

Article

# The Story of Water in Windhoek: A Narrative Approach to Interpreting a Transdisciplinary Process

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**Abstract:** The aim of the paper is to present a story about the 2015 to early 2017 Windhoek drought in the context of climate change while using the narrative approach. The story that is presented here is derived from the engagement of participants in a transdisciplinary, co-productive workshop, the Windhoek Learning Lab 1 (March 2017), as part of the FRACTAL Research Programme. The results show that the story starts with the ‘complication’ where the drought had reached crisis levels where the water demand increasingly exceeded the supply in the face of the drought. The City of Windhoek (CoW) was unable to address the problem, particularly the recharging of the Windhoek aquifer due to lack of funding. Phase 2 then shows four reactions to the drought: water conservation by water demand management; a Water Saving campaign; the Windhoek Managed Aquifer Recharge Scheme; and, the setting up of the Cabinet Technical Committee of Supply Security. The resolution of the story, Phase 4, is when the national government instructs NamWater to provide the funds for CoW to complete the recharging of the aquifer, which supplied water to the city at the last minute at the end of 2016. The final situation of the story is that ongoing collaborative work by CoW with FRACTAL on the city’s burning issues is planned to integrate climate change into future decision making for the longer term. The main actors in the story are the Ministry of Agriculture and NamWater as hero and villain, and CoW a hero, with the victims of the story, the residents of informal settlements. The main learnings from this story are that the lack of decentralization of power and resources serve to exacerbate water crises at the local level and hamper climate adaptation, despite a proactive and innovative local municipality. The paper also shows that the narrative approach provides the thread of the story to simplify a very complex set of arrangements and contradictions.

**Keywords:** transdisciplinary; water; narrative; Windhoek; co-production; participatory

## 1. Introduction

This paper aims to understand the contested nature of water that is present in the narrative or ‘story’ of the water problems and challenges in the city of Windhoek in the context of climate change. The use of narratives to present the stories of events or issues is becoming more prevalent in urban climate research, as they provide an understanding of urban issues as a form of evidence that is accessible to practitioners and civil society [1–3]. Furthermore, they help to capture the range of voices necessary to understand complex problems.

The story presented here is told by the participants of a transdisciplinary, co-productive workshop, the Windhoek Learning Lab 1 (14 to 15 March 2017), organised as part of the FRACTAL Research Programme. The participants of the Learning Lab (LL) were multi-scalar state and non-state actors in Windhoek, as well as academics who engaged collaboratively to co-produce knowledge about the ‘burning issues’ issues in Windhoek and to deliberate the potential pathways to address them in the context of climate change.

The paper adopts the concept of a narrative to structure of the ‘story of water’. The narrative consists of five phases: the initial situation, the complication, the reactions, the resolution, and the final situation. As the narrative of water is a situated narrative, which is in the semi-arid region of Windhoek, the focus of the narrative is on water insecurity and drought. The paper shows that the concept of the city narrative provides an intuitive framework for telling the story of water as viewed by local stakeholders, and highlights the main actors, their discourses and the technologies and decision-making processes that have taken place in this period of Windhoek’s water history.

The narrative approach as presented in the literature has been predominantly applied to narratives within policies [2–5], while this paper aims to apply the approach to understand the ‘story’ that emerges from a transdisciplinary process of public engagement. The issue of water as a developmental problem was highlighted as the main “burning” issue in the city of Windhoek by participants of the LL. Since the Learning Lab 1 was held shortly after the 2015–2016 drought, the story presents the City of Windhoek’s (CoW’s) struggle in the context of very low rainfall, to ensure water security for the residents to survive the drought. Hence, the ‘story’ that is being told here is about water as a critical challenge facing the Windhoek City Council and Namibian national government with its overall mandate to provide water to Namibian citizens in the face of climate change.

One of the normative goals of recent climate change research calls for the provision of climate information to city decision-makers, particularly in the developing world context [6,7]. An example of a large research project with this goal is the Future Climate for Africa (FCFA) Research Programme which is Funded by Department for International Development (DFID) and Natural Environment Research Council (NERC) in the United Kingdom. As captured in the proposal, “The FRACTAL Project aims to advance scientific knowledge on regional climate responses to global change; integrate this scientific knowledge into decision making at the city regional scale through ‘Learning Labs’ (LLs); and, use iterative, trans-disciplinary, co-exploration/co-production processes to enhance the understanding of co-production of climate change knowledge” [8] (p. 8). The main source of data is the Windhoek Learning Lab 1 Report (WLL1R) [9]. Where information is taken from the report, page numbers are cited. Learning Labs (LLs) have commenced in three cities, Lusaka, Maputo, and Windhoek and involve situated embedded researchers, who are immersed in the working world and practices of the city. At these events, decision-makers, practitioners, and researchers (from the fields of climate science, social science, hydrology, governance, adaptation, and others) come together to jointly frame climate-related problems and think about solutions [9].

