Assessing the Implications of Planning Policy Innovation for Urban Drought Resilience: The Case of Water Supply in Windhoek, Namibia

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Introduction

This paper assesses the implications of planning policy innovation for drought resilience, focusing on water supply in Windhoek, Namibia. The rationale for the analysis centres around the need to evaluate how innovation can help prevent or mitigate the negative impacts of climate change on natural resource conservation and use. The focus on Windhoek is essential given the arid conditions which characterise the city, resulting in several spells of drought in its recent history. Planning policy innovation is defined here as any spatial planning intervention which utilises novel approaches or offers technologically adept solutions to environmental and other challenges. For instance, a national green policy mechanism can help ensure a climate-friendly economy to engender a sustainable urban transition process.[1] Moreover, cities may engage in cross-border networks with other urban areas to create global platforms for addressing climate change issues.[2]

Policy innovation comprises introducing new ideas or concepts, their diffusion or implementation, and their impacts.[3] These may, for instance, entail the formulation and adoption of low-carbon policies toward minimising climate change effects.[4] With specific reference to sustainable urban development, the United Nations Human Settlements Programme (UN-Habitat) defines innovation in the processes, endeavours, and results that generate novel solutions and lead to improvements in the quality of life of city dwellers. It entails the utilisation of alternative approaches such as horizontal networks and collaborative partnerships towards attaining desired outcomes. Innovation is a people-centred approach that ensures greater inclusiveness. Moreover, it is a technologically oriented strategy that may entail the adoption of digital or non-digital tools.[5]

Planning policy innovation may have direct implications for urban resilience. City resilience entails the ability of an urban system to withstand shocks such that its residents, especially the poor and vulnerable, can thrive irrespective of these dynamics – evident in the process of engineering resilience terms which entails the ability of a system to return to its previous state after a disturbance.[6] However, *ecological resilience* conceptualises the term 'bouncing forward' and

[1] Lee and Woo, "Green new deal policy."

[2] Rashidi and Patt, "Subsistence over symbolism."

[3] Jordan and Huitema, "Innovations in climate policy."

[4] Hildén et al., "Climate policy innovation."

[5] UN-Habitat, *Guidance note.*

[6] Arup International Development, *City resilience framework.*

refers to the ability of a system to move to a new, more desirable state after a disturbance to its previous form.[7] *Resilience planning* is a long-term adaptation mechanism associated with complex climate systems. By extension, *resilient community development* focuses on how communities can build a long-term adaptive approach toward climate change transformation.[8] The physical and social assets influence the climate resilience that communities possess. Physical assets include capital resources and infrastructure, resulting in a better state of the built environment towards withstanding shocks. Moreover, social assets comprise human relationships or neighbourhood ties, resulting in the mobilisation of networks towards minimising the vulnerability associated with climate change impacts.[9]

As noted, this paper assesses the implications of planning policy innovation for drought resilience, focusing specifically on the water supply in Windhoek. Drought refers to a natural hazard situation, usually in arid climates, in which a characteristically low level of rainfall results in dry conditions and scarcity of resources such as water. This also may negatively effect the supply of water supply and current and future agricultural productivity.[10] Thus, *drought resilience* can be defined in terms of the capacity to recover from shocks caused by water shortages.[11] In sub-Saharan Africa, the Southern African region is susceptible to the impacts of drought due to the reliance on climate-dependent sectors such as agriculture, hydroelectric generation, and fisheries. The reactive nature of many planning approaches has exacerbated the situation, which imply that the focus often tends to be on drought management rather than forecasting. Decreasing levels of rainfall and rising levels of aridity amidst climate change continue to compound the situation. For instance, there was a 26 percent decline in rainfall levels between 1960 and 2007 and during 1980 to 2007 there was an 11 percent increase in aridity within the region.[12]

With specific reference to the case study, about 70–75 percent of Windhoek's water supply emanates from the three dams of Von Bach, Swakoppoort and Omatako, with the remaining 20–25 percent coming from reclaimed water and 5 percent or less emanating from groundwater.[13] The Grootfontein-Omatako Eastern National Water Carrier, which connects the reservoirs from the three dams and comprises surface and ground water, can generate 95 percent of the city's water needs.[14] The above developments notwithstanding, water supply has always been a challenging issue for Namibia. With a dry climate and erratic rainfall patterns, the country has experienced droughts at various times, such as 1980–1982, 1994–1996 and 2015–2017.[15] Given its rapid urbanisation, Windhoek has borne the brunt of many of these water supply challenges. For instance, the Windhoek drought of 2015–2017 originates from the 2012/13 season when the recoding of systematic shortfalls in rainfall levels indicated a situation whose effects were evident in subsequent periods.[16]

Planning policy innovation framework for drought resilience

This paper proposes an analytical framework that explains the linkages between planning policy innovation and drought resilience regarding water

[7] Meerow and Stults, "Comparing conceptualizations of urban climate resilience."

