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Reinforcing Climate Governance in Lesotho through Multi-Level Integration of Knowledge Systems

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Abstract: The most vulnerable countries in the world are disproportionately affected by climate change, which poses a serious and existential threat to human security and sustainable development. This vulnerability is best shown by the small, landlocked, mountainous nation of Lesotho in Southern Africa. Increasing climatic variability and extreme weather events pose a serious threat to its socio-economic fabric, which is intricately linked to climate-sensitive industries like rain-fed agriculture. This qualitative study makes the case that Lesotho's current top-down, state-centric climate governance models are essentially unable to provide the necessary systemic resilience. It is based on a thorough analysis of academic literature, policy papers, and international indices. According to the paper, the intentional and planned fusion of Indigenous knowledge systems (IKS) and scientific knowledge systems (SKS) is a fundamental governance requirement rather than just an additional adaptation strategy. This study shows that a multi-level governance (MLG) framework that strategically engages global, national, regional, local, and non-state actors is the most practical mechanism for leveraging the complementary strengths of both knowledge systems. It does this by critically analysing Lesotho's unique vulnerabilities and highlighting the inherent resilience of indigenous practices like the Machobane Farming System. Developing contextually relevant, economical, culturally acceptable, and participatory adaptation strategies requires this synergistic approach. The study comes to the conclusion that institutionalising this knowledge integration is essential to strengthening climate governance in Lesotho. A more networked, polycentric, and adaptable form of government would result from such a shift, which would ultimately improve the country's ability to handle the intricate problems posed by climate change and ensure a path towards sustainable growth.

Keywords: Climate Governance, Multi-Level Governance, Indigenous Knowledge, Scientific Knowledge, Sustainable Development, Lesotho.

Introduction

The Imperative for a Governance Paradigm Shift

According to Pandey (2019), the growing climate crisis is one of the Anthropocene's defining issues, highlighting a crucial failure in national and international governance structures to effectively mitigate human drivers and develop strong adaptive capacity. The time to take action to stop catastrophic warming is running out, as the Intergovernmental Panel on Climate Change (IPCC) has repeatedly issued dire warnings. SDG 13, "Climate Action," states that immediate and revolutionary action is needed to address climate change and its effects. Accordingly, the Kingdom of Lesotho and other nations in Sub-Saharan Africa view climate change as a multifaceted, fundamental issue that challenges the fundamentals of human security, economic planning, and governance (Chilunjika, 2024; Chilunjika and Gumede, 2021).

Because of its distinct geographic and socioeconomic characteristics, Lesotho is extremely susceptible. Being the "Kingdom in the Sky," with all of its land located more than 1,000 meters above sea level and 80% of it being highland, it has a delicate ecology that is extremely sensitive to changes in the climate. The country's economy is mostly reliant on natural resources and subsistence farming, two industries that are inextricably related to temperature and precipitation patterns. This reliance, together with high rates of poverty, little economic diversification, and institutional limitations, makes climate risk a perfect storm. According to the Notre Dame Global Adaptation Initiative (ND-GAIN) Index (2021), which rates nations according to their susceptibility to climate change and their preparedness to increase resilience, Lesotho is a worrying 124th out of 182 nations. The combination of high vulnerability and low readiness indicated by this score necessitates a drastic reconsideration of existing strategies (Chilunjika, 2024; Malefane, 2022). Across Basotho, the signs of this vulnerability are already glaringly apparent. Crop failure and livestock mortality result from the land becoming parched by more frequent and severe droughts.

The very resource that rural livelihoods rely on is deteriorated by severe and unpredictable rainfall events, which also speed up soil erosion and cause deadly floods. The cycles of poverty, food insecurity, and out-migration are not hypothetical future events; rather, they are current realities. Technocratic, compartmentalised, and top-down governance models have frequently been used to describe the traditional solution to such issues (Chilunjika, 2024; Rankoana, 2022). National governments create policies and programs, frequently with assistance from foreign partners, and then distribute them for execution at the lower levels. Although these methods may have advantages, they usually overlook local contexts, knowledge, and agency, which results in policies that are out of step with reality on the ground and, as a result, ineffectual.

