp contrast emerges when it comes to familiarity with existing climate action plans designed to address identified climate challenges, revealing divergent institutional communication and stakeholder engagement practices (Figure 3). In Kisumu, nearly half of the respondents (47.6%) reported to be extremely familiar with municipal climate action plans and actively participating in them. This suggests a high level of participatory governance and inclusivity, possibly enabled by Kenya's devolved governance system and subnational climate policy frameworks that emphasize county-level planning and public involvement. In stark contrast, Mafikeng exhibited low familiarity, with 26.7% of respondents admitting to knowing nothing at all about municipal climate plans, and none indicating active involvement. Only one-third were "very familiar." This gap points to information asymmetry, limited stakeholder engagement, or perhaps weak institutional structures for climate communication. Such a disconnect, despite high belief in the municipality's role, could limit the effectiveness and legitimacy of adaptation efforts.

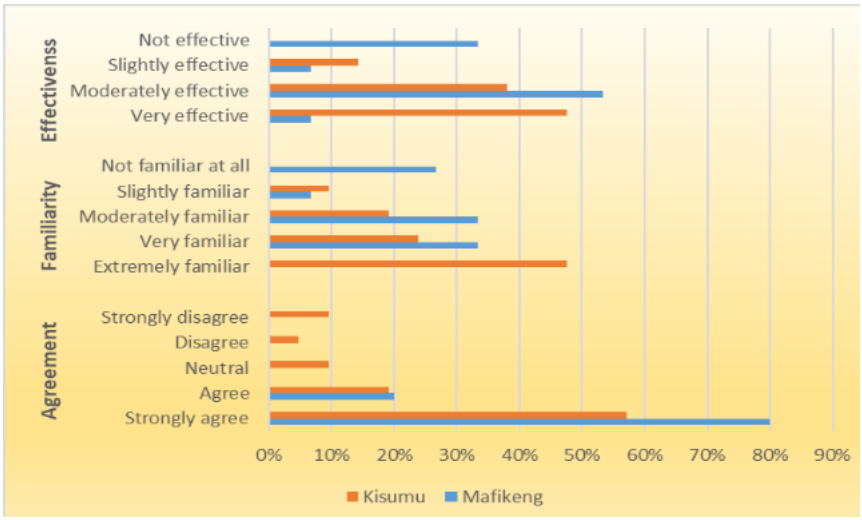

Figure 3: Responses on agreement level on the role of municipalities in climate adaptation, and familiarity & effectiveness of existing municipal climate action plans

4.2.4 Funding Landscapes for Local Urban Climate Action

Sustainable and predictable financing is a cornerstone of effective climate governance at the local level. The ability of municipalities to secure diverse funding streams significantly shapes their capacity to implement climate action plans, respond to urgent climate threats, and institutionalize adaptation across sectors. The analysis of the funding landscapes for the existing urban climate actions in Mafikeng and Kisumu revealed both shared funding priorities and context-specific variations in financial access and reliance (Table 4).

Government budget allocations are ranked as the top funding source in both cities, highlighting a shared reliance on public fiscal support from national or sub-national governments. In Mafikeng, this reliance is particularly pronounced and exclusive: nearly all respondents (n=12/15) ranked it first, giving it a dominant weight index of 0.960. Kisumu presents a more diversified scenario, where government funding somehow shared the top spot (index = 0.924) with multilateral development banks (MDBs) such as the World Bank and African Development Bank (0.914). This co-ranking points to Kisumu's dual strategy: securing public funds while actively engaging global financing institutions.

In Mafikeng, multilateral development banks (index = 0.693) were also recognized as significant, but less universally relied upon than in Kisumu. This suggests that while South African municipalities may be eligible for international financing, bureaucratic hurdles, co-financing requirements, or limited application capacity may constrain access. Conversely, Kisumu's equally strong reliance on MDBs indicates proactive engagement with global

climate finance mechanisms, likely aided by Kenya's devolved county governance and national-level donor coordination frameworks.

Table 4: Weighted ranking of the top five most significant sources of funding for climate actions

City	Funding Source	Distribution of Respondents per Rank					Weight	Index	Rank
		1	2	3	4	5			
Mafikeng	Government budget allocations	12	3	0	0	0	72	0.960	1
	Multilateral development banks	3	5	4	2	1	52	0.693	2
	Public-private partnerships	2	5	4	3	1	49	0.653	3
	Private sector investments	2	4	4	3	2	46	0.613	4
	Community-based financing	3	2	3	4	3	43	0.573	5
Kisumu	Government budget allocations	16	3	1	1	0	97	0.924	1
	Multilateral development banks (e.g., World Bank)	15	3	2	1	0	95	0.914	2
	Philanthropic foundations (e.g., NGOs, donors)	5	4	5	5	2	68	0.648	3
	Multilateral Climate Funds (e.g., green energy fund)	4	3	5	5	4	61	0.581	4
	United Nations Agencies and Programs (e.g., UNEP)	3	3	5	5	5	57	0.543	5
	Bilateral aid and foreign government grants	2	3	5	5	6	53	0.505	6

Beyond these top two sources, notable divergences appeared. Kisumu relies more heavily on external, diversified streams, including philanthropic foundations (index = 0.648), multilateral climate funds (0.581), and UN agencies (0.543). These reflect donor interest in climate action at the city level, and may also result from greater institutional readiness, flexible local partnerships, and the city's global visibility as part of regional climate resilience programs (e.g., the Lake Victoria Basin Commission). Mafikeng, in contrast, places more weight on domestic and private mechanisms, including public-private partnerships (PPP) (index = 0.653) and private sector investments (0.613). These preferences signal a more market-oriented approach to climate finance, albeit still emerging, possibly influenced by South Africa's policy frameworks encouraging private sector engagement in renewable energy and infrastructure development. Interestingly, community-based financing was listed among Mafikeng's top five (index = 0.573) but did not feature prominently in Kisumu. This may reflect South Africa's stronger community-based civic structures or localized cooperative savings mechanisms, but it also points to the limited scale and impact of such funding in the broader climate agenda.

4.2.5 Municipal Climate Actions Effectiveness, Achievements, Success Factors, and Barriers

The study investigated the perceptions of the effectiveness of the existing climate action plan in addressing identified urban climate challenges in the two cities (Figure 3 above). In Kisumu, nearly half (47.6%) rated plans as “very effective”, and a further 38.1% as “moderately effective”, suggesting a high level of confidence in local climate governance performance. No respondents rated the plans as ineffective. This positive evaluation aligns with earlier findings on familiarity and participation, highlighting how inclusive planning correlates with public trust and perceived efficacy. Conversely, Mafikeng respondents expressed skepticism, with only 6.7% viewing plans as very effective, and a concerning 33.3% stating the plans are not effective at all. This indicates disconnects between policy formulation and implementation, or perceived failures in outcomes. Despite Mafikeng’s experienced and well-educated workforce, the limited impact and weak outreach of climate strategies are clear barriers to effective urban adaptation.

When asked to identify specific climate action achievements in their respective cities over the past five years, respondents highlighted a diverse range of successful or impactful adaptation and mitigation initiatives (Figure 4a), reflecting varied local priorities and capacities. In Mafikeng, the most widely acknowledged achievements were *improved waste management* (80%), *community engagement in climate programs* (73.33%), and the *implementation of early warning systems for extreme weather events* (60%). These were followed by the *adoption of climate-friendly policies or regulations* (40%) and *improved air quality* (33.33%). However, a number of interventions, such as increased energy efficiency, increased green spaces, and improved water management, were recognized by less than 10% of respondents, indicating either limited progress or visibility in these areas.

In Kisumu, several achievements stood out with high percentages. *Flood risk reduction and the adoption of climate-friendly policies or regulations* were both reported by 90.48% of respondents. Other notable achievements included *increased green spaces* (85.71%), *community engagement in programs* (85.71%), and *protection/ restoration of natural ecosystems* (52.38%). In essence, a broader range of interventions in Kisumu were acknowledged compared to Mafikeng, with moderate percentages reported for improved water management, implementation of early warning systems, and increased use of renewable energy, each identified by approximately 42–48% of respondents.

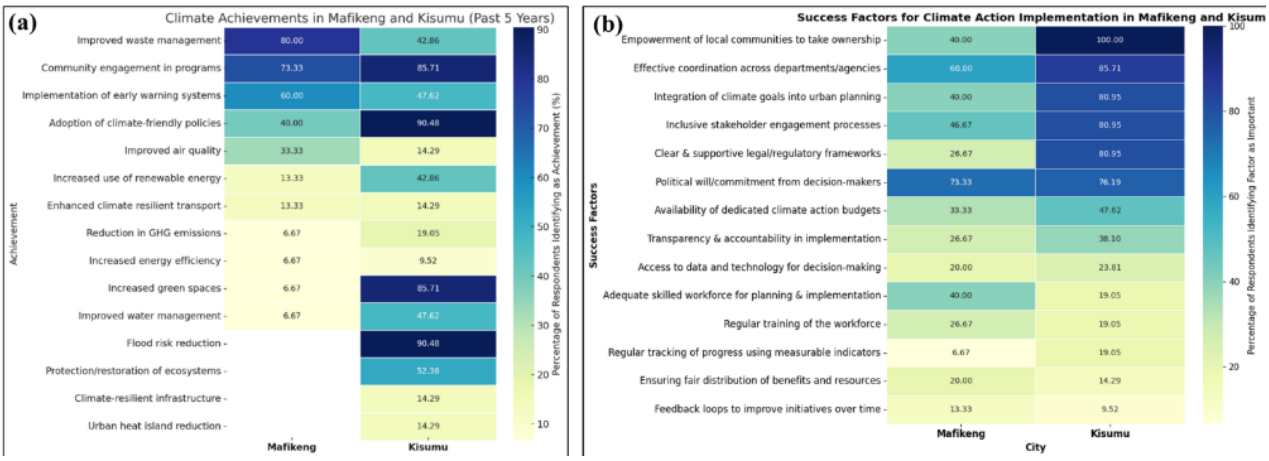

Figure 4: Recent climate action achievements (a) and associated success factors (b) in Mafikeng and Kisumu cities

These identified climate action achievements were attributed to a range of key success factors that supported the effective implementation of initiatives in both cities (Figure 4b). However, the results reveal differing emphases on institutional and community-level enablers, reflecting the distinct governance contexts and operational challenges faced by each city.