[8] Wardekker, "Contrasting the framing of urban climate resilience."

[9] Friend and Moench, "What is the purpose of urban climate resilience?"

[10] Rey et al., "Developing drought resilience."

[11] Scanlon et al., "Enhancing drought resilience."

[12] Nhamo et al., "Preparedness or repeated short-term relief aid?"

[13] van Rensburg and Tortajada, "An assessment of the 2015-2017 drought."

[14] Olivieri et al., "Enhancing governance capacity."

[15] van Rensburg and Tortajada, "An assessment."

[16] Ibid.

supply (Figure 1). Specifically, planning policy innovation concerning green technology innovation, natural resource governance and resource efficiency is defined. These three indicators critically unpack innovative elements in the urban water supply. Green technology innovation entails protecting the environment through adopting technology modernisation approaches and has the advantage of conserving resources, minimising pollution through reduced carbon emissions, ensuring better waste management and improving human capital.[17] Natural resource governance refers to the customs, usages, institutional and regulatory frameworks that define the use of natural resources.[18] Natural resource governance, as used here, refers to a scientific or technologically adept approach to the management or utilisation of natural resources such as water. Additionally, resource efficiency entails reducing waste to prevent shortages, minimising the impacts of climate change, and

[17] Wang et al., "Green technology innovation;" Rennings et al., "The influence of different characteristics;" Du and Li, "Towards a green world;" UNCTAD, *Technology and innovation report 2018.*

[18] IUCN, "Natural resource governance framework."

[19] UNEP, "Why does resource efficiency matter?"

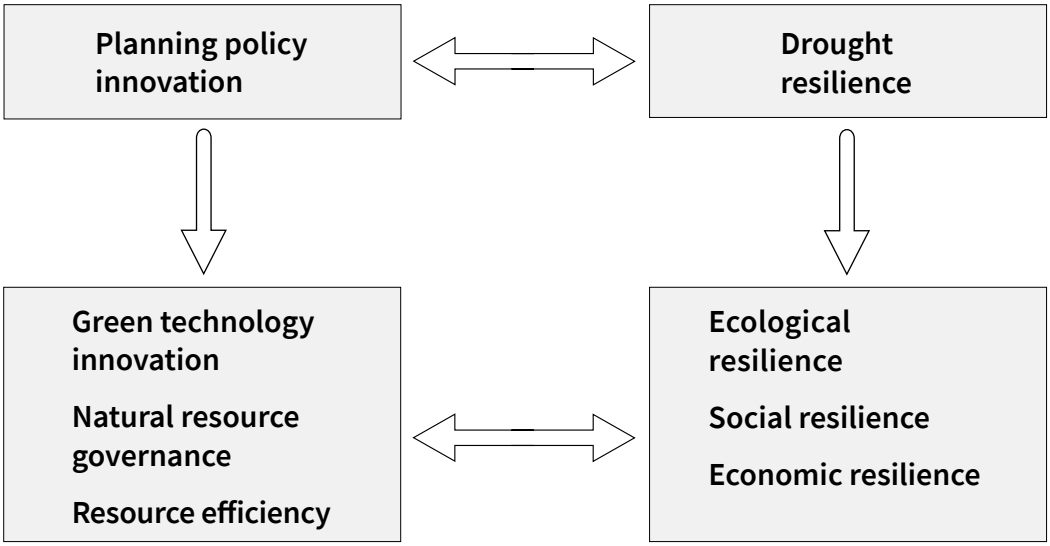

Figure 1 : Elements of planning policy innovation and drought resilience. © Author

Planning policy innovation	Drought resilience	Conceptual linkages
Green technology innovation	Ecological resilience	Green policies
	Social resilience	Public-private partnerships
	Economic resilience	Water demand management
Natural resource governance	Ecological resilience	Water governance
	Social resilience	Awareness creation
	Economic resilience	Diversification of water sources
Resource efficiency	Ecological resilience	Pollution control
	Social resilience	Climate adaptation
	Economic resilience	Waste minimisation