In order to overcome these constraints, this paper argues that a fundamental change towards a multi-level, inclusive, and adaptable approach to climate governance is necessary. The main argument posits that Lesotho's ability to adapt to climate change depends on its capacity to formally and methodically combine the strong predictive and analytical capabilities of Scientific Knowledge Systems (SKS) with its extensive collection of Indigenous Knowledge Systems (IKS) within a multi-level governance framework (Malefane, 2022; Rankoana, 2022). Instead of romanticising the past or blindly following scientific models, this integration is an essential and practical approach to building more resilient, effective, and legitimate governance regimes. Lesotho may create adaption plans that are both locally applicable and supported by science by combining the broad, trend-identifying ability of SKS with the fine-grained, context-specific knowledge of IKS.

The first step in this study is to develop the multi-level climate governance conceptual framework, outlining its main ideas and how it relates to the climate crisis. The climate vulnerability of Lesotho will then be thoroughly examined, presenting it as a key governance issue as well as an environmental one. To conceptualize IKS and SKS as vital governance resources that are currently underutilized, the paper will then explore their different yet complementary responsibilities. The main points of the argument will be covered in a section describing a specific multi-level governance approach for integrating multiple knowledge systems, with examples spanning from the local to the global level. To institutionalize this integrated approach and position Lesotho on a more secure and sustainable development path, the paper will conclude with a set of forward-looking policy proposals.

Conceptual Framework: Deconstructing Multi-Level Climate Governance

It is crucial to first provide a solid conceptual basis in order to comprehend the road towards more successful climate action in Lesotho. In its widest definition, climate governance refers to the systems, procedures, tools, and players that societies use to decide how best to respond to the challenges presented by climate change, distribute resources, and exercise power (World Bank, 2022). A vast range of stakeholders are involved, extending beyond the boundaries of government to include national ministries and international organisations as well as commercial companies, community-based organisations (CBOs), NGOs, local councils, and private citizens. The shortcomings of conventional, state-centric, hierarchical governance models have been made clear by the complexity and transboundary nature of climate change. A drought in the highlands of Lesotho influences the availability of water in South Africa's industrial heartland, while global emission trajectories decided in far-off cities shape local climatic realities in rural Lesotho. Climate consequences transcend administrative and political boundaries. This interdependence calls for a more flexible, cooperative, and multi-scale strategy. MLG, or multi-level governance, is responsible for this.

A conceptual paradigm known as "Multi-Level Governance" acknowledges that several interrelated levels of power and agency must work together in concert to effectively address climate change. According to this theory, governance is a system of distributed authority in which subnational, national, regional, and local actors all have

unique and significant roles, resources, and responsibilities rather than being a zero-sum game where power is held only at the national level (Hooghe and Marks, 2003). The MLG framework for climate action is built upon several core principles:

1. Vertical integration: is the alignment of policies, strategies, and actions at various vertical levels of governance, ranging from the national (like Lesotho's National Climate Change Policy), district, and village levels to the global (like the United Nations Framework Convention on Climate Change-UNFCCC and Paris Agreement). When vertical integration is done well, international commitments are converted into national plans that can be implemented and supported by communities and local governments. On the other hand, it maintains a two-way feedback loop by ensuring that local needs and experiences are communicated upstream to guide national and international policy-making.

2. Horizontal Collaboration: This principle highlights the necessity of collaboration and coordination among various disciplines, sectors, and stakeholder groups functioning at the same level of governance. Agriculture, water, energy, health, and finance are just a few of the industries that are both impacted by and influenced by climate change. Inefficiency and policy inconsistencies are guaranteed in a siloed model in which the Ministry of Energy functions separately from the Ministry of Agriculture. Creating agricultural policies that simultaneously improve water conservation and carbon sequestration is one example of how horizontal collaboration promotes integrated solutions (Mafongoya and Ajayi, 2017).

3. Participation and Inclusivity: A system of governance that is genuinely multi-level is by its by nature inclusive. For all pertinent stakeholders, especially the most marginalised and vulnerable, it actively establishes avenues and procedures for their meaningful participation in decision-making. This includes acknowledging non-state players as vital partners in the governing process, including traditional leaders, farmers' unions, women's organisations, youth organisations, academia, and the commercial sector (Busby, 2017). This is specifically acknowledged by the Paris Agreement, which promotes the involvement of numerous non-Party stakeholders.