In Kisumu, empowerment of local communities to take ownership of climate initiatives was identified as the most important success factor, cited by 100% of respondents. Illustrating this point, one official stated that: *"Our model emphasizes community-driven adaptation. Communities identify their own challenges and propose solutions. It's about ownership. You cannot impose adaptation from above; it must be locally grounded to be effective and sustainable."* This underscores the centrality of community participation in fostering ownership, long-term sustainability, and responsiveness to local needs. Other highly ranked success factors include effective coordination across departments and agencies (85.71%), inclusive stakeholder engagement processes, integration of climate goals into urban planning, and clear and supportive legal and regulatory frameworks (each at 80.95%). These responses reflect a strong recognition of the value of inter-sectoral collaboration and institutional coherence in mainstreaming climate considerations into city planning.

In Mafikeng, the highest-rated factor was political will and commitment from decision-makers, mentioned by 73.33% of respondents. This reflects the top-down governance approach prevalent in the city, where high-level leadership remains critical to unlocking climate-related institutional support and resources. Other significant success factors in Mafikeng include effective coordination across departments and agencies (60%) and

inclusive stakeholder engagement processes (46.67%), highlighting similar priorities to Kisumu, although with lower levels of reported implementation or success. Lower-rated factors, such as access to data and technology and regular tracking of progress using measurable indicators, suggest gaps in technical capacity and monitoring systems.

A comparative analysis of implementation challenges in the two cities revealed both shared and context-specific barriers to effective/successful implementation of climate actions, ranging from systemic financial constraints to institutional and capacity-related limitations (Table 5), that shape each city's ability to effectively operationalize climate resilience strategies.

Table 5: Weighted ranking of the top five most significant barriers to effective implementation of climate actions in Mafikeng and Kisumu cities

City	Barriers to effective CA implementation	Distribution of Respondents per Rank					Weight	Index	Rank
		1	2	3	4	5			
Mafikeng	Limited financial resources	8	3	2	1	1	59	0.813	1
	Corruption, abuse, and fraud in operations	3	4	2	1	0	39	0.52	2
	Limited human resources	4	2	1	1	0	33	0.44	3
	Limited political goodwill or support	1	3	3	3	0	32	0.427	4
	Low/poor stakeholder coordination	1	1	1	1	6	20	0.267	5
Kisumu	Limited financial resources	18	1	1	1	0	99	0.943	1
	Lack of effective monitoring and evaluation	1	2	4	7	7	46	0.438	2
	Lack of regular training of the workforce on new knowledge and practices	0	2	4	6	9	41	0.39	3
	Limited human resources	0	2	3	6	10	39	0.371	4
	Limited technical capacity	0	2	2	7	10	38	0.362	5

Across both cities, limited financial resources emerge as the most significant barrier, reflecting a pervasive constraint on municipal climate action. In Mafikeng, this challenge is underscored by a high index score of 0.81, indicating the frequency and severity with which respondents ranked it as a primary obstacle. As one Mafikeng official puts it, *"Funding issues… that is the mother of all problems. Climate change is not funded at all."* Another explained that *"Even with the funding that we get to do the policies and the plans, it's always limited. We have to be strategic—this year we can only afford to do this one project and hope to do another when we get the budget."* Kisumu also identifies financial constraints as the top barrier with a higher index (0.94), and this was consistently confirmed by various top officials during the interviews. As one noted, "*Funding is the*

biggest constraint. Many proposed projects are dropped or delayed because the available budget is inadequate." Another elaborated that *"many promising project ideas, whether from public participation or departmental planning, have to be scaled down, postponed, or even abandoned due to budget limitations. Sometimes we get partial support from development partners or the national government, but these are not always predictable or sufficient. Also, delays in fund disbursement further stall our timelines and disrupt continuity*." Even where legal provisions exist, implementation remains inconsistent. As one respondent pointed out, *"Although our Climate Change Act mandates allocating 2% of the county budget to climate interventions, this hasn't always been implemented."* These findings confirm the centrality of funding limitations in hindering climate action.

This shared challenge reflects broader Sub-Saharan urban realities, where municipal budgets are stretched across competing priorities, and climate action or environmental management remains insufficiently prioritized or resourced. In Mafikeng, this lack of prioritization was particularly evident in the interviews. One respondent explained, *"We're not a production sector. When it comes to council, they forget we must assess things before development happens. If the department doesn't bring much money, it doesn't get a lot of budget. Last financial year, we got R2.5 million. This financial year, we got nothing. We wanted to do waste management work but didn't get funds."* Another highlighted the structural challenge of expanding departmental functions without corresponding budget growth: *"The mandates our department is responsible for keep growing… resources are needed everywhere, but budgets don't go up every year — we usually just get our baseline — and that's the main challenge."* The repercussions of limited budgets extend to constrained human resources, inadequate technical capacity, and poor environmental management and services. In Kisumu, one official noted, *"There's also a challenge in awareness creation; we can't reach every community due to budget constraints."* Another added, *"In some sub-counties, a single officer is responsible for a wide area, which means extension services and project supervision may be delayed or uneven. This affects both the planning and implementation of climate adaptation projects, as close monitoring is essential for success."* Similarly, in Mafikeng, an official explained, *"In the past 12 years, we've only cleaned the river twice, both times funded by grants. Since the grant ended, there has been no cleaning, and waste keeps returning because there are no collection systems in the villages."* Beyond financial limitations, Mafikeng respondents identify corruption, abuse, and fraud (index 0.44) as a major impediment. These points to governance weaknesses that can drain resources, undermine project effectiveness, and erode public trust, making them a critical area for reform.

Mafikeng also grapples with institutional capacity issues, notably limited human resources (index 0.440) and limited political goodwill or support (index 0.427). One official noted, *"Inadequate technical capacity is a real issue. I'm a planner—I don't know anything*

about climate change, yet I'm placed in a position where I have to work on it." Explaining the effect of this situation, another official explained, *"Climate change work is like an add-on. I do it when I have time, on top of my actual job description. This has caused unnecessary delays in generating useful reports for the MEC [member of executive council]."* Political will was described as an equally significant barrier. *"The challenge is that all the work we do has to be approved by political heads, who often don't have the technical expertise. So even when we say, 'Let's do this because it will benefit the department or the province,' they'll have a different agenda. A lack of political will really hinders some of our work."* One example cited involved the removal of managers perceived as obstructive: *"This has happened recently, where managers were removed from their positions simply because they were standing in the way. Take the director of the EIA section, for instance. That section is seen as a bottleneck for development because many EIAs aren't approved due to non-compliance with legislation. So instead of aligning development with environmental laws, they move the people who are enforcing them."* These findings suggest that staffing shortages and inconsistent political backing weaken the city's ability to integrate climate priorities into broader development agendas. When political leadership does not champion climate goals, and institutional structures lack the personnel to carry out plans, implementation falters. Interestingly, low or poor stakeholder coordination was rated the least significant barrier (index 0.31), indicating that while coordination challenges exist, they are not viewed as the most pressing constraint relative to financial and governance concerns.

In Kisumu, the secondary barriers following financial limitations primarily relate to institutional weaknesses and capacity gaps. Key challenges include insufficient systems for monitoring and evaluation (index 0.438) and a lack of workforce training (index 0.390). These points to challenges in tracking progress, learning from implementation, and updating skills to keep pace with evolving climate science and technologies. One official from Kisumu pointed out that *"Climate change is evolving quickly, and there's a need for more training and capacity-building. We need officers who are well trained in climate risk assessments, GIS for land-use planning, and resilient infrastructure design, but those opportunities are still limited."*

Additionally, limited human resources (0.371) and limited technical capacity (0.362) suggest workforce shortages and skill gaps that can stall project execution, monitoring, and innovation. Describing the scale of this situation, one official explained, *"We do have adequate human resources, but there's often a mismatch between numbers and skills — a lot of people have been employed without the technical expertise we actually need."* Another noted that *"when you don't have the right skills, even good plans can fall flat,"* while a third observed that "*we lack enough human resources and technical capacity. Sometimes we rely on officers from other sub-counties or hire external experts for specialized work."* This skills gap is especially evident in disaster preparedness, as one respondent highlighted: *"We lack*

personnel trained in disaster preparedness and response, how to coordinate evacuations, manage early warning, and assess vulnerability. That's an area the county needs to strengthen."

Unlike Mafikeng, which ranked corruption as second most significant barrier, the issue is not prominently featured in Kisumu, which may reflect stronger institutional controls or lower perceived incidence. Commenting on existence of this issue, one of the interviewed officials in Kisumu observed that, *"Sometimes, MCAs [Members of County Assembly] try to influence which projects are implemented, which may not align with community needs or technical feasibility. This interference can make implementation more difficult."* Another issue that came out of the interviews in Kisumu is the overlapping of roles across institutions, which one official said, "*sometimes causes confusion or even duplication of efforts."* This is partly the result of the decentralization of environmental governance in Kenya.

Besides the ranked barriers presented in Table 5, interviews uncovered the two greatest and closely interrelated barriers to effective climate adaptation in Mafikeng. The first is the absence of a clear climate change legislative framework at the local level—something that Kisumu has established. As one official explained: "*We develop our own environmental management tools—most are legislated, so by law we must have them as a province. But some aren't legislated, and in those cases, we decide what's important. For example, we're currently drafting a biodiversity sector plan for the province. It's not required by law, but it's a key tool to help municipalities make better development decisions. And then there's climate change work—but here's the problem: there's no dedicated climate change unit in the province."* This leads directly to the second greatest barrier: the lack of a dedicated climate change directorate or department, in contrast to Kisumu. One official lamented: *"We don't have a climate change unit in our department—no structure, funding, or dedicated staff. For years, we've tried to establish one, but without success. In the meantime, we take on extra work to cover the function. I hope the Climate Change Act signals to Treasury and HR that such a unit is urgently needed."* Another confirmed the structural limitation: *"The climate change unit does not exist in the department's structure, so it cannot be funded, and no posts can be created."*

4.2.6 Monitoring, Evaluation, Accountability, and Learning in Climate Actions

An evaluation of the monitoring and evaluation (M&E) mechanisms for climate actions in the two cities reveals marked differences in the institutional structures and practices underpinning climate action assessment, reflecting variations in governance models, resource availability, and engagement with external stakeholders (Figure 5). In Mafikeng, climate action M&E is overwhelmingly dominated by local municipal officials (47%) housed within a single dedicated department, indicating a high degree of internal

responsibility. As one municipal official noted, *"We have a separate section for that [the M&E], that is dedicated to monitoring and evaluation of those projects… It is in that directorate — planning and technical services — so they are the ones who are responsible for M&E."* While this localized ownership could enhance alignment with city-level priorities and faster responsiveness, it also raises concerns about limited oversight, potential capacity gaps, and insufficient external verification. National and other local government agencies collectively account for 40%, suggesting some intergovernmental involvement, but no input was reported from international organizations, NGOs, or academic institutions. This closed-loop system may constrain the ability to access external expertise or objective evaluation.