Table 1: Conceptual linkages between planning policy innovation and drought resilience. © Author

mitigating adverse environmental consequences – all of which are important for improving residents' quality of life.[19]

Drought resilience can be defined as ecological, social and economic resilience. Ecological resilience entails the ability of a natural system to withstand shock and recover while experiencing change.[20] Social resilience may be defined based on the ability of society to cope with, adapt to or transform existing systems and institutional frameworks to ensure better human welfare.[21] Finally, economic resilience describes the ability to recover from an external shock to an economic system, such that it either returns to its previous state or moves on to a better state of affairs.[22] The proposed analytical framework (Table 1) is applied to evaluate drought resilience in Windhoek with respect to its water supply.

Green technology innovation

Namibia's drought policy and strategy minimises the phenomenon's effects on water supply and the natural environment. Part of the approach entails adopting technologies and interventions that mitigate drought. These include reducing agricultural risks, identifying alternative income sources, and water supply and demand management strategies.[23] The approach also comprises creating a favourable policy environment that protects land rights, devolves powers, ensures proper pricing for water resources, and interventions for enhancing the agricultural sector.[24]

The City of Windhoek has adopted partnership building (especially public-private partnerships) to ensure a reliable water supply. For instance, the Gorengab water reclamation facility was built in 1968 to reclaim sewage wastewater for reuse and a newer facility in 2002. The partnership approach brought together local experiences with international inputs, resulting in establishing a system that generates water of acceptable international standards.[25] Moreover, the collaboration between the City of Windhoek and the industry played an essential role in addressing the water shortage.[26] Thus, establishments such as Namibia Breweries Limited have taken various measures to reduce their water consumption levels. The success of their efforts has been boosted by financial and related support from the City of Windhoek. However, these largely positive results notwithstanding, successes in the construction sector were limited due to concerns about the potential implications of implementing water-saving measures for jobs.[27]

The City of Windhoek has also adopted a Water Demand Management Strategy (WDMS) and a Drought Response Plan (DRP) to ensure water conservation. The WDMS rolls out interventions to limit water use based on assessments of the drought situation. Additionally, the DRP entails regulations on water supply and use as per existing drought conditions. This helps improve residents' quality of life through a reliable water supply. They also enhance communities' health, security, and economic well-being.[28] Additionally, the Windhoek Managed Aquifer Recharge Scheme seeks to store water in the underground aquifer during plenty so it can be used when drought occurs.[29]

[20] Walker et al., "Resilience, adaptability and transformability;" Spears et al., "Effective management."

[21] Keck and Sakdapolrak, "What is social resilience?"

[22] Mayor and Ramos, "Regions and economic resilience."

[23] Republic of Namibia: National Drought Task Force. *National drought policy and strategy.*

[24] Ibid.

[25] Ndebele-Murisa, "City to city learning."

[26] van Rensburg and Tortajada, "An assessment."

[27] Ibid.

[28] Department of Infrastructure, Water and Technical Services, *Water management plan. Version 1;* Department of Infrastructure, Water and Technical Services, *Water management plan. Version 2*; Scott et al., "The story of water in Windhoek."

[29] N.A., "Windhoek plans to tap into aquifer;" Murray et al., "The Windhoek managed aquifer recharge scheme;" Scott et al., "The story of water in Windhoek."

Natural resource governance

The city blueprint approach is an innovative integrated mechanism that comprises three sub-models from a water governance perspective. These include the trends and pressures framework (TPF), the city blueprint performance framework (CBPF) and the governance capacity framework (GCF).[30] The TPF encompasses the economic, social, environmental and other dynamics which affect water supply. In the case of Windhoek, this reveals the socio-economic inequities and arid conditions which impact the water supply. Moreover, it underscores the need for strong leadership to address the situation. Also, the CBPF refers to the integrated water management system that comprises diverse sources and how this shapes climate adaptation and its effects on water security. Specific reference to Windhoek shows a technical infrastructure gap that must be addressed to ensure adequate water supply. Finally, the GCF entails the ability of cities to offer governance solutions to their water challenges through collaborative networks. The innovations of the City of Windhoek have resulted in interventions such as water reclamation to ensure better resilience. Furthermore, the sense of collaboration among stakeholders in this sector has generally benefited the project and community. Notwithstanding, there are implementation challenges and mistrust due to top-down decision-making.