This MLG strategy is consistent with the idea of polycentric governance, which was created by academics such as Elinor Ostrom. A system is said to be polycentric if it has several overlapping centres of decision-making that function at various scales, govern themselves independently, and cooperate under a general set of rules. Because it enables experimentation and learning at different sizes, this structure is seen to be more inventive, robust, and adaptive when dealing with complicated issues like climate change. Adopting an MLG framework would require Lesotho to abandon the paradigm in which the Maseru central government is the only entity responsible for designing and directing the country's climate response. The Ministry of Forestry and Land Reclamation, the Ministry of Local Government, the District Administrations, the Community Councils, the Chiefs, and finally, individual farmers and herders are all part of this networked governance ecosystem (Chilunjika and Gumede, 2021). This networked ecosystem makes it not only feasible but also necessary to integrate various knowledge systems.

Research Methodology

The study used a qualitative research strategy where there was a thorough and methodical evaluation of secondary literature. The methodological approach was chosen due to its ability to support a comprehensive, contextual, and conceptual understanding of the intricate interactions among multi-level frameworks, knowledge systems, and climate governance in Lesotho. In order to guarantee thorough coverage of the study problem, a large variety of written sources were purposefully chosen as part of the data collection process. Peer-reviewed journal articles, academic books and book chapters, official government publications like National Communications and Lesotho's National Climate Change Policy (2017), reports from international organisations (like the World Bank, UNDP, and IPCC), and pertinent dissertations and conference papers were some of these sources. The vulnerability of Lesotho was further quantitatively supported by an analysis of global indices, particularly the Notre Dame Global Adaptation Initiative (ND-GAIN) Country Index. A purposively selected 32 distinct sources made up the study's sample. This sample size was chosen to preserve a manageable scope for in-depth qualitative analysis while ensuring theoretical saturation, the point at which no new themes or insights arose from further sources. This figure was chosen in order to strike a compromise between analytical depth and comprehensiveness (including important policy papers, ground breaking scholarly works, and current empirical studies), enabling a thorough analysis of the research subject.

A two-step analytical procedure that combined content analysis and thematic analysis was applied to the gathered data. The principles of multi-level governance, the expressions of climate vulnerability, and the unique features of Indigenous and Scientific Knowledge Systems were among the patterns (themes) that were found, examined, and reported using thematic analysis. By offering a structured method for classifying and quantifying particular ideas,

important phrases, and policy recommendations, content analysis made it possible to compare the ways in which knowledge integration is discussed in various document types. Several techniques were used to reduce internal biases present in the secondary data that was gathered. In order to cross-verify information and viewpoints, data triangulation was first used by consulting a variety of sources, including academic, policy, institutional reports, and indices. Second, to provide transparency in the interpretive process, a reflective log was kept to record analytical choices and possible researcher biases. Third, in order to avoid over-interpretation and preserve faithfulness to the authors' intended meanings, emerging themes were regularly compared to the original source material. In order to create a cohesive case regarding the need to integrate IKS and SKS within a multi-level governance structure in order to improve climate resilience in Lesotho, a thorough analytical method was employed. This article presents the nuanced insights and context-specific policy recommendations that are made possible by the interpretative character of this methodology.

Lesotho's Climate Vulnerability: A Symptom of Governance Deficits

The extent and magnitude of Lesotho's climate vulnerability must be understood before one can recognise the necessity of a governance transition. A complex risk landscape is produced by the interaction of physical, socioeconomic, and governance elements, which results in this vulnerability.

The Biophysical Reality

In the context of climate change, Lesotho's topography is both its defining characteristic and its primary source of exposure. From the lowlands (around 1,500 m above sea level) to the imposing summits of the Maloti and Drakensberg mountains (about 3,000 m), the country is marked by a sharp climate contrast. According to the World Bank Group's (2021) climate projections, the region will experience more extreme weather and greater uncertainty in the future. Rising temperatures, unpredictable rainfall, and an increase in extreme weather events have significantly worsened water insecurity and agricultural vulnerability, becoming hallmarks of Lesotho's changing climate. Higher evapotranspiration rates and increased water stress during dry periods have resulted from the country's steady rise in mean annual temperatures, especially in lowland areas where most people and agriculture are concentrated (IPCC, 2022; World Bank Group, 2021). A more frequent occurrence of severe, short-lived storms and shifts in the rainy season timing have made rainfall distribution more unpredictable, even if total annual rainfall has not decreased much (PreventionWeb, 2022). Limited infiltration and groundwater recharge due to rapid runoff create a paradox of simultaneous floods and water shortages. Additionally, cyclical droughts have become more frequent and prolonged, and heavy rainfall events often lead to flash floods that damage fertile soils, destroy infrastructure, and threaten lives (UNDP, 2023; Malefane, 2022). Besides hailstorms and early frosts, other climate hazards further threaten agriculture, endangering livelihoods and food security. These combined climatic factors emphasize the need for flexible water and agricultural management plans to strengthen Lesotho's resilience.