In contrast, Kisumu's M&E landscape is more distributed and multi-actor, pointing to a more open and layered governance approach. Local municipal officials are marginal (only 5%), while regional agencies (29%), other local government bodies (29%), and national agencies (14%) share the main oversight role. As one Kisumu official emphasized, *"In our department we have the internal checks for our projects, internal audits, but we also have the national government, in terms of the Auditor General's office, so we have both internal and external [evaluation] every financial year."* This reflects Kenya's devolved governance model, where counties often work collaboratively with subnational and national bodies in climate planning and performance review. Moreover, Kisumu includes international organizations (14%), NGOs/CBOs (5%), and academic institutions (5%) in the M&E process, signaling greater inclusivity and reliance on external validation. Recalling an instance where funders played a role in auditing, one respondent added, *"Since FLLoCA is a national project across various counties, [funders] just select a few counties whose projects they are subjecting to auditing."* This shows a clear linkage between local M&E practices and broader national and donor-driven audit processes. This broad base enhances legitimacy, supports learning, and connects local climate action to global evaluation standards.

The frequency of climate action evaluations also differs substantially between the two cities. In Mafikeng, assessments are largely internalized and event-triggered, with 33% conducted quarterly, 33% continuously, and smaller shares linked to end-of-project cycles (7%) or grave challenges (7%). This suggests some routine monitoring, but also a reactive orientation to critical events. The inclusion of "in case of grave challenges" hints at limited institutionalization of anticipatory evaluation frameworks. In Kisumu, on the other hand, the majority of assessments (57%) are conducted annually, likely aligned with the financial year and national reporting frameworks. As one respondent clarified, *"We normally evaluate the success of every project annually — usually at the end of the financial year. A specific example is our flood vulnerability mapping, which has been quite effective in guiding further interventions in flood-prone areas."* A further 29% occur continuously, while only 10% are quarterly. This pattern reflects a more formalized and periodic assessment process, integrated into budgetary and donor accountability cycles. It also implies stronger

alignment between planning, financing, and reporting, which is essential for climate fund access and results-based management.

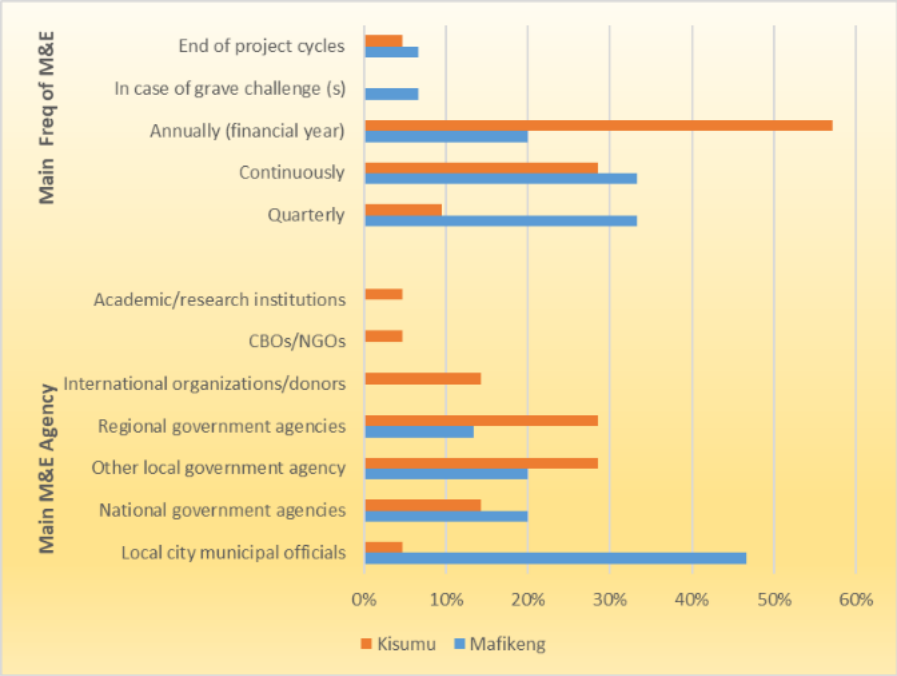

Figure 5: Responses on agencies responsible for M & E and the frequencies of M&E assessment in both cities

Continuous knowledge exchange and capacity development are essential components of effective monitoring, evaluation, and adaptive governance in urban climate resilience. As illustrated in Table 6, distinct approaches and preferences exist between Mafikeng and Kisumu in how knowledge dissemination and capacity development in climate action occur.

In Mafikeng, the most effective knowledge-updating measure is reported as collaboration with academic or research institutions (index 0.600). This often involves sponsoring select individuals for advanced studies in specific technical areas at an academic institution. However, the effectiveness of this approach is significantly constrained by its limited reach and irregularity. As one official observed, *"In our department, I think they've only been able to train one person in the last 7 years. And that person was sponsored for a master's degree…but still, we lack technical skills for this kind of stuff [climate change-related work]."* Collaboration with academia is followed by the distribution of newsletters, reports, or publications (0.578) as the second most effective measure, indicating a preference for traditional, document-based knowledge sharing. Online webinars rank third (0.533), showing some uptake of digital learning but with less perceived effectiveness. Training workshops were not part of capacity building measures frequently used in Mafikeng, and

this is captured in one respondent's lament, *"For our department, no, they haven't done any [trainings] since 2018... It's very sad because we lack very valuable technical skills that we would get from such trainings. We are required to do these climate change reports, and we are not climate change experts — we are basically planners."* These findings highlight Mafikeng's strong reliance on formal partnerships for accessing climate science expertise, yet also highlight the need for broader and more consistent capacity development strategies within departments.

Kisumu, on the other hand, prioritizes engagement with community awareness campaigns (index 0.698) as the top method for keeping informed, emphasizing knowledge flow not only from formal institutions but also directly from community interactions. This highlights Kisumu's participatory governance ethos and the valuing of ground-level insights. The second-ranked mechanism is regular training workshops and seminars (0.587), reflecting structured, interactive learning environments. Similar to Mafikeng, online webinars (0.540) rank third, showing an increasing but still modest role of digital platforms. In both cities, access to training is often constrained by budget limitations, as illustrated by a comment from one of the officials in Kisumu: *"We always do online webinars especially on climate change. [because formal] Trainings by the department are rare because they are not budgeted for unless they are funded by external funders."* Nevertheless, both cities reflect the need for sustained and equitable investment in climate knowledge systems, particularly in the face of evolving risks and responsibilities. As a certain climate change officer emphasized, *"I think the big takeaway is that we need more structured capacity building. If people are well-trained and properly equipped, the rest follows — better implementation, better planning, and better outcomes."*

Table 6: Weighted ranking of the most effective capacity-building measure in Mafikeng and Kisumu

City	Capacity-building measure	Distribution of Respondents per Rank			Weight	Index	Rank
		1	2	3			
Mafikeng	Collaboration with academic/research institutions	5	2	8	27	0.600	1
	Distribution of newsletters, reports, or publications	2	7	6	26	0.578	2
	Online webinars	3	3	9	24	0.533	3
Kisumu	Engagement with community awareness campaigns	8	7	6	44	0.698	1
	Regular training workshops/seminars	5	6	10	37	0.587	2
	Online webinars	4	5	12	34	0.54	3

The frequency of capacity-building training provision varies notably. In Mafikeng, over 53% of respondents report that trainings occur irregularly or only, when necessary, while 33% receive at least some training quarterly. Only a small fraction experience monthly or weekly opportunities (around 6.7% each). This indicates that structured, frequent capacity development is limited, potentially constraining continuous learning and adaptation. On the other hand, Kisumu respondents report more regular training cycles, with the largest group (43%) receiving biannual (twice-yearly) training, followed by 24% quarterly and 14% irregularly. Monthly and weekly training are less common (under 5% each), and a small portion receive annual training (9.5%). This suggests Kisumu provides more consistent and scheduled learning opportunities, which likely supports better institutional knowledge retention and climate resilience capacity.

4.3 Stakeholder Engagement Processes in Climate Actions

4.3.1 Nature and Level of Engagement

To understand the breadth and diversity of stakeholder involvement in climate action efforts, respondents were asked to identify which actors they perceived as actively contributing to climate resilience in their respective cities (Figure 6a). In Kisumu, community-based organizations and multilateral development banks were the most frequently recognized, with over 90% of respondents identifying them as active players. Other key actors in Kisumu included research and academic institutions (80.95%), international NGOs, charities, and donors (71.43%), and regional government agencies (61.9%). Interviews with various heads of departments corroborated these findings, revealing a broad ecosystem of collaboration. Stakeholders in Kisumu reported active engagement with a wide range of institutions, including: national government agencies (State Department for Urban Planning, Ministry of Water and Environment, NEMA, KFS); multilateral and international organizations (World Bank, FAO, Green Building Kenya); local government bodies (Kisumu County Government); non-governmental and community-based organizations (Plan Kenya, SAS Watch); and private sector actors, such as banks, mainly through corporate social responsibility initiatives like tree planting and biogas technology projects. These partnerships reflect a multi-scalar governance approach, spanning city, county, national, and international levels.

However, while collaboration is widespread in Kisumu, several respondents highlighted significant gaps in unrealized partnerships, especially with key global institutions. A city planner remarked: *“One partner we’d really like to work with is UN-Habitat, but we haven’t yet managed to create a proper framework to operationalize that relationship.”* The potential

value of such a partnership was clearly articulated: *"We're hoping that working with UN-Habitat could help us access global technical expertise, especially in urban resilience and smart city design, and provide funding or technical tools to improve our spatial and land use planning."* Similarly, the city's director for climate change emphasized the limitation imposed by geography: *"Some [international organizations] are not yet active in Kisumu, but we would welcome collaboration with them. The key limitation is whether they're operating in our region."*

In contrast, Mafikeng showed a different engagement profile. The most recognized stakeholders were other local government agencies (80%) and regional government agencies (73.33%), followed by community-based organizations (60%) and NGOs (53.33%). Research and academic institutions also had a moderate presence (53.33%), while international NGOs, UN agencies and programs, and the private sector were identified by fewer respondents. Notably, the public was not reported as active in Mafikeng, whereas in Kisumu, 4.76% of respondents acknowledged public involvement. Key agencies identified by respondents as important collaborators include the Department of Agriculture, Land Reform and Rural Development; the Department of Water and Sanitation; the Department of Forestry, Fisheries and the Environment (DFFE), "*which supports local capacity-building and provides equipment*,"; and the South African Local Government Association (SALGA) "*…a body that assists the municipality. All the municipalities are affiliated with SALGA… they assist in capacitating the municipalities in terms of environmental and waste management issues.*" In addition, North-West University was recognized as an academic partner, "*collaborating with DHS on climate change impacts on housing and livelihoods*."