The FRACTAL research approach prioritises the co-production of knowledge as part of a transdisciplinary, collaborative process of knowledge production, and it is as equally interested in the co-production *process* as it is in the *products* of the research [10]. Urban problems in African cities are predominantly developmental and tend to focus on issues of urban poverty, the provision of services to the poor, weak urban governance, and the management of informality, among others. It is argued that climate change in the long term will exacerbate these problems. Thus, factoring in climate information into development decision-making and mainstreaming climate change into governance processes is proposed to make cities more climate-resilient [11].

The FRACTAL project was conceptualised from the outset as a transdisciplinary project in which knowledge is co-produced and understandings of and potential solutions to problems are co-developed [10]. The Learning Lab was proposed as the forum in which collaborative knowledge production would take place and it was co-designed as an interactive process. Two important FRACTAL papers were written to frame the design of the proposed Learning Labs [8] and the

co-production process [10]. Co-production takes place outside academic institutions and involves societal actors working with academics to address social problems. Windhoek LL was designed to promote social learning and provide a forum for knowledge exchange and co-production between academics and practitioners [10]; for the various knowledge holders to 'get to know each other' and to derive the 'burning issues' of the city, relating them to the nexus of water, energy, and climate change. FRACTAL and the city partners then chartered a way forward for the partners to work together in addressing them. The issue of water as a developmental problem was highlighted as the main burning issue in the city of Windhoek, exacerbated by climate change.

The diverse group of 37 participants from the CoW, government ministries and departments, non-state actors, and academia from UNAM and UCT were purposively selected by the Windhoek Principal Investigator (PI) and Embedded Researcher (ER), as they represent key institutions to discuss and debate water issues and their relation to climate change in Windhoek.

Narrative analysis [4] was used to analyse the WLL1 Report and the related presentations and flipcharts and reveal the sequential phases of the story using the content of the WLL1 Report. Using the five stages of the narrative (see Figure 1), the WLL1 Report is explored to provide information about each stage of the story [4]. As part of the ethos of co-production, the paper is co-authored by a range of diverse authors from different institutions who attended the first participatory Windhoek.

The literature used in this paper on the narrative approach focuses on examining the narratives apparent in policy documents, but qualitative storytelling has also been used to provide insights into climate adaptation in grassroots communities (Sakakibara, 2008) [12]. According to Slocum, the narrative provides a 'situated' story, which embeds water and its link to weather and climate change "within a relational context that may include the places people live, their histories, daily lives, cultures or values" in Windhoek [13] (p. 8). There are plans to present the 'story of water' to the City of Windhoek at a future LL, and, in this way, the story will be folded back into the transdisciplinary process for ground-truthing and providing knowledge for decision-making [9]. The significance of the paper is that it demonstrates the value of narratives as a concept in water and climate change research in that they provide a vehicle for simplifying the complexity of the nexus between water and climate change.

It is proposed here that with increasing interest in transdisciplinarity and the co-production of knowledge between scientists and societal knowledge holders, the value of narratives is increasing. Narratives offer "increased comprehension, interest and engagement" as a form of scientific communication but have a 'bad reputation' within the natural sciences due to their qualitative format, although this is shifting [14] (p. 13614) [15]. The proposition here is that transdisciplinary, participatory processes do not necessarily present a linear narrative or argument and that the discussions and debates are 'messy' and incomplete. It is argued therefore that by presenting the substantive content of the deliberations as a 'story', the narrative will create a more accessible body of knowledge about the issue at hand providing a temporal framework for the deliberations of the process. The authors argue that qualitative storytelling, as presented in this paper, has potential to offer insight into climate adaptation processes in other cities.

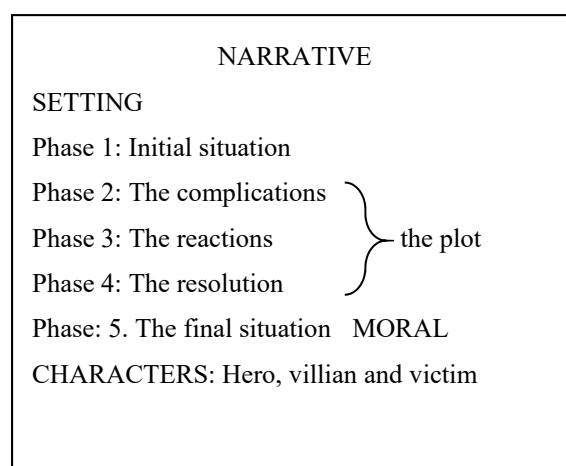
The paper commences in Section 2 with an overview of the concept of the 'narrative' and how it has been used in previous qualitative research as a form of policy analysis [4,5]. In the contextual section, in Section 3, the FRACTAL project is outlined with a focus on the importance of the transdisciplinary City Learning process in the project. The design and facilitation of the LL and the profile of the participants in the Windhoek LL process is described, along with its goal of facilitating the co-production of the city's 'burning issues'. In Section 4, the qualitative method of undertaking a narrative analysis is presented. The discussion and results of the narrative analysis are presented in Section 5, using primarily the WLL1R as evidence, as well as another relevant documentary evidence to amplify points that are raised in the WLL1R.