Socio-Economic Amplifiers

Lesotho's changing climate has been characterised by rising temperatures, unpredictable precipitation patterns, and an increase in the frequency of extreme weather events. These factors have made water insecurity and agricultural vulnerability much worse. The nation's mean annual temperatures have been steadily rising, which has increased evapotranspiration rates and exacerbated water stress during dry spells, especially in lowland areas where the majority of the population and agricultural activity are concentrated (IPCC, 2022; World Bank Group, 2021). With the rising frequency of severe, short-duration storms and changes in the time of the rainy season, the temporal and spatial distribution of total annual rainfall has grown more unpredictable, even though it may not have decreased significantly (PreventionWeb, 2022). Rapid runoff restricts infiltration and groundwater recharge, creating a paradox of floods and water scarcity at the same time. Additionally, cyclical droughts have become more frequent and prolonged, and high rainfall events result in flash floods that degrade fertile soils, ruin infrastructure, and put human lives in jeopardy (UNDP, 2023; Malefane, 2022). Hailstorms and early frosts are two more climatic hazards that increase agricultural risks and jeopardise lives and food security. When taken as a whole, these climate dynamics highlight how vital it is to create flexible water and agricultural management plans for Lesotho's resilience.

The Governance Challenge

The fragmented response to climate change is a clear example of the governance dilemma. Individual ministries frequently approach interrelated concerns like soil erosion and food insecurity as separate problems, which results in disorganised and sometimes contradicting responses. For instance, one ministry's promotion of deep ploughing may counter another's attempts to save soil (World Bank, 2022). To make matters worse, the prevailing policy approach is still top-down, with technocratic solutions created in the capital and applied locally with little to no input

(Mafongoya and Ajayi, 2017). There are serious problems with this centralised architecture that make it vulnerable. It does this by first producing a lack of contextual significance. Standardised solutions are agronomically inappropriate for many communities and result in project failure since they do not take into consideration Lesotho's enormous ecological variety (Nkomwa, Joshua, Ngongondo, Monjerezi and Chipungu, 2014).

Second, it encourages a lack of ownership and credibility. Communities are less inclined to trust, accept, or maintain external interventions when they are viewed as passive recipients, which leads to project failure after external assistance ceases (Berkes, 2012). Last but not least, it leads to a systematic underestimation of local capacity, rejecting centuries of highly developed indigenous knowledge and tried-and-true resilience techniques, like the Machobane Farming System, as being less effective than contemporary methods (Mekbib, Olaleye, Johane, and Wondimu, 2017). This creates a vicious loop whereby socio-economic systems are stressed by climate change and are overseen by governance mechanisms that are not prepared to handle complicated threats. By increasing vulnerability, the ensuing policy failures and maladaptation produce a vicious cycle of eroding resilience. In order to break this loop, a fundamental shift towards a governance structure that is as flexible and multifaceted as the climate crisis itself is necessary. A system that is both locally rooted and informed by science can be fostered through the strategic integration of Indigenous and SKS, which is a crucial change lever within this reform imperative (Hooghe and Marks, 2003; World Intellectual Property Organisation, n.d).

Indigenous and Scientific Knowledge as Complementary Governance Assets

The effectiveness of a multi-level governance framework depends on the calibre and pertinence of the information that passes through it, yet it offers the institutional basis for successful climate action. SKS and IKS are two enormous and potent knowledge streams that operate in parallel in Lesotho with little convergence. To generate transformative resilience, it is essential to acknowledge and utilise these as complementary governance assets.

Indigenous Knowledge Systems: The Bedrock of Local Governance and Adaptation

According to Berkes (2012), IKS are the collective, place-based, and dynamic body of knowledge, customs, and beliefs that have been passed down through the generations via cultural transmission and have developed via adaptive processes. For the Basotho, IKS is a real, breathing framework for comprehending, engaging with, and regulating their surroundings; it is not merely an abstract idea. It is a type of local, decentralised governance that gives communities the ability to self-organise and adapt to changing conditions. In the context of climate adaptation, Basotho IKS manifests in several critical domains.