Collaboration with international agencies and the private sector was consistently identified by respondents as a significant gap, an unrealized partnership. This sentiment was clearly articulated by a Kisumu respondent who noted: *"Other partnerships that we want to work with are various organizations, like international organizations… they are coming with new technologies and innovations for dealing with environmental issues and mismanagement."* A Mafikeng official similarly observed: *"Yeah, so in terms of what is happening [stakeholder engagement] in the province, international [agencies/bodies] are not really involved as much."* Another echoed this sentiment when referring to the private sector, particularly rural waste collectors: *"We do not have that partnership with private sectors or NGOs… they are doing that on their own, we do not have a partnership with them."* Despite these gaps, there was a clear interest in building formal collaborations, particularly in the waste sector, especially in Mafikeng. One waste manager noted aspirations to advance waste separation at source and establish a local recycling forum: *"We wish to have a recycling forum around Mafikeng… maybe allocate portions to them to help us clean those spaces."* Academic collaboration also emerged as an area with room for

deeper engagement, as one respondent observed: *"We do work with the academic world, especially NWU… but I feel like we could be working with them more, coz as at now only one department I know of [DHS] is in active collaboration with them. It's about intensifying the depth of connections we already have."*

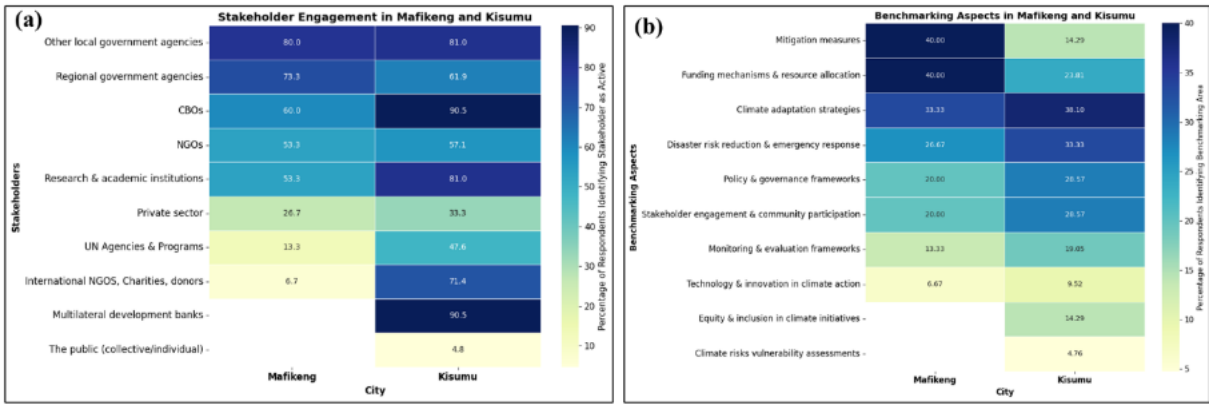

Figure 6: Heatmap showing key actors in climate actions and key focus areas for benchmarking in Mafikeng and Kisumu cities

Stakeholder engagement patterns further illustrate the governance differences. In Kisumu, engagement is frequent and institutionalized: over 52% of respondents report quarterly interactions, with others engaging biannually, annually, or even monthly. This regularity points to an active participatory governance model, fostering continuous dialogue, trust-building, and feedback loops essential for adaptive climate governance. Mafikeng shows a contrasting pattern, with two-thirds of respondents indicating rare engagement, only when necessary, and only 33% experiencing quarterly contact. This reactive and sporadic stakeholder involvement risks alienating community groups, reducing social learning, and weakening collaborative adaptation efforts. In both cities, interviews with departmental heads revealed that even in cases where stakeholder engagement is highly institutionalized, the strength of that engagement is highly person-dependent and lacks formal enforcement. As one official from Kisumu noted: *"But in general, coordination depends a lot on individual officers; there are no formal structures enforcing it."* Illustrating this point, the respondent added: *"It really varies from project to project. When there's a project, like in energy or water, coordination tends to improve, especially if the project is big and comes with at least some monetary or operational benefits for the departments involved. But projects where the benefits might be less or not there, that level of coordination isn't consistent."*

The study asked respondents whether their respective institutions/departments engage in benchmarking with similar institutions from other cities or municipalities, both nationally and internationally, to learn and adopt best practices for enhancing urban climate resilience. In response, 60% of participants from Mafikeng indicated that such

benchmarking practices are in place, compared to only 38.10% in Kisumu. Notably, 42.86% of respondents in Kisumu were unsure whether their institutions engage in benchmarking, which may point to gaps in communication, institutional transparency, or limited involvement of certain stakeholders in inter-city learning processes. The benchmarking heatmap (Figure 6b) illustrates the thematic areas in which officials from Mafikeng and Kisumu most frequently engage in such efforts. While the two cities show differing patterns, both prioritize benchmarking in key domains such as adaptation strategies, funding mechanisms, and disaster risk reduction. However, areas like technology and innovation, equity and inclusion, and monitoring and evaluation frameworks receive comparatively less attention, indicating potential opportunities for expanding knowledge exchange in underexplored aspects of climate governance.

4.3.2 Effectiveness of Coordination Among Stakeholders

The study explored the effectiveness of coordination/collaboration among the relevant local government departments and the stakeholders in implementing climate initiatives in both cities (Figure 7). In Kisumu, coordination between departments responsible for climate change-related duties and other local government agencies is perceived as very effective by a majority (62%), signaling strong intra-local government collaboration. This aligns with Kenya's devolved governance framework that promotes inter-county and inter-agency cooperation. Conversely, Mafikeng respondents rate this coordination much lower, with only 13% viewing it as very effective, and almost half (47%) moderately effective, but a significant 40% rating it slightly or not effective. This suggests that Mafikeng's local government coordination faces challenges, potentially due to siloed departments or bureaucratic inertia.

Kisumu again reports very effective coordination (67%) with regional (county) government bodies, underscoring well-established vertical linkages. Mafikeng shows a more fragmented picture: only 13% very effective, with 40% each moderately and slightly effective, and a small portion (7%) not effective. The weaker regional coordination in Mafikeng may reflect the complexities of South Africa's provincial governance or limited institutional integration on climate initiatives.

Regarding coordination with national government agencies, both cities demonstrate more moderate assessments. Kisumu respondents rate coordination as moderately effective (43%) or very effective (29%), with fewer viewing it as slightly effective (29%). Mafikeng's ratings are somewhat less positive, with 40% rating coordination as only slightly effective and 27% each moderately or very effective. The absence of "not effective" in Kisumu suggests more functional national-local interactions, possibly due to Kenya's stronger devolution, while Mafikeng still contends with national-local governance friction.

A critical divergence emerges in coordination with non-state actors, including NGOs, CBOs, and private sector entities. Kisumu respondents overwhelmingly perceive this relationship as very effective (62%), reflecting the city's robust engagement with civil society and donors in climate action. Mafikeng, in contrast, shows a majority rating coordination as slightly effective (53%) or not effective (40%), with no respondents rating it as very effective. This indicates substantial barriers to meaningful multi-sector partnerships, which are crucial for resource mobilization and community-based adaptation.

On coordination with communities, Kisumu again leads, with 76% rating coordination with communities as very effective, highlighting deep participatory governance and community inclusion in climate initiatives. Mafikeng's results are less positive, with 67% rating it as slightly effective and 27% not effective, and no "very effective" ratings. This gap reflects weaker community linkages and possibly limited trust or communication between municipal officials and local populations.

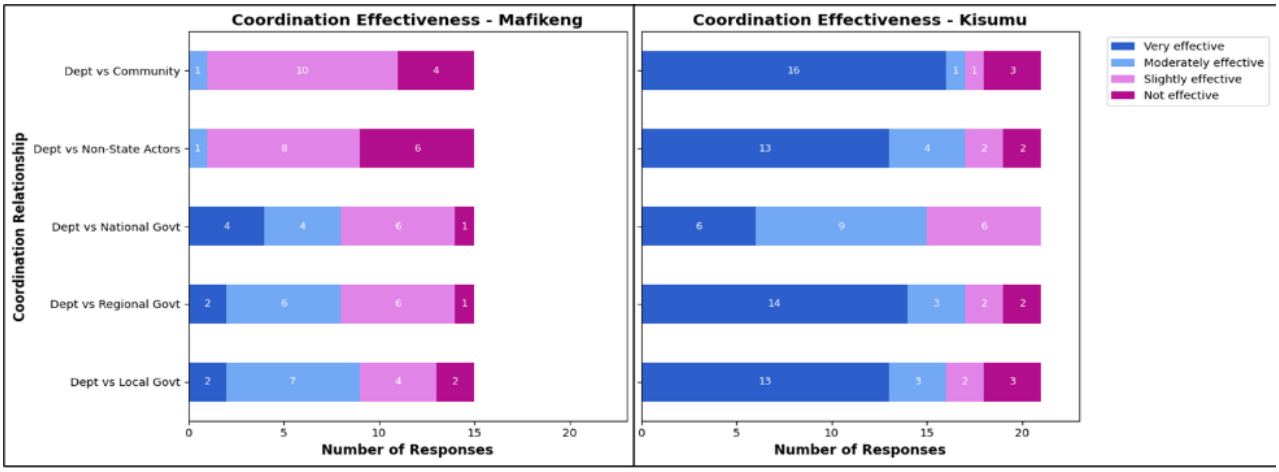

Figure 7: Perceived effectiveness of coordination among stakeholders

4.3.3 Barriers and Recommended Strategies for Enhancing Stakeholder Engagement in Climate Action

According to the results presented in Table 7, both Mafikeng and Kisumu identified insufficient funding as the most significant barrier to effective stakeholder engagement, emphasizing the critical role of financial resources in enabling inclusive and sustained climate action. In Kisumu, this challenge is particularly acute, reflected in a higher index score (0.895), which may point to the greater scale, complexity, and cost associated with participatory processes in a rapidly urbanizing context. Although slightly lower, Mafikeng's funding constraint (index 0.813) remains substantial, suggesting persistent budgetary

limitations that hinder efforts to build stakeholder capacity and support community outreach initiatives.