The City of Windhoek embarked on a Water Save campaign in 2016 to encourage water users to cut down on their consumption levels by 40 percent. Through awareness creation and other related strategies, 2017 witnessed a 33 percent reduction in water usage.[31] Specifically, an intensive public education campaign played an important role in water shortages.[32] At the national level, the Ministry of Agriculture, Water and Land Reform launched a National Water Saving Campaign in 2017 to cut down on waste in all government departments and agencies.[33]

Windhoek's approach to natural resource governance entails diversifying its water supply sources. The reclamation of wastewater which occurred from the 1960s onwards has been an important strategy.[34] This currently accounts for 25 percent of the city's water supply.[35] Other approaches include the utilisation of the aquifer as a receptacle for surface and reclaimed water to enhance storage capacity.[36] Moreover, there are plans to transfer water from the Okavango River. However, these proposals are stalled sometimes by their cost implications and cross-border national interests.[37]

Resource efficiency

Regarding resource efficiency, the introduction of regulations on pollution in Windhoek has meant that those responsible for water pollution bear the brunt of the costs.[38] The regulations have also minimised the erection of polluting establishments close to the land, which serve as sources of groundwater.[39] For instance, the Windhoek aquifer has been declared a protected zone to save it from any developments that could compromise its ability to supply the city

[30] Olivieri et al., "Enhancing governance capacity."

[31] Scott et al., "The story of water in Windhoek."

[32] van Rensburg and Tortajada, "An assessment."

[33] Scott et al., "The story of water in Windhoek."

[34] Haarhoff and Van Der Merwe, "Twenty-five years of wastewater reclamation;" Olivieri et al., "Enhancing governance capacity."

[35] Ibid.

[36] Lewis et al., "Urban water management;" Olivieri et al., "Enhancing governance capacity."

[37] Ibid

[38] Moyo, *Wastewater production*; Olivieri et al., "Enhancing governance capacity."

[39] Lewis et al., "Urban water management;" Olivieri et al., "Enhancing governance capacity."

with water in times of drought.[40] Namibia's climate change policy seeks to enhance the nation's adaptation to the phenomenon by incorporating it into various development interventions. This entails context-specific initiatives at various levels of government, as well as stakeholder engagement. Moreover, it requires awareness creation and capacity building among relevant actors. Given the limited availability of resources, the policy underscores the need for cost-effectiveness and equity.[41]

The City of Windhoek has also made several planning policy interventions, resulting in reductions in water losses. In 1993, for instance, a dual-pipe system was implemented to channel waste water for use in irrigating parks, gardens, and pitches or playgrounds. This served as a substitute for 6 percent of potable water.[42] Pipe repairs have also reduced technical losses of water from 18 percent in 1997–1998 to 13 percent in 2001–2002.[43] Furthermore, a Cabinet Committee on Water Security has made important decisions regarding the Windhoek aquifer at the national level. It has also come up with proposals for long-term water security. In addition, the committee has put in place a Water Crisis management Strategy and sought to improve water supply infrastructure through the provision of boreholes.[44]

Implications for Windhoek's urban resilience

City resilience and natural resource governance frameworks may be regarded as preeminent approaches for effective water management to mitigate adverse climate impacts such as drought. A city resilience framework minimises human vulnerability through better environmental management to ensure sustainable development. Moreover, it promotes the supply of essential services. It also ensures diverse livelihood opportunities, a stronger sense of community, empowered stakeholders, improved urban management, and an integrated approach to development planning.[45] Additionally, a natural resource governance framework defines modalities for decision-makers at all levels to make just and informed choices regarding the utilisation of natural resources to create equitable outcomes.[46] Windhoek's approach to water management amidst drought conditions reveals diverse approaches which other city leaders can adopt. Some of the key lessons are given below.

1. The city's strategy may be described as **bouncing back and forward**. Bouncing back occurs through the aquifer recharge system, which essentially seeks to retain underground water for future use. Also, bouncing forward is evident in the use of technologically adept approaches such as water reclamation, which results in a more desirable state for previously affluent resources. Moreover, resilience planning is demonstrated by the long-term approaches adopted to manage water resources amidst rapid urbanisation and population growth. This simultaneously serves as a strategy for resilient community development, i.e., local communities' ability to build long-term adaptive capacity to climate change.