Prior to the development of contemporary weather models, Basotho societies developed an intricate knowledge of their surroundings and relied on careful monitoring of bio-indicators to anticipate the weather and seasons. In this Indigenous Knowledge System (IKS), the fruiting of certain shrubs, the nesting habits of birds, the movement of insects, and the flowering patterns of particular trees, such as the wild pear (Dombeya rotundifolia), are all monitored (Mafongoya and Ajayi, 2017). For example, it has long been believed that an early or plentiful rainy season is about to begin when a certain tree bears its first fruit or when a particular species of caterpillar exhibits an unparalleled abundance. According to Rankoana (2022) these metrics form a dynamic and responsive early-warning system by providing a timely, cost-free, and locally accessible source of information that directly informs important livelihood decisions, including when to plant crops, when to move livestock to different grazing areas, and when to plough.

Through the establishment of a strong, community-based governance structure, IKS offers the fundamental ideas for sustainable natural resource management in addition to forecasting. Maboella, or the intentional resting of grazing grounds, is one of the traditional methods used to prevent overgrazing and promote pasture regeneration for common-pool resources, such as grazing plains, forests, and water supplies (Berkes, 2012). The long-term sustainability of firewood and medicinal plant gathering is also ensured by unwritten but generally accepted regulations. The authority of traditional leaders (Chiefs) and strong social norms enforce these practices, which are not just unofficial recommendations. This establishes a decentralised yet efficient system of governance that has preserved ecological balance for generations while firmly ingraining environmental stewardship into the social fabric. The Machobane Farming System (MFS) is the masterpiece of Basotho IKS in the field of agriculture. A sophisticated type of intense, low-input agriculture, this system was created by Dr. J.J. Machobane and is intended to replicate robust natural ecosystems (Machobane and Robert, 2004).

Intercropping maize, beans, and pumpkins on the same plot, rotating crops in a methodical manner, and fertilising heavily with ash and organic manure are some of its fundamental ideas. This strategy produces a synergistic agricultural microcosm whereby beans' deep roots store nitrogen in the soil, naturally fertilising the maize, while intercropping offers constant ground cover to prevent soil erosion and control weeds. The method is designed to maintain soil structure and fertility, improve water retention, and produce a varied harvest that disperses the risk associated with climate change. According to empirical research, MFS produces noticeably more outputs per unit area than traditional mono-cropping, especially in the face of environmental stressors like drought or unpredictable rainfall (Mekbib et al., 2017). This strong integration into the local social fabric is what gives IKS its significant governance value. This deep integration into the local social fabric is what gives IKS its significant governance value. It forms the foundation of autonomous local adaptation since it is culturally acceptable, easily accessible, and has been tried and tested for centuries. It gives local communities the ability to make their own well-informed, context-specific judgements.

Scientific Knowledge Systems: The Macro-Level Governance Scaffolding

SKS provides a potent and complementary viewpoint to Indigenous Knowledge by representing the formal, methodical, and quantitative pursuit of knowledge using accepted research procedures (Chilunjika, 2024). SKS provides a macro-scale framework that local knowledge is unable to convey, making it essential for comprehending the global and long-term aspects of the issue in the climatic domain. In light of this, SKS represents the formal, systematic, and often quantitative pursuit of knowledge through established research methodologies. Its main advantages are threefold. First, SKS creates estimates of future climate scenarios, greenhouse gas concentrations, and general trends using Global and Regional Climate Modelling, which is promoted by organisations such as the Intergovernmental Panel on Climate Change (IPCC) (IPCC, 2014). National governments need to grasp the "big picture" to plan long-term investments in vital infrastructure, energy systems, and national disaster risk mitigation frameworks (World Bank, 2022).

Second, SKS makes it possible to collect data and monitor precisely. To provide precise, quantitative data on variables including temperature, precipitation, wind speed, and humidity, national meteorological services use a network of advanced devices, such as weather stations, satellites, and radar (World Bank Group, 2021). In order to create historical baselines, identify statistically significant trends over time, and provide timely early warnings for upcoming extreme weather events, like cyclones and severe storms, that can save lives and safeguard property, this data is essential (Pandey, 2019). Thirdly, SKS is the catalyst for technological innovation, propelling the creation of new tools for adaptation. The development of drought-tolerant agricultural varieties, effective irrigation techniques, land-use planning using remote sensing, and the use of Geographic Information Systems (GIS) to precisely map vulnerabilities and target interventions are all examples of this (Nkomwa et al., 2014). SKS' ability to offer a consistent, fact-based basis for national and international policymaking is what gives it governance value (Busby, 2017). By presenting projects supported by solid scientific analysis, it provides a universal language of data and models that allows Lesotho to access crucial international climate finance, like that from the Green Climate Fund, and participate credibly in global climate negotiations under the UNFCCC (Chilunjika and Uwizeyimana, 2015).