Beyond the shared challenge of limited funding, the two cities diverge in their secondary barriers. In Mafikeng, the second-most significant challenge is a lack of stakeholder awareness or interest (index 0.760), indicating difficulties in mobilizing and informing local actors about the relevance and urgency of climate initiatives. As one official from Mafikeng explained, community members often approach engagement sessions with expectations of direct economic gain, which can derail the intended participatory process: *"Immediately when we try to engage them [stakeholders]... they want to be employed by the municipality, either as workers or [would like us to] assist them with tenders. Those are the main challenges that we face."* This highlights how socio-economic needs intersect with participation, shaping both expectations and responses during engagement processes. Such, in turn, leads to low public engagement and limited grassroots ownership, which can significantly weaken the legitimacy and sustainability of local climate action.

By contrast, Kisumu ranked "conflicting priorities among stakeholders" as its second major barrier (index 0.733), suggesting a more complex stakeholder landscape characterized by competing interests and sectoral fragmentation. One departmental head explained that *"There are instances where certain stakeholders have priorities not aligned with yours or for the project you are working on, so the engagement or participation becomes a bit lukewarm."* For instance, another official explained: *"We sometimes deal with conflicting interests—for instance, between developers and environmental advocates. We try to mediate through technical working groups, often involving researchers from Maseno University, so our decisions are grounded in data."* This highlights the challenges of coordination and consensus-building in a diverse and dynamic governance environment, where aligning various actors around a common climate agenda requires deliberate negotiation and facilitation.

Additional barriers also reflect each city's contextual realities. In Mafikeng, mid-level obstacles include limited technical capacity (index 0.627) and poor communication channels (index 0.493), highlighting gaps in skills, knowledge systems, and information dissemination that constrain meaningful engagement. For Kisumu, political barriers (index 0.486) stand out as an important constraint, pointing to issues related to political will, governance structures, or local power dynamics that may affect the ability to foster inclusive stakeholder collaboration. As one respondent explained, *"bureaucratic inefficiencies sometimes delay our engagements with stakeholders. For instance, it may take a while before you get a green light to involve a particular partner in a project."*

Interestingly, poor communication channels ranked as one of the least significant barriers in both cities. While this may suggest the existence of basic communication infrastructure, it also implies that other, more structural and institutional issues take precedence in shaping stakeholder engagement challenges. One government official in Mafikeng articulated this communication issue, stating: *"Once you take the invite out to say this is the engagement that is happening, and other key stakeholders don't get part of that, it's a problem...we do engagements with whoever is around."*

Table 7: Weighted ranking of the top five most significant barriers to stakeholder engagement processes

City	Barriers to stakeholder engagement	Distribution of Respondents per Rank					Weight	Index	Rank
		1	2	3	4	5			
Mafikeng	Insufficient funding	7	4	3	0	1	61	0.813	1
	Lack of stakeholder awareness/interest	5	5	3	1	1	57	0.76	2
	Limited technical capacity	3	3	4	3	2	47	0.627	3
	Poor communication channels	1	2	4	4	4	37	0.493	4
	Conflicting priorities among stakeholders	0	1	2	3	9	25	0.333	5
Kisumu	Insufficient funding	14	5	1	0	1	94	0.895	1
	Conflicting priorities among stakeholders	5	8	5	2	1	77	0.733	2
	Political barriers	1	3	6	5	6	51	0.486	3
	Lack of stakeholder awareness/interest	0	2	4	8	7	43	0.409	4
	Poor communication channels	0	2	2	7	10	38	0.362	5

When asked to identify strategies for improving stakeholder engagement in climate action (Table 8), both Mafikeng and Kisumu converged on the importance of increasing funding. "Allocating more funding for engagement" emerged as the most highly ranked strategy in both cities, reinforcing the view that without sufficient financial investment, efforts to strengthen participation, awareness, and collaboration will remain constrained. This sentiment is perfectly captured by a comment from one of the interviewed officials: *"Also, we need more consistent funding to support engagement activities. The will is always there, and the people are always ready."* Kisumu reported a higher index score (0.857) compared to Mafikeng (0.827), potentially reflecting its broader stakeholder base and the associated costs of managing more expansive participatory frameworks.

Beyond this shared priority, the strategic preferences diverged in line with each city's specific challenges. Mafikeng ranked "increasing stakeholder awareness through outreach" as its second most important strategy (index 0.720), directly addressing the barrier of low interest and awareness. This indicates a focus on building foundational engagement through education, information sharing, and community mobilization. As one official suggested, *"If we can have a structured type of engagement with stakeholders—say, a schedule where we meet quarterly within the financial year—then I think coordination can really be strengthened."*

Kisumu, on the other hand, prioritized strategies aimed at deepening participation and building stakeholder capacity. "Encouraging participatory decision-making" (index 0.562) and "providing stakeholder training" (index 0.533) were identified as key approaches, reflecting a commitment to empowering stakeholders through more inclusive governance structures and targeted capacity-building initiatives. Like in Mafikeng, a government official from Kisumu suggested: "*We need better coordination mechanisms, perhaps formal platforms at the ward or sub-county level…But we need to institutionalize the process."* These efforts aim to move beyond consultation toward co-production of climate solutions. Kisumu also emphasized the importance of partnering with more NGOs and community-based organizations through increased outreach (index 0.457), highlighting the role of civil society as both a facilitator and amplifier of engagement efforts. This aligns with the city's broader strategy of leveraging collaborative networks to enhance the effectiveness and reach of its climate actions.

In Mafikeng, lower-ranked strategies, such as improving communication channels and promoting participatory decision-making, suggest that these approaches are either in the early stages of development or have yet to gain significant traction within existing institutional frameworks. This points to an opportunity for institutional strengthening and policy reform to embed more inclusive and interactive forms of climate governance. For example, one department head described their progress on this issue as follows: *That is what our [current]study is currently trying to address. Since we [the research unit], are not directly involved with the key role players in project delivery, we aim to engage departments, particularly officials from the planning unit, to understand the challenges they face and do other role players come on board. We want to identify collaboration issues, pinpoint where the gaps are, and explore how we can help address them.*"

Table 8: Weighted ranking of the proposed strategies for improving stakeholder engagement in climate action

City	Strategies for enhancing stakeholder engagement	Distribution of Respondents per Rank					Weight	Index	Rank
		1	2	3	4	5			

Mafikeng	Allocate more funding for engagement	10	1	1	1	2	63	0.827	1
	Increased awareness through outreach	4	5	3	2	1	54	0.720	2
	Improve communication channels	0	5	2	1	7	35	0.467	3
	Provide stakeholder training	0	1	5	5	4	33	0.44	4
	Encourage participatory decision-making	0	4	1	3	7	32	0.427	5
Kisumu	Allocate more funding for engagement	14	2	2	3	0	90	0.857	1
	Encourage participatory decision-making	3	5	3	5	5	59	0.562	2
	Provide stakeholder training	2	5	4	4	6	56	0.533	3
	Increased awareness through outreach	2	2	4	5	8	48	0.457	4

4.4 Inclusiveness, Equity, and Responsiveness of Climate Actions

To understand the extent to which inclusive approaches are being adopted in local climate governance and decision-making processes, this study investigated the recognition and integration of community and indigenous knowledge in climate action initiatives in the two cities and noted a striking divergence. In Kisumu, an overwhelming 85% of respondents (71% strongly agree; 14% agree) affirm that climate initiatives incorporate such knowledge, reflecting a deep cultural and institutional valuing of local wisdom. This may stem from Kenya's rich tradition of indigenous environmental stewardship and decentralized governance structures that actively engage community groups. Based on interviews with departmental heads, Kisumu has strong participatory frameworks that support inclusivity, as public participation for climate actions is conducted down to the smallest administrative/political unit, known as wards. One of the departmental heads notes, *"We make sure that communities are involved right from project design through implementation and monitoring. We often hold validation workshops where community members can critique or refine proposed interventions… This way, they feel ownership."* Such community feedback is *"gathered through forums and barazas, and combined with the scientific data from the work of various technical departments, especially when drafting the ward adaptation plans."* One major climate action project that illustrates this framework is the Financing Locally-Led Climate Action (FLLoCA) program, through which Ward Climate Change Committees (WCCCs) were established. These committees *"devolve climate action*

to the grassroots, at the ward level, and play a key role in mobilizing and implementing locally relevant interventions on the ground."

By contrast, only 54% of Mafikeng respondents (7% strongly agree; 47% agree) perceive that community or indigenous knowledge is integrated, while 40% remain neutral, and a combined 7% disagree. This neutrality and slight dissent suggest that Mafikeng's climate governance may still rely heavily on technical/scientific frameworks, with less meaningful incorporation of grassroots knowledge. As one departmental head explained, *"…because we are sometimes involved in projects that are actually not ours… we depend on the project heads to be the ones that do the public participation process… whether people come forward or not [with inputs], that's never considered a problem."* Reflecting on the process, another noted, *"They put out a notice in a newspaper… maybe another one on the radio… but because they've done it, they think they've done their part. I don't know if we're actually doing a good thing in terms of how we do our public participation."* These remarks highlight a critical gap between policy and practice, where mechanisms for inclusion may exist in form but not in substance. Such limitations can undermine local legitimacy and reduce the contextual relevance of climate interventions.