## 2. Literature Review

### Narratives

The section aims to provide an overview of literature that is related to ‘narratives in decision and policy making’. Language plays a critical role in communicating science to society and there is a growing literature in the social sciences and humanities on the methods that are being used to analyse texts to understand the underlying meanings that are embedded in policies and decision-making [1,2,4,14–18]. These methods include narrative analysis, discourse analysis, and content analysis. People use ‘story-telling’ as a means of making sense of complex phenomena and thus it is argued that narrative analysis is an important method of analysing these stories, their production and their influence at different scales [4]. With its focus on science and society, we are using narrative analysis as a way of interpreting and understanding the construction and content of narratives or stories in specific contexts that talk about urban issues and their proposed solutions to bridge the science-society binary [19,20].

Adam 2008 [4] was one of the early researchers who began to write about narratives in relation to other text structures. Other than narratives, there are four prototypes of text or talk structures which are argumentation, explanation, description, and dialogue, each of which is structured in a particular way. The narrative is the only one of these text structures that is a “specific discursive activity, namely storytelling, which manifests itself in the form of text sequences” around a plot [4] (p. 3) (Author’s italics). A simple definition of a narrative is a ‘story’. Fløttum et al. describe a narrative as a text or discussion with a ‘storyline’, which helps to identify the characters or actors in the story, namely, the hero, the victim, and the villain, and their relationships [4]. Narratives provide more detailed stories of problems, and their causes and solutions, and the role of different actors or characters in the stories. Narratives have a temporal structure or sequence of stages over time, which describes the actions of different actors and relationships between actors through time (Figure 1).



**Figure 1.** The sequence of phases and features of a narrative (Source: Adam, 2008) [4].

Fløttum and Gjerstad [2–4] have used narrative analysis to analyse climate change and development policies. They argue that a policy narrative has the structure of a story, i.e., a setting, characters (heroes, villains, and victims), a plot, and a moral (the policy solution) [4] (p. 3). Furthermore, in a narrative, the storyteller can “give the floor to others” where alternative narratives are included [4] (p. 5). This is termed polyphony—meaning the inclusion of many voices. The story presented here has ‘many voices’.

The *initial stage* of the story telling sequence presents the intrigue and tension between different actors and events at the outset of the story, which includes the setting, which describes the conditions that determine the initial situation. The *complication* is part of the plot and describes problem or issues experienced in the specific context and related to certain actors and events. The *reactions* as

the next stage, refers to certain “recommendations or reactions”, which should take place to address the problem (here ethical factors may be advanced as reasons for responses); the *resolution* is what is decided should be done about the problem or complication; and, the *final situation* is an argument that explains the reactions and why they were made, often providing a moral justification [2,3,5,21] (Figure 1).

An interesting example of the analysis of a climate narrative is an analysis of the South African National Climate Change Response White Paper published in 2011 to understand to what extent social justice and poverty are part of the ‘story’ presented in the policy [3]. The findings show that, although South Africa is a developing country and the poor are the most likely to suffer and the least able to adapt to climate change, there is very little in the narrative referring to social justice and poverty in the White Paper. In Fløttum and Gjerstad’s analysis of South Africa’s White Paper—the National Climate Change Response—that underwent public participation, they illustrate that the text is polyphonic as other voices have been included in the text through a public participation process. They demonstrate that South Africa is presented as both the villain and the victim in the policy, as the country contributes to global climate change with its fossil-fuel based economy, but at the same time, it is very vulnerable to climate change impacts. However, they also show that the South African government presents itself as a hero by stating that it is a “responsible global citizen” [2] (p. 8). The analysis of a range of climate change policies concludes that heroes are largely absent in climate change policy narratives [4] (p. 13). Given that the hero of the story has an important persuasive role to play, this is a critical factor to consider when writing a policy document.

These examples show that a narrative analysis can be a relevant alternative way of understanding complex documents or debates and linking them to broader societal discourses [4]. By understanding the underlying narratives and language within urban decision making, this could help us to better understand why certain decisions are made, who has made them, and how to promote more informed decisions being made in the future [22] (p. 35). The Windhoek LL 1 was an important event during which the city partners engaged with each other to think about water and climate change issues in their city and presented their ideas about how to go about addressing these issues, and, in this way, it is argued here, they tell a story about water in Windhoek.

### 3. Context

#### 3.1. The Context of Water in Namibia and Windhoek

To provide some context for the Story of Water in Windhoek, this section presents the context of water in Namibia and Windhoek. Windhoek has always experienced a shortage of water and has strived to combine surface water and unconventional sources of water to supply the water demand of the city and its surrounds. Namibia is reported to be the “driest country south of the Sahara Desert” [23] (p. 2), with potable water being a scarce resource in the country [22]. The Grootfontein-Omatako catchment in the Central Area of Namibia (CAN) forms the main water supply system for the city of Windhoek and surrounding areas. The potable water supply scheme is owned, operated and maintained by NamWater as the national bulk supplier of water in the country and consists of the NamWater supply scheme—the “three dam systems”. This comprises (i) the Von Bach Dam which is 70 km, (ii) the Swakoppoort Dam which is 90 km, and (iii) the Omatako Dam, which is 160 km from the city.