The Governance Gap: The Perils of Disconnection

But when SKS and IKS function independently, serious governance flaws arise that make climate adaptation less successful. Cultural globalisation, youth out-migration, and the resulting decline in intergenerational knowledge transfer pose serious threats to IKS, notwithstanding its contextual advantages (Adger, Barnett, Chapin and Ellemor, 2011). Climate change is pushing environmental circumstances beyond historical norms, making some long-trusted indigenous indicators less reliable, which exacerbates this loss. For example, a weather pattern that is often predicted by the flowering cycle of a particular tree may be upset by an unusual heat wave or changing seasonal patterns, which could result in inaccurate predictions for important agricultural choices (Roncoli, Jost, Kirshen, Sanon, Ingram, Woodin and Hoogenboom, 2009). Because of this degradation and waning dependability, communities become more susceptible to new climate extremes when they only rely on IKS. On the other hand, SKS frequently lacks the contextual awareness and granularity necessary for significant local action when it is implemented in a strictly top-down, technocratic fashion.

Although a national meteorological service's regional rainfall forecast may be statistically correct on a large scale, it is unable to give a farmer in a specific valley the field-specific knowledge they require about the timing, strength, and distribution of rains (Kolawole, Wolski, Ngwenya, and Mmopelwa, 2014). Furthermore, the marketed technologies, like hybrid seeds or specific irrigation systems, may be agronomically or financially unsuitable for smallholder farmers with limited resources, and scientific advice is sometimes written in technical language that is

incomprehensible to rural communities. This basic gap creates a lack of trust in scientific data and is an example of a systematic inability to capitalise on the complex understanding that is ingrained in local knowledge. According to Mafongoya and Ajayi (2017), the outcome is a governance failure: the execution of climate policies and programs that are not entirely trusted by the communities they are meant to serve and are not entirely effective because of their lack of local relevance, which ultimately reduces the resilience of society as a whole.

A Multi-Level Governance Strategy for Integrating IKS and SKS

To close this gap, a multi-level, intentional, and systematic approach is needed that goes beyond impromptu partnerships to institutionalised integration. For this endeavour, the MLG framework offers the perfect scaffold, establishing nodes of interaction and co-production at all decision-making levels.

Integration at the Local Level: Building Trust and Co-Production

The most important setting for combining Indigenous and Scientific Knowledge Systems is at the local level, which includes Community Councils, Village Development Committees, and, most importantly, the institution of Traditional Leadership (Chiefs). This is because it is here that abstract knowledge meets practical action. Several tangible strategies can be used to accomplish effective integration. Agricultural extension agents and district meteorological officers can first undertake Participatory Scenario Planning (PSP), which involves holding frequent forums with farmers, herders, and community knowledge holders. The meteorological service's SKS seasonal forecast is addressed significantly in these discussions, coupled with the community's indigenous indicators (IKS). It is possible to co-create a blended, context-specific seasonal advice by posing questions such as whether the community's observation of delayed bird migrations and a scientific forecast of a late-onset rainy season are consistent. According to Roncoli et al., (2009), compared to indigenous knowledge or a top-down scientific bulletin, this co-produced knowledge is more reliable, nuanced, and ultimately more actionable for farmers.

Second, a methodical approach to recording and verifying IKS is necessary. In collaboration with scholars, local NGOs and CBOs can document IKS pertaining to soil conservation and agro-biodiversity through participatory techniques including focus groups and community mapping. In addition to protecting this delicate knowledge, this offers a foundation for scientific verification. To promote its broader promotion and legitimisation in policy circles, the Machobane Farming System (MFS) can be experimentally examined in soil laboratories for its soil-enhancing qualities, for example (Mekbib et al., 2017). Chiefs are essential as knowledge bridges, to sum up. Traditional leaders, who are the keepers of tradition and land, have a special power to call meetings, support the jointly created advisories, and use their clout to promote the broad implementation of these integrated practices, giving the process vital social and cultural legitimacy (Berkes, 2012).