Similarly, concerning whether climate actions integrate the needs of vulnerable communities, Kisumu again leads, with 86% of respondents (62% strongly agree; 24% agree) endorsing inclusivity of vulnerable groups in climate policies. This high proportion signals an explicit focus on equity, consistent with Kenya's broader policy emphasis on marginalized groups within climate resilience frameworks. Several departmental heads echoed this priority. One noted, *"For every project, we follow the Public Participation Policy. It requires that marginalized groups, such as women and youth, be included in planning… We also work with NGOs and CBOs to mobilize these groups."* Another emphasized that, *"The constitution mandates inclusion. [Therefore], we ensure representation of these groups in every committee."* One of the climate change officers confirmed that even currently, "*Under FLLoCA, the WCCCs ensure that all people, be it women, youths, and the marginalized people in that area are not only represented… but are also active members giving their opinions and ideas on the projects being implemented."* In Mafikeng, only 47% agree that vulnerable community needs are adequately integrated, with 47% neutral and 7% strongly disagreeing. This ambivalence points to a possible gap in social vulnerability mainstreaming, which could undermine the effectiveness and fairness of climate interventions, particularly given South Africa's socio-economic disparities. This fact is encapsulated by a sentiment from one of the heads, stating: *"I wouldn't say our communities do have that much say in part of decision[making]… the municipality will just announce… and it'll be considered public participation has been conducted. What we lack in the department is early… engagement. We mostly do post-project education, when people have already moved in."*

Regarding the adaptiveness of climate actions to emerging risks, Kisumu again shows stronger performance, with 95% of respondents rating local climate initiatives as moderately to very adaptive to emerging risks. As one Kisumu respondent explained: *"Yes, particularly in flood-prone areas. People now proactively clear drains, report blocked waterways and are more involved in early warning systems. The culture is slowly shifting from reactive to more preventive behavior, which is very encouraging for our city."* Mafikeng displays a more mixed picture: 33% see the actions as moderately adaptive, but 20% rate them as not adaptive, and 27% remain uncertain. This uncertainty reflects possible challenges in institutional flexibility, risk monitoring, or resource constraints in Mafikeng, hampering its ability to respond dynamically to evolving climate threats.

An assessment of how both Mafikeng and Kisumu promote equity and inclusiveness in their climate action initiatives reveals both commonalities and distinct approaches tailored to their local contexts (Figure 8). In Mafikeng, the most emphasized measure is prioritizing areas with the most vulnerable communities, reported by 66.7% of respondents. This indicates the realization of the inadequate consideration of the needs of vulnerable communities in climate actions and the need to ensure that climate actions focus on those needs. Describing these efforts, one respondent noted that *"We usually attend community participation meetings…organized through the office of the speaker…where communities from various wards, NGOs and business people are represented… we note their issues there… we go back and sit down and try to prioritize… from the municipal manager down to general workers—we try to listen to everyone's input."* Following this, 40% of respondents noted the development of inclusive policies considering diverse population needs, while 33.3% highlighted community participation in decision-making as a key strategy. Other measures, such as supporting indigenous-led climate initiatives and traditional knowledge, and addressing historical inequities in environmental decision-making, were reported by 20% of participants each. However, fewer respondents indicated the use of equity assessments for climate initiatives (13.3%) and fair resource distribution for adaptation and mitigation (6.7%), suggesting these areas may be less developed or prioritized in Mafikeng.

In contrast, Kisumu demonstrated a stronger emphasis on community participation in decision-making, with 100% of respondents recognizing it as a critical measure. This reflects a highly inclusive governance approach, potentially reflecting strong community engagement frameworks. Similarly, 90.5% of respondents in Kisumu reported the development of inclusive policies that accommodate diverse population needs, while 80.9% prioritized vulnerable communities. There was also substantial support for indigenous-led initiatives and traditional knowledge (71.4%). Measures related to fair resource distribution for climate adaptation and mitigation were noted by nearly half (47.6%) of respondents, significantly higher than in Mafikeng. Conversely, measures

such as conducting equity assessments (9.5%) and interdepartmental joint operations (4.8%) were less commonly reported, suggesting potential gaps in institutional coordination and formal equity evaluation.

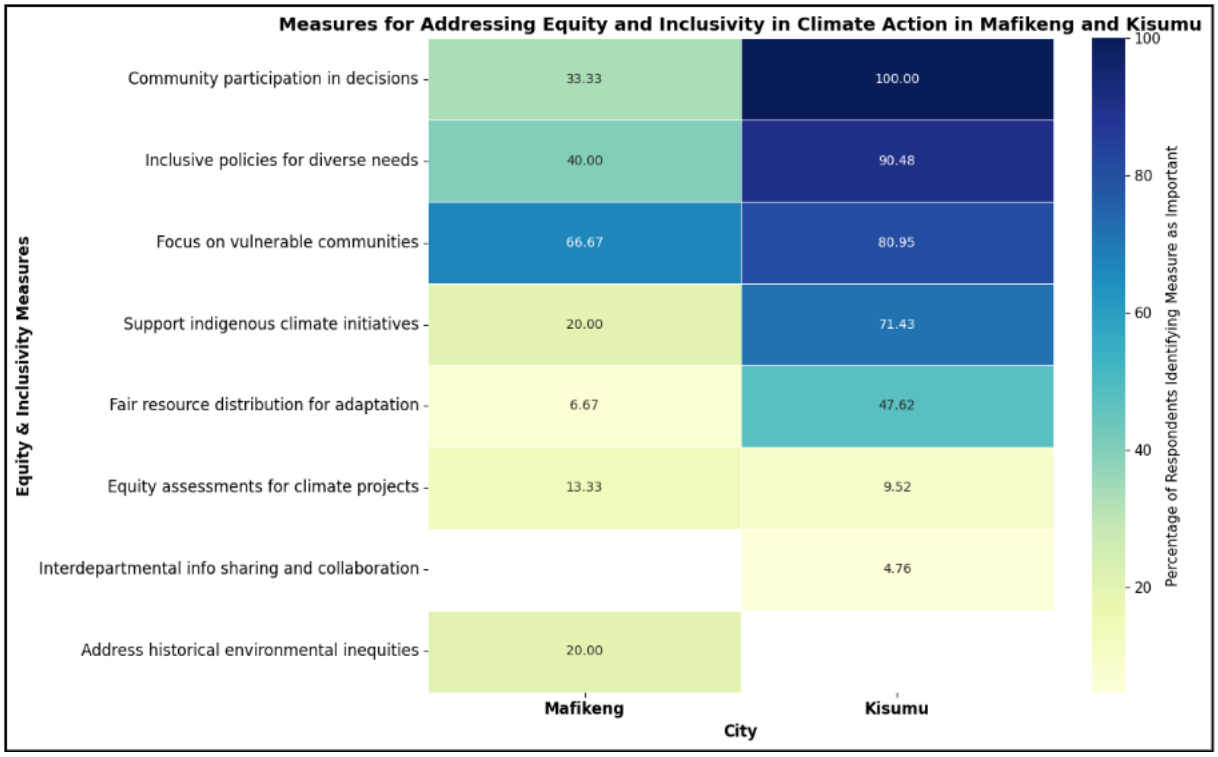

Figure 8: Heatmap showing the key measures employed by both Mafikeng and Kisumu to promote equity and inclusivity in their climate action initiatives

4.5 Statistical Analyses

4.5.1 Differences in Perceptions Between Cities

To assess whether perceptions on urban climate resilience significantly differ between Kisumu and Mafikeng municipalities, a series of Mann-Whitney U tests were conducted across key response areas. The results indicate significant differences between the two cities in nearly all measured indicators, except one. Respondents in Kisumu reported a significantly higher degree of familiarity with their city's climate actions compared to those in Mafikeng ($U = 251.5$, $p = 0.0019$). They also rated the effectiveness of those climate actions more positively ($U = 241.5$, $p = 0.0043$), and expressed significantly stronger agreement that these actions integrate local knowledge ($U = 253$, $p = 0.0012$) and address the needs of vulnerable populations ($U = 258$, $p = 0.0007$). These findings suggest a comparatively higher level of public engagement and trust in climate policy implementation in Kisumu.

Moreover, Kisumu respondents also perceived the city's climate initiatives as significantly more adaptive to emerging climate-related risks ($U = 256.5$, $p < 0.001$). This perception of responsiveness may reflect differences in institutional agility, public communication, or recent climate-related interventions experienced in each context. In terms of governance coordination, Kisumu respondents again reported significant stronger/higher coordination between their departments and other local governments ($U = 221.5$, $p = 0.0317$), non-state actors ($U = 279$, $p < 0.001$), and community groups ($U = 269.5$, $p < 0.001$). These results underscore the city's comparatively greater emphasis on multi-actor engagement in climate governance, suggesting more inclusive and networked institutional arrangements in Kisumu. Notably, there was no statistically significant difference between the two cities regarding the general belief that local governments can play a role in urban climate resilience ($U = 114$, $p = 0.098$), suggesting broad agreement on this foundational issue across both contexts.

4.5.2 Predictors of Perceptions within Each City

To explore whether demographic and professional attributes shape climate resilience perceptions, Chi-square tests were conducted separately for Kisumu and Mafikeng, using education level, experience in climate-related work, and nature of role as predictors. These tests assessed associations with nine key perception variables, including familiarity with climate actions, perceived effectiveness, integration of community needs, adaptiveness, and inter-organizational coordination.

In Kisumu, the most consistent predictor was experience level. Experience in climate-related work was significantly associated with several perceptions: familiarity with the city's climate actions ($\chi^2 = 21.35$, $p = 0.045$), and the belief that climate actions integrate local knowledge ($\chi^2 = 27.3$, $p = 0.007$). Although not reaching conventional levels of significance, education level showed a near-significant association with familiarity ($\chi^2 = 11.04$, $p = 0.087$) and coordination with the community ($\chi^2 = 10.66$, $p = 0.099$), suggesting a potential trend toward influence.

In contrast, Mafikeng showed a different pattern. Here, experience level significantly influenced perceptions of coordination between departments and other local governments ($\chi^2 = 22.21$, $p = 0.008$). Similarly, the nature of role was significantly associated with coordination, particularly with other local governments ($\chi^2 = 19.62$, $p = 0.020$), non-state actors ($\chi^2 = 18.33$, $p = 0.005$), and the community ($\chi^2 = 16.66$, $p = 0.011$). These findings suggest that in Mafikeng, respondents' functional roles in the municipality may play a stronger role in shaping perceptions of inter-agency and community collaboration.

Interestingly, across both cities, no demographic or professional predictor was significantly associated with the belief that local governments can play a role in urban climate resilience, reinforcing previous findings from the Mann-Whitney U test that this belief is widely shared regardless of background.

Taken together, these results point to city-specific dynamics in how professional experience and role affect perception. In Kisumu, experience level appears more important for understanding familiarity and perceived integration, whereas in Mafikeng, the structural nature of respondents' roles is more strongly linked to their views on coordination and stakeholder engagement.

4.5.3 Determinants of Perceived Effectiveness of Climate Actions

To understand what shapes these perceptions within each city, an Ordinal Logistic Regression (OLR) was conducted for each city (Table 9) using the self-reported *effectiveness of city climate actions* as the outcome variable. Independent variables included demographic characteristics (education level, experience level, nature of role) and institutional dimensions such as familiarity with climate policies, integration of local knowledge, consideration for vulnerable groups, and inter-institutional coordination mechanisms.