The CoW (Department of Infrastructure, Water and Technical Services) is responsible for the supply, distribution, and quality of potable water within the urban area. The City, under average conditions, acquires water from NamWater (60%), groundwater (20%), and 20% from reclaimed water [9] (p. 4). CoW purchases bulk water from NamWater, which enters the Windhoek’s Central Reservoir. Groundwater is obtained from the Windhoek Aquifer, which is situated in the southern parts of Windhoek with about 50 production boreholes that are owned by the City of Windhoek. Permits are necessary from MAWF.



Historically, Windhoek is globally recognised for its progress in developing unconventional water sources. The Goreangab Wastewater Reclamation (GWR) plant was built in 1968 by the CoW to reclaim potable water directly from domestic sewage effluent [9] (p. 4). The Goreangab Company (WINGOC) operates the new GWR plant, completed in 2002 [24]. The semi-potable effluent from Gammans Wastewater Treatment Plant treats domestic sewage effluent which is treated to potable drinking quality at new GWC. This is then blended with other sources of water before it is supplied to government, business, industry, and residents in the formal areas. In the Northern Industrial Zone, the Ujams Wastewater Reclamation Plant reclaims the wastewater from industries in this zone. The plant is one of the city's main water infrastructure projects. There was a heavy reliance on these plants with the decreasing amounts of water being available from the dams during the drought.

The CoW and NamWater are thus important actors in the water narrative of Windhoek. The problem at this stage is the shortage of surface water and the reliance on unconventional sources of water where CoW has partnered with private sector to reclaim water. While water demand is managed in the formal areas, water cannot be supplied in the illegally occupied informal areas until a formal tenure of land is obtained. However, CoW has installed communal water points where water can be purchased through a pre-paid system. A programme of the planning division of CoW is systematically regularizing informal settlements and improving their water supply [9] (p. 11).

Namibia is characterized by low and highly variable annual rainfall patterns and experiences extremely high evaporation rates with losses of up to 97% of rainfall through evaporation. The remaining two percent and one percent make up the run-off surface water and recharge groundwater, respectively [23] (p. 3). The region experienced extreme drought in 2015 and early 2017, which has put pressure on the CoW to provide water for Windhoek.

As the capital of Namibia, Windhoek is the economic, political, industrial and business hub of the country. There are 300 of Namibia's manufacturing firms in Windhoek [25]. The high demand for water from households and these industries contributes to the water crisis. Furthermore, the population growth rate of the city of Windhoek is 3.1% per annum is high and the city is home to 36% of the total urban population in the country [25,26]. This is expected to increase with the high urbanisation rate, due to "large-scale rural-urban migration, especially from northern Namibia" [27] (p. 1). Windhoek's climate, status as capital, economic importance, and demographic growth provide an important context in which to understand the story of water in the city of Windhoek.

The Ministry of Agriculture, Water, and Forestry (MAWF), the Namibia Water Corporation (NamWater) and the CoW are the main institutions governing the supply of water to Windhoek. Established in 1997, NamWater introduced a full cost recovery approach to water supply services [28]. The apartheid era Water Act 54 of 1956 is still in force because the regulations of the Water Resource Management Act of 2004 and 2013 have not yet been promulgated, resulting in a policy vacuum in the water sector. The two main new policies regarding water and sanitation are the National Water Policy White Paper 2000 and the Water Supply and Sanitation Policy of 2008 [29]. The latter policy took over from the Water and Sanitation Policy (WASP) of 2003. In 1993, influenced by Agenda 21, the WASP policy declared "water is an economic good and all consumers shall contribute for water supply services" [28] (p. 248).

### 3.2. Windhoek Learning Lab: Structure and Process

Since the paper uses the recorded Windhoek LL 1 Report (WLL1R) (14 and 15 March 2017) as the chief data source in this paper, it is necessary to sketch the role and importance of the Learning Labs in the FRACTAL project. FRACTAL uses the mechanism of the 'Learning Lab' to explore the water, energy, and climate change nexus in southern African cities [8,9] [30,31]. A LL is an event that is a platform of engagement and collaboration in which participants from the city discuss and identify critical issues and share knowledge and potential solutions in relation to burning issues with members of the FRACTAL team [8]. This transformative learning process assumes the knowledge of all participants is equally relevant and that they will become receptive to other views [9,32–35].

After setting the scene, participants collaboratively identified the two burning issues of: (1) water insecurity; and, (2) lack of access to services in informal settlements, including water and the related actors. Climate change formed an important element of the deliberations in relation to the Climate Risk Narrative of Windhoek which was interrogated by the participants. The climate risk narrative was a description of the current and future scenarios of the climate of the Windhoek Region based on climate modelling outcomes [34].

### 3.3. The Windhoek Learning Lab Report

The WLL1R is the major source of data for the paper, and it is both an institutional report for the City of Windhoek and a research/engagement/learning report for the FRACTAL project. The report has an authoritative voice' as the participants are either scientists or municipal practitioners trained in science (embedded knowledge holders) in addition to participants who are experts by way of their experiential knowledge of the issues in informal settlements and the city [5,36]. There were a range of knowledge-holders at the workshop, however, their individual 'voices' were not recorded. Rather, the report predominantly captures the collective and consensual dominant view of issues and responses in the language of officials, as they were the dominant actors.