Integration at the National Level: Creating an Enabling Policy Environment

In order for the integration of IKS and SKS at the local level to be scalable and durable, national policies and institutions must formally mandate and actively promote it, fostering an atmosphere that goes beyond pilot programmes. Integrating IKS into national policies is a crucial first step (Nyong, Adesina, and Elasha, 2007). IKS must be expressly acknowledged as a crucial national resource in Lesotho's major strategic documents, such as the National Agricultural Policy, the National Adaptation Plan (NAP), and the National Climate Change Policy. This acknowledgement needs to be put into practice by requiring its incorporation into all programming pertaining to climate change, supported by designated financial resources and unambiguous monitoring and assessment metrics that monitor the application and results of co-produced knowledge (World Bank, 2022). Without this dedicated funding and accountability, policy statements risk remaining purely aspirational. It is possible that policy pronouncements will remain only aspirational in the absence of this committed money and accountability.

And at the same time, research and extension systems need to undergo a profound change. It is imperative that national agricultural research organisations, like the Department of Agricultural Research, adopt a participatory action research paradigm instead of focussing only on creating and distributing technologies. In "living laboratories," which are frequently the farmers' own fields, scientists collaborate with IK holders to test, improve, and scale up hybrid innovations (Mafongoya and Ajayi, 2017; Wilkinson, Kirbyshire, Mayhew, Batra, and Milan, 2016). Researchers might, for example, concentrate on enhancing the yield potential of hardy native crop varieties that are essential to the Machobane Farming System (MFS) or jointly create integrated pest management plans that efficiently blend botanical pesticides that are sourced locally with a restricted, focused application of scientific ones.

Lastly, educational curriculum reform is essential to guaranteeing the intergenerational durability of this integrated strategy. IKS ought to be methodically integrated into university degree programs in development studies, environmental science, and agriculture as well as the national school curriculum. This collaborative ethos will be woven into the fabric of Lesotho's future governance and scientific practice by cultivating a new generation of professionals, from extension officers to policy analysts, who are not only respectful of indigenous knowledge but also practically skilled in the methodologies required to bridge different knowledge systems (Berkes, 2012).

Integration at the Regional and Global Level: Advocacy and Access

Lesotho must deliberately use regional and international venues to further this agenda and get the support it needs in order to integrate knowledge systems for climate governance. Proactive regional information sharing via reputable organisations such as the Southern African Development Community (SADC) is a crucial tactic. Through the methodical documentation and dissemination of its experiences, both positive and negative, in integrating IKS with scientific forecasts and methods such as the Machobane Farming System, Lesotho can establish itself as a pioneer in locally-based adaptation. By establishing a wider community of practice and bolstering the political influence of IKS across Southern Africa, this knowledge sharing can support the creation of regional protocols and cooperative initiatives targeted at preserving, confirming, and advancing indigenous knowledge internationally (Mafongoya and Ajayi, 2017; Huntington, Fox, Berkes, Krupnik, Whiting, Zacharof, McGlashan and Brubaker, 2005).

At the same time, Lesotho has a significant impact on the global climate finance framework. The nation can take the lead in advocating for changes to the management and access of multilateral climate monies, such the Green Climate Fund (GCF), at international negotiations under the UNFCCC. The delegation from Lesotho can claim, based on first-hand experience, that the strict and frequently extremely bureaucratic project proposal and reporting criteria serve as deterrents for local governments and community-based organisations looking to carry out IKS-based projects (World Bank, 2022). Lesotho may contribute to the development of financing windows and streamlined approval processes that are expressly intended for locally-led adaptation by promoting IKS on this international platform. By doing this, international resources would be directed straight to the local level, where integrated knowledge is implemented, making global financial flows more accessible to the very communities that have the place-based, nuanced knowledge necessary to create true resilience.

The Role of Digital Technology as an Integrative Enabler

According to Mafongoya and Ajayi (2017), information and communication technologies (ICTs) are strong and transformative instruments that help bridge the gap between national institutions and local people by facilitating the multi-level integration of Indigenous and Scientific Knowledge Systems. An important breakthrough in this area would be the creation of a nationwide digital platform that is specifically made to be accessible through entry-level mobile devices in order to guarantee inclusion. This platform would be more than just an information gateway; it would be a dynamic, two-way knowledge repository. The strategic design of its primary functionalities would promote integration: First of all, it might distribute jointly created seasonal warnings by interactive voice response (IVR) or SMS in regional languages, guaranteeing that the combined forecasts from Participatory Scenario Planning are sent in a timely and understandable manner to even the most remote farmers (Roncoli et al., 2009).