The OLR results for Mafikeng revealed that perceptions of effectiveness are primarily influenced by policy awareness and inclusive governance processes. familiarity with city climate actions emerged as the most influential predictor ($\beta = 1.214$, $p < 0.001$), with respondents who indicated a high level of familiarity being 3.37 times more likely to perceive the actions as effective. Likewise, a strong belief that local knowledge is integrated into climate responses emerged as a key driver of perceived effectiveness ($\beta = 0.963$, $p < 0.001$), suggesting that recognition of community-based knowledge systems contributes positively to the legitimacy and perceived success of interventions. Importantly, respondents who saw active community coordination rated actions more positively ($\beta = 0.778$, $p = 0.008$), suggesting that inclusive, bottom-up engagement strategies enhance confidence in municipal initiatives. From a demographic perspective, education played a notable role: participants with a doctorate were significantly more likely to rate city actions as effective compared to those holding only a bachelor's degree ($\beta = 1.095$, $p = 0.027$). This finding may reflect increased policy literacy or closer involvement in technical or decision-making processes among more educated professionals.

In contrast, the model for Kisumu revealed both overlapping and distinct determinants. Like Mafikeng, familiarity with city climate actions was the strongest and most consistent

predictor (β = 1.315, $p < 0.001$), reinforcing the importance of information dissemination and stakeholder engagement in building trust across both contexts. Perceptions that the city integrates local knowledge (β = 0.834, $p < 0.001$) and addresses the needs of vulnerable populations (β = 0.628, $p = 0.001$) also significantly influenced perceived effectiveness, pointing to the salience of equity and inclusion in Kisumu's climate governance discourse. Unlike in Mafikeng, vertical coordination with regional government agencies (β = 0.509, p = 0.003) was positively associated with perceived effectiveness, underscoring a more vertically integrated governance structure in the Kenyan context. This points to the importance of multi-level governance and regional collaboration in cities where broader policy frameworks and funding mechanisms influence local capacity. Moreover, professional experience also mattered: respondents with more than 10 years in climate-related work were more likely to view city actions as effective (β = 1.025, $p = 0.004$), suggesting that prolonged exposure to climate policy processes enhances evaluative judgment. Interestingly, education again played a differentiating role, but in the opposite direction: individuals with only a diploma qualification were significantly less likely to perceive climate actions as effective compared to those with higher qualifications (β = -0.729, $p = 0.026$). This may reflect differences in access to strategic information or involvement in key decision-making forums.

Table 9: OLS Results for Mafikeng and Kisumu – Determinants of Perceived Climate Action Effectiveness

Predictor Variable	**Mafikeng**				**Kisumu**			
	Coefficient (β)	**SE**	**OR (exp(β))**	***p***	**Coefficient (β)**	**SE**	**OR (exp(β))**	***p***
Education Level (Diploma vs. Bachelor's)	0.124	0.32	1.13	0.62	-0.729	0.331	0.48	0.026*
Education Level (Master's vs. Bachelor's)	0.432	0.286	1.54	0.13	0.385	0.247	1.47	0.11
Education Level (Doctorate vs. Bachelor's)	0.895	0.41	2.45	0.029*	0.202	0.331	1.235	0.533
Experience Level (1–3 vs. <1 year)	0.141	0.564	1.15	0.804	0.241	0.612	1.272	0.692
Experience Level (4–6 vs. <1 year)	0.682	0.312	1.98	0.035*	0.194	0.311	1,21	0.741
Experience Level (7–10 vs. <1 year)	0.087	0.29	1.08	0.752	0.125	0.277	1.13	0.671
Experience Level (10+ vs. <1 year)	0.913	0.34	2.49	0.007**	1.025	0.348	2.79	0.004**
Role (Field Officer vs. Other)	-0.015	0.27	1.06	0.615	0.092	0.44	2.03	0.643

Role (Technical Officer vs. Other)	0.576	0.59	0.93	0.81	0.148	0.283	1.84	0.86
Role (Admin Officer vs. Other)	-0.123	0.271	0.88	0.65	0.174	0.265	1.19	0.51
Familiarity with City's Climate Actions	1.203	0.214	3.33	0.000**	1.315	0.228	3.72	0.000**
Local Government Can Play a Role in Climate Resilience	0.14	0.25	1.15	0.59	0.28	0.29	1.08	0.78
Agreement: Actions Integrate Local Knowledge	0.874	0.243	2.4	0.001**	0.834	0.202	2.3	0.000**
Agreement: Actions Address Needs of Vulnerable Groups	0.647	0.23	1.91	0.005**	0.628	0.195	1.87	0.001**
Adaptiveness of Current Climate Initiatives to Emerging Risks	0.09	0.28	1.09	0.74	0.11	0.31	1.12	0.71
Coordination with Other Local Governments	-0.05	0.27	0.95	0.85	0.06	0.29	1.06	0.83
Coordination with Regional Government Agencies	0.541	0.207	1.72	0.009**	0.509	0.173	1.66	0.003**
Coordination with National Government Agencies	0.322	0.291	1.13	0.7	-0.08	0.28	0.92	0.77
Coordination with Non-State Actors	-0.09	0.439	0.91	0.76	0.07	0.719	1.07	0.81
Coordination with the Community	0.05	0.217	1.05	0.85	-0.04	0.548	0.96	0.88

*Note: SE = Std. Error; OR = Odds Ratio; * p < 0.05, ** p < 0.01*

5. Discussions

The study revealed that both cities experience climate extremes, though to varying degrees. Flooding emerged as the most pressing concern in both Mafikeng and Kisumu, highlighting the increasing frequency and intensity of hydroclimatic extremes across Sub-Saharan African cities (Adom, 2023). This finding is consistent with evidence that flooding remains a critical climate risk for many African urban centers (Tietjen et al., 2023). Kisumu's elevated concern for flooding, alongside land degradation and lake level rise, reflects its documented lakefront vulnerabilities—informal settlements, shoreline erosion, and wetland encroachment—that have heightened exposure to inundation and ecosystem degradation (Masimbe, 2018; Othoo, 2021). In contrast, Mafikeng's inland, semi-arid setting explains the prominence of water scarcity, drought, and heatwaves, consistent

with local studies documenting chronic water stress in North West Province of South Africa (Mothupi, 2020; Oladele, 2022). Furthermore, Kisumu's recognition of urban heat islands highlights the influence of rapid urbanization and declining vegetation cover in the city (Kandie, 2024), while Mafikeng's concerns remain focused on broader climatic heat stress rather than localized urban morphology (Oladele, 2022).

In terms of climate resilience, both Kisumu and Mafikeng have made measurable progress, though the nature and focus of their achievements differ in relation to their respective recognized climate challenges. In Kisumu, high recognition of flood risk reduction, green space expansion, and ecosystem restoration indicates that interventions are strategically aligned with the city's major climate risks, reflecting effective local governance and participatory planning processes that integrate stakeholder perspectives into both mitigation and adaptation measures (Kareem et al., 2020). Conversely, in Mafikeng, achievements such as waste management, community engagement, and early warning systems, while notable, do not directly correspond to the city's primary climate challenges, suggesting potential tensions between broader national adaptation priorities and municipal-level agendas (Sibiya et al., 2023). These contrasting profiles highlight how context-specific governance structures, institutional capacities, and stakeholder engagement shape the alignment of climate action with both local needs and national strategies (Kareem et al., 2020).

The findings indicate that pathways to the identified successful climate actions in Kisumu and Mafikeng are strongly influenced by their respective governance contexts and institutional capacities. In Kisumu, community empowerment emerges as the most significant success factor, reflecting a bottom-up approach in which local participation, awareness, and ownership are considered essential for the sustainability and effectiveness of climate initiatives (Chitsa et al., 2022). This participatory model likely strengthens the legitimacy and responsiveness of interventions, ensuring alignment with the needs of vulnerable populations (Zhang et al., 2020). Additional factors, including interdepartmental coordination across governance scales, inclusive engagement, and supportive regulatory frameworks, further demonstrate Kisumu's integrated and strategic approach to climate governance, highlighting institutional mechanisms that mainstream climate considerations across urban planning while promoting transparency and accountability (Therrien et al., 2020). In contrast, Mafikeng's reliance on political will as the primary success factor points to a centralized governance model, where high-level leadership is crucial for mobilizing resources, securing stakeholder buy-in, and guiding departmental coordination (INFF, 2021). The relatively low emphasis on community empowerment in Mafikeng suggests challenges in participatory planning and the institutionalization of evidence-based decision-making, which may limit the inclusiveness and responsiveness of local climate interventions (Goldstein et al., 2015).

Barriers to effective climate action in Kisumu and Mafikeng reveal both shared constraints and context-specific challenges that shape the cities' capacity to translate climate policies into tangible outcomes. Across both contexts, limited financial resources emerge as the most pervasive constraint, reflecting the broader trend in Sub-Saharan African municipalities where overstretched budgets and competing service delivery priorities often limit investment in climate initiatives (Sibiya et al., 2023; Tietjen et al., 2023). This study found that in Mafikeng, limited funding for climate action stems from municipal governments not prioritizing climate change or environmental management, largely because these are considered non-productive sectors that do not generate direct income. This finding confirms previous research showing that the historic tendency of municipalities to frame climate change primarily as an environmental issue has constrained mainstreaming efforts, as environmental concerns are often assigned lower priority compared to other service delivery imperatives (Hardoy & Lankao, 2011; Wilhelm-Rechmann et al., 2013). Consequently, environmental departments are frequently marginalized in terms of both influence and resources (Wilhelm-Rechmann et al., 2013; Sibiya et al., 2023). Moreover, earlier studies suggest that politicians have yet to recognize climate adaptation as a politically urgent issue, limiting its advancement on the policy agenda (Sibiya et al., 2023). In Mafikeng, governance-related obstacles—including corruption, abuse, and inconsistent political support—compound these financial limitations, undermining institutional credibility, redirecting resources, and weakening the city's ability to mainstream climate priorities across development agendas (Mark, 2022). Institutional and human resource constraints further restrict implementation, with limited staffing and technical capacity constraining the execution and sustainability of climate programs (Grasso et al., 2021; Allarané et al., 2024). By contrast, Kisumu's secondary barriers are primarily technical and institutional in nature, encompassing insufficient monitoring and evaluation systems, limited workforce training, and gaps in technical expertise, which impede adaptive management and evidence-based improvements even where governance support is comparatively stronger (Sharma-Wallace et al., 2018). While both cities face workforce challenges, the nature of these constraints differs: in Mafikeng, shortages are compounded by political and institutional limitations, whereas in Kisumu, the focus is on capacity building and skill development. The findings are consistent with previous studies that have identified limited financial, human, and technical capacity as the biggest barriers to climate change adaptation in developing countries (Mohmand & Loureiro, 2017; Ampaire & Jassogne, 2017; Ryan & Dusto, 2019). Collectively, these findings emphasize that addressing financial, governance, and capacity constraints in a context-sensitive manner is critical for enhancing the effectiveness of local climate resilience strategies and ensuring long-term sustainability of interventions (Tietjen et al., 2023; Sibiya et al., 2023).