## 4. The Story of Water in Windhoek

### 4.1. Introduction

This section presents the 'narrative of water in Windhoek' through an analysis of the documentary data produced by the Windhoek LL. The five stages of the narrative, the 'initial situation', the 'complications; "reactions', and resolution' are presented below.

### 4.2. Initial Situation

The *initial stage* of the story telling sequence presents the intrigue and tension between different actors and events in relation to the problem of inadequate water supply at the outset of the story, and thereby setting the scene for the story of water in Windhoek. The drought in the city of Windhoek between 2013 and 2017 was attributable to many factors including low overall precipitation in consecutive years and high evaporation in the Central Area of Namibia (CAN). There was exceptionally low rainfall in 2012 in 2013 there was no inflow of water into Von Bach Dam in the 2012/2013 rainy season, a first in the reservoir's history [23]. Highly variable and unpredictable rainfall resulted in 475 mm falling during the 2014 rainfall season, contributing to inadequate bulk water supply during these drought years [37,38].

It was this prolonged drought of 2015 to early 2017 that put great strain on Windhoek's water supply with the City of Windhoek setting in place several emergency measures to avert critical water shortages and the lack of potable water in the city [23]. The participants of the LL identified the following 'drivers' that contributed to the precariousness of the city's water supply: urbanization leading to population growth; industrialization; lack of investment in water infrastructural development; lack of capacity (skilled human resource); and, the pollution of water supplies [9] (p. 12). These drivers were proposed to have led to the following problems: limited water supply (drought); disruption of livelihoods; compromised health and hygiene; the unequal distribution of water among residents; and, the loss of income due to unemployment and retrenchment, e.g., there were significant job losses in the beer brewing and construction industries [9] (pp. 12–13). It was reported that opposing views of these problems and their possible solutions began to become apparent at this stage among the range of stakeholders at the city level.

The MAWF, NamWater and CoW are the primary decision-making actors that made the major management decisions at different stages of the drought [23], with private water experts and engineers playing an important role. National government through the MAWF, formed a committee, through Cabinet, to deal with reduced water supply due to the drought and in August 2016, instructed all

public institutions to urgently address water wastage (Water Marshals' Programme) [38]. The main private sector actors that were affected and involved in the drought were water dependent businesses, particularly the large bottling plants (the Namibia Brewing and Coco Cola Company), "car-wash" businesses, and the city residents in formal and informal settlement.

#### 4.3. Complications

Water insecurity is an enduring problem in the city and it was identified as a 'burning issue' in the LL. In explaining the problem, issues of drought, climate change, urbanisation, pollution, and the lack of infrastructure were pointed out. However, drought, and increased water demand in relation to constrained water supply were the critical context-specific issues affecting water security in the city. The burning issue was therefore conceptualised as 'water insecurity' in the city without any interrogation of what this meant. A complication was that this understanding varied among actors. For instance, LL participants working with informal settlers conceptualised the water challenge as an issue of non-recognition of informal settlements in the city. Other actors, such as the CoW saw water insecurity as an issue triggered by drought, climate change, and the indecisiveness of the national government to address the challenge.

The drought exacerbated the otherwise known and expected problem of limited water. However, the drought had differential impacts on various actors in the city. Residents were affected with water rationing as the CoW intensified water demand management measures. Overall, the water shortage raised water as a critical issue that required resolution in the city. In that process, the water issue brought together the main actors namely, MAWF, NamWater, and CoW to co-devise solutions.

Climate change was also a recurring theme in explaining water challenges. Repeatedly, the water issues were attributed to climate issues. The country's vulnerability to the impacts of climate change, as characterized by extreme weather events and drought, was highlighted by city actors. Such a situation demands the development of strategies to reduce the city's vulnerability to climate change. The complex impacts of climate change in the city, i.e., on urban development, water and energy were flagged as a critical concern. While it was agreed that the impacts of climate change were apparent in the city manifesting in droughts, uncertainties remained as to how to act at the city-regional scale to provide some solutions to this issue. This uncertainty existed despite the existence of several national and city level policy frameworks with a climate change focus. These frameworks are the National Climate Change Policy, the National Climate Change Strategy and Action Plan, and Windhoek's Drought Response Plan.

As actors struggled to agree on remedial action on the water challenge, the MAWF government was pointed to as both the 'villain' and 'hero'. Villain in the sense that the national government was unsupportive and indecisive on the options available to avert the water challenges in the city, particularly its lack of support for the proposed Windhoek Managed Aquifer Recharge Scheme (WMARS). This emergency water supply project was part of CoW's initiative in 2015 to accelerate the implementation of the WMARS to its full design potential. Towards the end of 2016, however, the government was conceived as the 'hero', largely because it provided the funds for the WMARS resolving the impending total lack of water for the city. Throughout the drought, all residents of the city were seen to suffer, particularly the residents of the informal settlements who were considered as the main victims.