[40] N.A., "Windhoek plans to tap into aquifer;" Weidlich, "N$73m;" Scott et al., "The story of water in Windhoek."

[41] Republic of Namibia: Ministry of Environment and Tourism, *National policy.*

[42] Lewis et al., "Urban water management;" Olivieri et al., "Enhancing governance capacity."

[43] Republic of Namibia: Ministry of Agriculture, Water and Forestry, *Technical summary*; Olivieri et al., "Enhancing governance capacity."

[44] Lahnsteiner and Lempert, "Water management;" Scott et al., "The story of water in Windhoek."

[45] Arup International Development, *City resilience framework.*

[46] IUCN, "Natural resource governance framework."

2. Windhoek also utilises both **physical and social assets** to manage water resources. The physical assets are evident in terms of the finances, physical infrastructure and technology tools adopted to ensure resilience in the water supply. Moreover, the social assets primarily comprise the city's water sector stakeholders. This paper underscores the role of partnership building in enhancing resilience when it comes to the urban water supply. This is evident in the efforts of local authorities, industry, and other actors to address the city's water challenges.

3. **Planning policy innovation**, if well formulated and implemented, can lead to a more reliable source of water supply. As already noted, this occurs because of reductions in water wastage and diversification in the sources of water supply. Thus, much of the population of this city continues to be served with water despite the rapid pace of urbanisation and population growth. Planning policy innovation also results in a scientific approach to managing and utilising water resources. This is evident in the establishment of the Windhoek Managed Aquifer Recharge System and the reliance on various technology tools for water management. Furthermore, the scientific approach implies a proactive planning mechanism that is responsive to the ever-changing needs of natural resource governance.

Conclusions

As elaborated, planning policy may be understood in terms of tools, processes and outcomes. Regarding urban water supply, for instance, the tools are evident from using technology-based mechanisms such as water demand management and an aquifer system. The processes include the various platforms such as stakeholder engagements and awareness creation, resulting in a better water management approach. Moreover, the outcomes entail positive developments such as pollution control and waste minimisation associated with planning policy innovation for water use.

Innovation in planning policy is both a political and social construction. As a political phenomenon, it requires the central government's initiatives, local authorities, mayors, and other public officials to succeed. Furthermore, as a social construction, it underscores the importance of social networks such as stakeholder engagement and the efforts of local communities to yield results. Similarly, the analysis reveals that planning policy innovation confounds national and local policy interventions. The national-level policy provides the overarching framework, while urban planning constitutes the specific domain for mitigating impacts on cities. These require the agency of political actors such as public officials, mayors and local councillors to succeed.

Concerning the nexus between innovation and planning, at the most fundamental level, innovation enhances the effectiveness of urban planning. This occurs because the concept constitutes an alternative paradigm that seeks to change the status quo. As a result, it prioritises the introduction of novel approaches or mechanisms in accomplishing the task of planning, i.e., improving

citizens' health, safety, and well-being. With specific reference to water supply, this implies looking beyond the conventional focus on distributing available resources to residents. Thus, the emphasis shifts to technologically adept ways of conserving and supplying this resource such that it caters for the needs of both present and future generations.

Furthermore, while planning is a political and technical endeavour, innovation is primarily a scientific and technological phenomenon. The political aspects of planning are evident in the need to engage stakeholders such as government officials and other relevant actors to provide public services like water. Moreover, the need to resolve conflicting interests and allocate limited resources lend credence to this assertion. Also, the technical elements of planning comprise the planner's role in spearheading the orderly development of cities through service provision and other functions. On the other hand, innovation may be regarded as a scientific endeavour due to its efficiency-based approach toward enhanced water supply. Moreover, the technological aspects are evident in the use of advanced tools or techniques for enhancing drought resilience.

Ultimately, innovation in the planning process constitutes a nuanced response to the challenges posed by climate change. With specific reference to drought, the phenomenon reduces the availability of water, creating the need for alternative approaches to water management that cut down on waste. This portends the need for out-of-the-box approaches that recognise this resource's scarcity and the need to conserve it. Thus, innovation ensures the adoption of green concepts in the planning process toward enhancing drought resilience. This implies that it creates avenues for a sustainable approach to urban planning through more ecologically sound choices.