The study reveals significant differences in perceptions of urban climate resilience between Kisumu and Mafikeng, highlighting how contextual and institutional factors shape stakeholder views. Mann-Whitney U tests showed that Kisumu respondents reported significantly greater familiarity with city climate actions, rated these actions as more effective, and perceived stronger integration of local knowledge and attention to vulnerable groups, as well as higher levels of inter-institutional and community coordination (all $p < 0.01$). These differences suggest a significantly more inclusive and adaptive governance culture in Kisumu compared to Mafikeng, likely reinforced by Kisumu's long-term engagement in global resilience initiatives and multi-level partnerships (Hayombe et al., 2018). For instance, Kisumu is part of the Rockefeller Foundation's 100 Resilient Cities program, which is helping cities institutionalize multi-level partnerships and citizen participation in urban planning. In contrast, Mafikeng's significantly lower scores point to limited institutional capacity, less stakeholder engagement, or weaker participatory mechanisms, emphasizing the importance of local governance structures in shaping perceptions of climate action (Chitsa et al., 2022). Within-city Chi-square analyses also reveal significant contrasts in perception drivers: in Kisumu, professional experience in climate-related work significantly predicts more positive views across multiple indicators, whereas in Mafikeng, the functional role of respondents—rather than experience—significantly influences perception, underscoring the context-dependent nature of governance interactions ($p < 0.01$). This finding aligns with Romero-Lankao et al. (2018), emphasizing the role of professional exposure in shaping understanding and appreciation of complex governance systems. This implies that functional responsibilities, possibly aligned with certain departments or mandates, more directly influence one's interface with resilience initiatives in Mafikeng. Ordinal logistic regression further confirms that familiarity with city climate actions, perceived integration of local knowledge, and coordination mechanisms are significant determinants of perceived climate action effectiveness in both cities, but with distinct patterns: coordination with regional governments and experience matter more in Kisumu, whereas community-level coordination and higher educational attainment are significant in Mafikeng. Collectively, these statistically significant differences illustrate that effective urban climate governance in African cities cannot follow a one-size-fits-all model; instead, interventions must be tailored to local realities, reinforcing awareness, inclusive design, and context-specific coordination to strengthen resilience (Kapucu, 2007; Archer, 2016; Therrien et al., 2020).

Despite these differences, one area of convergence between the two cities was the shared perception that local governments can and should play a meaningful role in building climate resilience, with no significant difference found in this belief. This consensus underscores growing awareness in both contexts of the local government's strategic

position in climate response, particularly as the interface between national policies and community needs (Tanner et al., 2009; Satterthwaite et al., 2018). In Mafikeng, the unanimous belief in the municipality's responsibility for climate adaptation reflects strong normative support, consistent with literature emphasizing the centrality of local authorities in South Africa's National Climate Change Adaptation Strategy (Buchner et al., 2015; Cassim et al., 2021; Khavhagali et al., 2024). However, this high level of endorsement contrasts sharply with limited familiarity and low perceived effectiveness of municipal climate plans, suggesting a disjunction between policy intent and operational implementation, a pattern documented in studies of top-down climate governance approaches (Koontz & Newig, 2014). This aligns with previous studies in South Africa, which highlight that limited knowledge among local government staff tasked with environmental responsibilities, the absence of adequate climate change plans, and reliance on outdated information continue to undermine the effective implementation of climate actions at the local level (Sibiya et al., 2023; Khavhagali et al., 2024).

By contrast, Kisumu's relatively high familiarity and positive assessment of municipal plans support arguments that participatory governance and devolved structures enhance the visibility, ownership, and trustworthiness of climate action at the local level (Hayombe et al., 2018). The link between active stakeholder participation and perceived plan effectiveness observed in Kisumu resonates with studies showing that inclusive climate planning fosters both public legitimacy and stronger policy outcomes (Therrien et al., 2020; Tietjen et al., 2023). Collectively, these findings indicate that while recognition of municipal responsibility is widespread, the effectiveness and credibility of urban climate governance are contingent upon meaningful engagement, transparent communication, and mechanisms that translate institutional mandates into actionable, participatory strategies.

6. Conclusions

This study examined urban climate resilience perceptions and governance practices in two rapidly urbanizing African cities—Kisumu (Kenya) and Mafikeng (South Africa)—through a comparative lens. The findings reveal that while both cities recognize the strategic importance of local governments in climate action, their approaches, capacities, and institutional cultures differ markedly, shaping how climate interventions are perceived and implemented. Kisumu's participatory, multi-actor governance model, supported by diverse technical expertise and international engagement, fosters high levels of stakeholder familiarity, perceived effectiveness, and adaptive capacity. In contrast, Mafikeng's governance approach, anchored in research expertise and internal control mechanisms, exhibits strong normative commitment but comparatively lower operational visibility, coordination, and community engagement.

The analysis emphasizes that demographic composition, institutional roles, and local context are critical determinants of climate governance effectiveness. In Kisumu, experience and exposure to project-based climate work drive positive perceptions, whereas in Mafikeng, functional roles within planning and coordination structures are more influential. Both cities share common climate priorities, such as flooding, but the manifestation of other climate risks—such as water insecurity, heatwaves, and urban heat islands—is context-dependent, reflecting differences in topography, hydrology, and urban form. These insights emphasize that climate resilience strategies must be tailored to local realities, integrating community knowledge, vulnerable populations' needs, and context-specific risk assessments.

Furthermore, the study highlights the centrality of financial resources, stakeholder engagement, and monitoring frameworks in shaping governance outcomes, Kisumu demonstrates that diversified funding streams, inclusive coordination, and routine evaluation mechanisms strengthen institutional effectiveness, legitimacy, and adaptability. Mafikeng, while possessing a skilled and research-oriented workforce, faces challenges in translating belief into actionable engagement and accessing external funding mechanisms. These findings suggest that urban climate resilience is not merely a function of technical capacity or policy design, but is deeply influenced by participatory governance, inter-institutional coordination, and adaptive learning processes.

In summary, the comparative assessment illustrates that effective urban climate governance in Sub-Saharan Africa requires a balance between strategic planning, operational inclusivity, and adaptive capacity. Kisumu's model offers valuable lessons in participatory, transparent, and multi-level climate governance, while Mafikeng's experience highlights the importance of leveraging institutional knowledge, enhancing stakeholder engagement, and diversifying financing mechanisms. Policymakers and practitioners should prioritize locally relevant, adaptive, and inclusive approaches that integrate both technical expertise and community insights to foster sustainable and resilient urban futures.

7. Recommendations

The study offers the following recommendations for enhancing urban climate resilience in the two cities:

1. **Enhance Legislative and Institutional Frameworks**: Mahikeng should prioritize localized climate change legislation and institutional mechanisms to operationalize national and provincial frameworks at the district/municipal level. This could involve enacting a local climate change regulation, creating a dedicated climate

change unit, and integrating climate priorities into planning, service delivery, and budgets. Kisumu's model—especially its community-driven structures and ring-fenced funding—offers a useful template for strengthening Mahikeng's climate governance.

2. **Enhance Multi-Level and Multi-Actor Coordination Mechanisms**: Mafikeng should institutionalize cross-departmental forums, formalize community liaison structures, and build partnerships with non-state actors, including civil society, NGOs, and international development actors, to enhance resource mobilization and project delivery. It should develop mechanisms for meaningful community engagement, including town halls, participatory planning workshops, and public feedback channels. Kisumu should refine its multi-actor framework by deepening vertical coordination with regional and national agencies to sustain scalability and by ensuring clear accountability mechanisms.

3. **Strengthen Financial Diversification and Resource Mobilization:** Reduce overreliance on government allocations in Mafikeng by building capacity to access international climate finance (e.g., GCF readiness programs), public-private partnerships, and donor-supported programs, while Kisumu should continue leveraging multilateral and philanthropic funding. Blended finance models combining national budgets, donor funding, and private-sector investments could help both cities to alleviate resource constraints.

4. **Institutionalize Equity and Inclusion**: Both cities should embed structured equity assessments and fair resource allocation frameworks in climate policy. Mafikeng needs to strengthen community participation and indigenous knowledge integration, while Kisumu should ensure that more female staff are incorporated into the environmental management departments and that equity is systematically evaluated across programs.

5. **Improve Monitoring, Evaluation, and Knowledge Sharing:** Mahikeng should broaden M&E partnerships by involving universities, NGOs, and donors to enhance rigor, transparency, and learning. It should implement routine, predictive, and learning-oriented evaluations to move beyond reactive assessments. Both cities should institutionalize data-sharing mechanisms across departments to enhance transparency, improve coordination across departments, and support evidence-based decision-making for effective climate action and urban resilience.

6. **Integrate Contextual Climate Risks into Urban Planning:** Both cities should prioritize flood resilience measures, water-sensitive designs, and heat mitigation strategies. Kisumu should scale up urban greening, incentivize cool roofs, and

enforce climate-sensitive building codes to reduce urban heat risks. Mahikeng should prioritize drought and heatwave response by strengthening early warning systems, investing in water conservation, and integrating heat-health action plans into disaster management.

7. **Capacity Building and Knowledge Sharing**: Increase regular training and professional development in both cities, focusing on adaptive governance, monitoring and evaluation, and climate innovation. Mafikeng should particularly expand beyond academic partnerships to more interactive and frequent training. Both cities should expand blended digital and face-to-face training programs to build technical and adaptive capacity.
8. **Peer Learning and Benchmarking:** Facilitate South-South exchanges between Kisumu and Mafikeng or other African cities to share best practices in community engagement, funding diversification, and adaptive governance strategies.

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