Historically, the CoW was aware of the impending water shortages in the city based on studies conducted in 2004 and 2012 [39]. However, the city was of the view that taking corrective measures is not their responsibility. Rather, the city placed such responsibility on NamWater, the bulk water utility. On the other hand, NamWater argued that the central government needed to make the decision to invest considerable resources on one of the three proposals, namely: WMARS, a desalination, and drawing water and piping it from the Kunene River [37]. At the same time, NamWater applied for borrowing powers from the government to fund the development of new water supply connections. It was reported that the MAWF turned down such proposals three times due to financial constraints,



and eventually, at the last moment, after several years of indecisiveness, they provided the financial resources to Windhoek to implement the WMARS. Thus, there was a history of contention over the responsibility to provide solutions for water shortages, even before the drought began.

#### 4.4. The Reactions of the CoW and the National Government to the Water Shortage and Drought

The four main reactions to drought and water shortage in Windhoek, which had been undertaken by the time of the 1st LL in Windhoek [9] (p. 13), are discussed below (Table 1).

**Table 1.** The four reactions to the drought and water insecurity in Windhoek.

1.	Water conservation: Water demand management
2.	Windhoek's Save Water campaign
3.	Windhoek Managed Aquifer Recharge Scheme (WMARS)
4.	Cabinet Water Technical Committee on Supply Security

##### 4.4.1. Water Conservation

The City of Windhoek put in place the Water Demand Management (WDM) Strategy and the Drought Response Plan (DRP) [40,41] to avert critical water shortages and managing water supply and water use during drought situations [23,41]. WDM strategies use drought severity indicators as the basis for the rules that determine the actions of authorities and consumers to limit water consumption and conserve water.

The CoW DRP outlines guidelines that will be used to manage water supply and water use during drought situations. Once the severity of drought is decided, there are corresponding actions that are recommended. The guidelines are designed to maintain the health, safety, and economic vitality of the community; to avoid adverse impacts to public activity and quality of life for the community; and to consider individual customer needs [41]. However, the "City's overall water supply situation remains precarious" largely due to the rapidly increasing water demand due to urbanisation and economic growth [23].

These measures introduced by CoW have not been straightforward and have given rise to tensions in the city. Firstly, the public feel that the CoW has set water saving targets that are too stringent. Secondly, the formal and informal water-dependent businesses are concerned about the financial impacts of water saving measures. Thirdly, there has also been a concern that communication and awareness raising by MAWF, NamWater and CoW regarding the drought and water crisis has not been effective [23]. While water experts and engineers persistently flagged prevalence of low water levels in the three-dam systems [23], the press reported that MAWF, NamWater, and City of Windhoek were perceived as not taking proactive steps to address the drastic situation.

##### 4.4.2. Windhoek's Save Water Campaign

In 2016, the CoW launched a public water saving campaign "Save Water" to urge residents to save 40% of their water consumption. In 2017, the CoW achieved 33% reduction in water used by awareness raising, urging water conservation, and the retrofitting of water technology [9] (p. 2). In addition, a National Water Saving Campaign was also launched in 2016 by MAWF to improve water management by ensuring that wastage is curbed in all government institutions [42–44].

##### 4.4.3. Windhoek Managed Aquifer Recharge Scheme

With high evaporation rates in CAN, several studies identified the Windhoek Managed Aquifer Recharge Scheme (WMARS) as the best option to improve water supply security [45,46]. The primary objective of the WMARS is to increase the internal long-term sustainable water supply capacity of the city by inserting water into an aquifer during times of high rainfall and abstract it under controlled conditions during times of drought [42]. The Windhoek aquifer is used as a water bank, whereby treated surface water is transferred to the aquifer for safe storage for later use as needed [46].

Surface water from the city's supply dams is used and a portion of reclaimed water; both of which are treated to drinking quality standards prior to recharge [39]. The aquifer was identified by the national government and a Cabinet resolution directed that it be a protected zone. The CoW took this decision into its planning frameworks by declaring the area a 'no development zone' in the southern areas of the City [42,47]. The water recharge project is a combined effort by the MAWF, CoW and NamWater and is a project of national strategic importance, as it was designed to secure water supply for the CAN [48,49].

#### 4.4.4. Cabinet Water Technical Committee on Supply Security

Furthermore, a national Cabinet Committee on Water Security was formed, which is currently discussing inter-basin transfer [44]. The Committee has taken critical decisions, i.e., on the Aquifer Recharge project and is also considering long-term water security proposals for Windhoek. A Water Crisis Management Strategy was also devised [23]. In addition to these reactions, there has been decision to extend water supply infrastructure in the form of boreholes.

#### 4.5. Potential Solutions to the Drought

The narrative of the shortage of water also included what could potentially be done to address the issue of drought. Some of these suggestions were technical solutions, while others were governance related. Suggestions were made that an upgrade of the water reclamation plant could contribute to addressing water shortage as well as an expansion and upgrading of the existing infrastructure. This would include the upgrading of dams that have accumulated silt, so that they could hold more water. Two of the much-discussed technical suggestions were the transfer of water from the Kunene River in the north to the CAN water basin. Desalination has been on the agenda as a possible solution to water shortages in Windhoek for some time and was raised as a possible solution. This would have to be a decision taken by the National Inter-Basin Transfer Committee.