Second, and perhaps most importantly, it would allow farmers to create a crowdsourced, real-time library of bio-indicators by uploading images and descriptions of their own findings, like odd plant blossoming or animal behaviour. This citizen-science method gives scientists access to priceless ground-truthed data to improve climate models while also digitally conserving knowledge that is at risk. According to Chilunjika (2024), users could also compare and contextualise various types of knowledge by using the platform's easily accessible information on scientifically approved approaches as well as tried-and-true indigenous methods like the Machobane Farming System. A networked climate governance model would rely on such a platform as its central nervous system, acting as a channel for information flow. Hyper-local observations are directly linked to national meteorological resources and global climate data, establishing a feedback loop that continuously enhances both knowledge systems and enables communities to take an active role in governance rather than being passive information consumers (World Bank, 2022).

Conclusion and Policy Recommendations: Forging a Resilient Future

The problem of climate change in Lesotho serves as a sobering reminder of how closely human security, environmental sustainability, and efficient governance are all intertwined. The country is reaching a turning point. Maintaining top-down governance paradigms as is will simply increase vulnerability and solidify poverty. On the

other hand, there is a promise by adopting a revolutionary path that integrates IKS and SKS within a multi-level governance structure to harness the collective intelligence of its people. According to this study, such integration is a basic governance requirement rather than a luxury. Both the rich tapestry of traditional knowledge from Basotho and the Machobane Farming System are dynamic assets for a resilient future, not relics of the past. Scientific knowledge is also an essential instrument for comprehending macro-scale trends and developing novel solutions, not an alien imposition. Lesotho can create a polycentric, flexible, legal, and efficient climate governance framework by combining them. This study's conclusions are supported by a methodological strategy intended to guarantee robustness and reduce bias. The study was based on data triangulation across several sources, maintained by reflexive recording, and regularly cross-referenced with original texts, as described in the methodology. This meticulous procedure guarantees that the conclusions and suggestions especially the demand for integrated, multi-level governance, come from a fair analysis of the data rather than from biased or selective readings of the literature. In order for the Government of Lesotho, its development partners, and all parties involved in the country's sustainable development to realise this vision, the following specific policy proposals are put forth:

Use Multi-Stakeholder Platforms to Institutionalise Co-Production: Establish District Climate Change Committees in each district by law or policy. Local NGOs, farmers' unions, women's organisations, district administrations, agricultural extension, meteorological services, and traditional leadership (Chiefs) should all be represented on these committees, which ought to be established continuously. Co-producing seasonal warnings and localised adaptation plans, formally combining IKS and SKS, should be their main responsibility.

Revive and Expand Tried-and-True Indigenous Methods: Initiate a nationwide initiative to revitalise and expand the Machobane farming system. This should involve setting up MFS demonstration plots in each community, offering targeted subsidies for system-required inputs, and developing a new cadre of agricultural extension personnel with specialised training in MFS instruction. The multi-stakeholder platforms at the district level should be used to plan and oversee this programme.

Incorporate IKS into Formal Education and Research Agendas: To include modules on IKS, environmental ethics, and climate change, the Ministry of Education and Training, in partnership with the National University of Lesotho, should conduct a thorough review and revision of curricula from elementary school through university level. Simultaneously, participatory action research initiatives that necessitate cooperation between scientists and IK holders should be given priority in national research funds.

Democratise Knowledge by Using Digital Platforms: Fund the creation of a national climate knowledge portal. This ICT platform ought to be made accessible, with both Sesotho and English-language content and support for smartphones and low-end feature phones. It should act as a central location for jointly created warnings, a storehouse of recorded IKS, and a route of communication that allows farmers and professionals to exchange information.

Match Local Realities with National Policy and Finance: Eliminate any barriers to indigenous techniques and aggressively support integrated approaches by conducting a thorough assessment of all national policies about climate change, agriculture, water, and the environment. Additionally, the government ought to collaborate with development partners to create a specific, easily available fund for Community-Based Adaptation. This fund would give CBOs direct funding for projects that use a combination of IKS and SKS methodologies. Lesotho can accomplish more than merely addressing climate change by implementing this multi-level, integrative governance paradigm. It may set off on a path towards sustainable growth that is based on its rich cultural legacy, guided by the most up-to-date scientific research, and motivated by the enthusiastic involvement of its people. By doing this, the globe and the entire African continent can learn valuable lessons about resilience and governance from this tiny mountain kingdom.

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