A more controversial suggestion was to divert new 'water hungry' industries to other cities in the north. Participants noted that in such drastic situation as a severe drought, industries, such as abattoirs, breweries, and those in the construction industry, could be restricted from developing in Windhoek. This idea would need much consideration from the national government as it has development implications for the whole of Namibia.

Governance solutions were also seen to have merit. Therefore, the possibility of 'doing things differently' was a suggestion that received much attention at the WLL1. Changes in the governance of water could be a way forward to contribute to addressing the drought issues. The main issue that was raised here was the need to enact the Water Resources Management Act 11 of 2013, which is a revision of the Water Resources Management Act of 2004 and create regulations that can then allow for the implementation of the Act. It is also raised that there is a lack of compliance of existing policy and legislation that needs to be attended to [9]. The main resolution was to work with FRACTAL to develop possible solutions to address the drought issue in the present and near future and several questions were posed, which FRACTAL could collaborate with the local partners.

There was a call for more research with policy resolutions that could be accessed and understood by practitioners as these could lead to 'concrete action'. It was acknowledged that multiple researchers would be required because of the diverse nature of the solutions needed. The CoW was framed as the hero responding to the drought and devising potential solutions. However, it was acknowledged that they would not be able to resolve the issue of water supply entirely on their own as decision-making power and resources were held largely at national level.

#### 4.6. Final Situation

This narrative tells the story of the issue of water at the collaborative workshop that took place shortly after the CoW had experienced a severe drought. The collaboration of the city stakeholders and University of Namibia with FRACTAL in the Windhoek LL brought to the fore that the 'burning issues'

in Windhoek were water related. Although the interest of the FRACTAL research is in examining the nexus of climate change and water, climate change was not dwelt on as an important issue in decision-making in the city in the context of the drought. However, the thread of climate change was woven through the workshop as it was included in the presentations given to the group and appeared in the final questions that were raised at the meeting, for example, what climate information would be necessary to plan for new water infrastructure? This is evidence that the participants were receptive to the proposal that climate change need to be considered in future water related decision-making [9,35] (p. 10).

The representative of the Ministry of Environment and Tourism's Department of Environmental Affairs, on climate change at the national level (the National Climate Change Committee) presented the Namibian national response to climate change. The University partner, however, raised the issue in his address that at the local level, that there is little evidence, if at all, that Windhoek development decision-making considers the implications of climate change [50]. While the City showed awareness of how climate change would exacerbate the existing water issues, it was clear that little explicit action had been taken in the policy space that was related to climate change at this stage at the local level. In fact, a senior official noted that the engineers in the Windhoek municipality "are not sure that they believe in climate change" [51]. To date, mainstreaming climate change into the CoW's policies and practices has only just commenced. Since the Windhoek Learning Lab 1, CoW has commenced the development of a Windhoek Climate Change Strategy and Action Plan.

The drought of 2015 to early 2017 placed the City in a very vulnerable position. NamWater reported "the supply of water from the three-dam system may not last until the next rainy season. Consumers can also ready themselves for poorer quality water" [52]. Anxiety on the part of the public sector and civil society was evident. There was a request from the City to declare a 'hydrological drought' as when the water from NamWater runs out, Windhoek would be entirely reliant on groundwater and reclaimed water. After repeatedly requesting the MAWF government for funding to initiate an aquifer recharge system to store water for drought conditions, the national government finally instructed NamWater to give CoW funding to undertake this scheme when the drought conditions had become dire. In 2016, in great haste this project was undertaken to provide water security for the city. It was finally commissioned in December 2016 just before the supply of water to Windhoek was estimated to end. This showed the lack of decentralization of water governance in Namibia [53].

The drought has been a critical trigger to place climate change on the agenda of CoW and raise awareness amongst all the stakeholders in the city about water security. Water security is a concept defined by Cook and Bakker [54] as an integrative concept that "includes access and affordability of water as well as human needs and ecological health". This broader definition has a central focus on governance, with good governance giving rise to better water security and vice versa which would therefore consider the implications of climate change for the future. The partnership of the FRACTAL research project with the Windhoek City Council and UNAM was well timed to raise the receptivity of local actors to the implications of climate change and the need for co-operation.

## 5. Discussion and Conclusions

The research presented here contributes an additional empirical example to research using a narrative approach. The analysis shows that the major focus of the LL was the burning developmental issue of water insecurity. However, the narrative of the impact of climate change, promoted by the FRACTAL research project was a minor, albeit an urgent focus, which was threaded through the workshop emerging as central in the questions posed by the local participants at the end of the LL. Since the 1st Learning Lab was the start of the FRACTAL/CoW/UNAM engagements and activities to provide climate information for decision-making, it was an open-ended workshop, concluding with the research questions that this FRACTAL consortium might pursue together. The questions suggested

by local partners demonstrated that participants were receptive to the notion that climate information is a critical component of urban developmental decision-making [36].

The setting for the story was the dire situation of the City of Windhoek, situated in a semi-arid region and experiencing a drought from 2015 to early 2017. The story of the drought has a clear plot, that of the urgency of the drought and its potential impacts on the residents and economy of Namibia's capital city, and how national and local state engaged to put in place a range of reactions to ensure water security for the city (Table 1). The plot concludes with the resolution of the drought crisis by the MAWF, which instructed NamWater to finance the CoW aquifer recharge scheme and provide water security at the last moment just before the water supply dried up.

The process of the Windhoek LL provided a platform for different stakeholders to share their knowledge and experience about an issue of common interest. It became apparent during discussions at the LL that participants were not only involved professionally in the issues of water and climate change based on their expertise and experience, but these issues helped to highlight what they all were personally involved the issue of water shortage in their everyday lives, namely, due to drought.

Residents in informal settlements were identified as the major victim of the water problem. The participants decided that in addition to a lack of water supply for the city as a burning issue, the lack of services, particularly water, in the informal settlements was an equally important burning issue. The CoW is portrayed as the hero of the narrative as much of the story tells of the efforts of the municipality to respond and adapt to the drought. The governance of water is multi-scalar and necessitates the actions and co-operation of national and local actors. So, to some extent, the national government also appears as a hero towards the end of the drought. At the same time, there is a recurring discourse of co-operation throughout the story as the MAWF, NamWater, and CoW can also be viewed as heroes for co-operating to provide measures for effective use of water, reduction of wastage and provision of unconventional water sources. However, there was some reference to the national government as the villain for not being forthcoming until the last moment of the drought with the funding necessary funding to secure the Aquifer Recharge Scheme, despite many requests from CoW. This serves to cast the MAWF as both a hero and a villain in this case. The narrative therefore provides a way of understanding the drought issue as a contradictory process with the various actors playing overlapping roles in the story.

The phases of the story from 2015 to early 2017 show the build up to the drought with the decrease in rainfall over two years, the conditions it was giving rise to and the complication of CoW getting adequate funding for alternative sources of water (aquifer recharge scheme) for Windhoek. Part of the plot included the range of reactions of local and national government to the critical drought conditions, with several potential solutions that were deliberated and could still be implemented. The plot ends with national government funding the recharge of the aquifer as a longer-term source of alternative water, completed just before the drought was broken by rain in early 2017.

The story of water in Windhoek from an ongoing participatory collaborative process cannot deliver a final resolution to the story as a water policy does [2–4]. What can be argued is that the participants, from the FRACTAL research project and local partners in the municipality agreed to continue working together after the LL and formulated a set of questions upon which they could proceed. Thus, the story will have 'further instalments' as FRACTAL and the Windhoek city partners continue their work together. The process of the LL is reported as being consensual. While the consensual process of the LL is a good starting point, so much of the richness of the story comes from the different perspectives and the contested views that did emerge. These different perspectives were not revealed here because they were not explicitly captured in the Windhoek LL Report. However, just as a policy includes the voices from the participatory processes, so the different voices of the participants are captured and entangled into one dominant story with some remaining marginalized.

The main learnings from this paper are twofold. The first is that what we have found confirms literature that reports that decentralization is weak in southern African cities with national governments retaining decision-making power and resources in relation to water and energy [53,55]. However,

the evidence shows that the CoW has been proactive and innovative in its approach to securing non-conventional water sources, despite the lack of response of the national government to its repeated requests for financial support.

The second lesson is that the application of the narrative approach to a participatory process provides a lens to make clear the actors who were involved in the process and the events that occurred during the crisis of the drought. This provides both important and accessible information about the issues of water and climate for decision-makers in a simplified and intuitively understandable form. This, in turn, demonstrates the value of collaboration that is engendered through participatory processes of co-production.

However, the narrative approach drawing on knowledge that has been co-produced in participatory processes is not without its challenges. Collaborative processes of co-production are very time and resource consuming. Because of the need to get academics, who in a consortium such as FRACTAL come from distant locations, civil society and municipal officials together at a dedicated location and time, a large amount of resources is necessary for travel, administration and accommodation. However, besides this more logistical challenge, it is very important to manage and reveal the underlying power relations among participants. The workshops are facilitated on the principle that all participants are equal and should be respected; and that their knowledge is equally valuable. Participant observation showed powerful actors steering the debate and dominating discussions on occasions, hence influencing the storyline of the narrative. This is a critical challenge and it is suggested that future work should focus on examining the contribution of diverse knowledges and how the consensus narrative is negotiated among participants. This challenge also calls for a revisiting of the design and content of participatory, collaborative workshops to more successfully ‘equal the playing fields’ among actors. It needs to be ensured that co-production be more of a disruptive process, to shift the dominant and business-as-usual technical approaches to water and climate change to consider issues of social justice in the impacts of climate risk and water insecurity [56]. It is proposed that the receptivity of participants to the ‘story of water in Windhoek’ when presented at a future Learning Lab will surely raise awareness about the ‘story’ that is contained in a policy-making process.

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