STRENGTHENING DECENTRALIZED WATER GOVERNANCE IN A SEMI-ARID ENVIRONMENT: THE CASE OF MARIENTAL, NAMIBIA

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ABSTRACT

Semi-arid environments are characterized by high rainfall variations such that they may suffer from both floods and droughts. The Intergovernmental Panel of Climate Change (IPCC) has cautioned countries, especially in southern Africa to be on alert for the impact of climate change as well as changing patterns in the water cycle. In addition, there is a need for good water governance, to effectively manage water resources for countries located in a semi-arid environment, most specifically recognizing community inputs in water governance. There are concerns that the concept of community participation in water governance is used for political gains rather than being incorporated in policy-making. Other concerns include the knowledge uncertainties in water resource management. Therefore, this study focused on if and how community participation could strengthen decentralized water governance in a semi-arid environment.

The Three-Layer Model of water governance, which originates from the Netherlands, is used to realize the study's objective. The framework provided the baseline for structuring the questionnaire and adapting predefined questions that were incorporated in the questionnaire and later in qualitative data analysis. The case study was based in Mariental, Namibia where two stakeholder groups (community members and organizations in water governance) were identified for the study. Each stakeholder group had a different questionnaire used for data collection, which had the same content and slightly different questions that were appropriate for each group. The qualitative data analysis was completed in ATLAS.ti using the conceptual mapping approach, including the analysis of official documents from organizations involved in water governance.

The results show that Mariental's water governance is constituted with a well-defined content layer which includes providing clear policies to manage water resources although minor shortcomings were detected. However, the institutional and relational layers are weak in critical components (accountability, finances, and participation) essential for effective water governance. Hence, the current state of water governance in Mariental should be improved. Maintaining the content layer while improving the institutional and relational layers can strengthen the current state of water governance. Indeed, community participation in water governance will be encouraged, and their input will be valued in decision-making to reflect good water governance.

Keywords: *Water governance, community participation, decentralization, Three Layer Model.*

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1. INTRODUCTION

In the book *Water Is Life*, the researchers emphasized human rights to water and their involvement in water resource management that include; understanding the water supply, creating a balanced share of ownership, as well as general access to water as a basic need (Anne, Kameri, & Barbara, 2015). Attention is given to semi-arid environments, including east and southern Africa with regards to water resource management. Also, many countries in semi-arid environments are affected by both floods and droughts, causing infrastructure damages and other socio-economic uncertainties. Therefore, the Intergovernmental Panel on Climate Change (IPCC) has strongly cautioned countries specifically in southern Africa over the impact of climate change, and changing patterns in the water cycle (Hoegh-Guldberg, Jacob, & Taylor, 2018). In general, climate change leads to fluctuations of the annual rainfall's frequency; its variation has a more significant impact on the water supply system. Hence, the reliability of rainfall in semi-arid environments is very low (Sagarika, Kalra, & Ahmad, 2014). Moreover, water resource management becomes complicated due to uncertainties in the water cycle (Ahmad, 2016), and the areas are characterized by low to no rainfall; shorter rainy seasons, and extended dry seasons, which translate into water deficit (Houston et al., 2011).

A semi-arid country such as Namibia generally has short rainy seasons and long dry seasons and, it suffers from both floods and droughts; about 14 significant floods have been recorded countrywide, between 1987-2019 (UNDRR, 2020). The recorded flood events included the 2006 flood in the Fish River, which had a massive impact on Mariental, Namibia (the study area). Figure 1 shows a graph with the history of floods and droughts in the Fish River Basin, where Mariental is located. Although the presented data are taken at Keetmanshoop hydro-station, it is still relevant for this study. Keetmanshoop is about 230km south of Mariental. Based on the Climate Index, the graph indicates that, in a century (1900-2010), only nine years recorded an annual rainfall above average (200mm). Rainfalls recorded with 200mm per annum have resulted in flooding, reference to the Climate index and 2006 flood in Mariental. However, just like other semi-arid environments, the rest of the years are characterized by drought to severe drought, as well as the high standard deviation for rainfall patterns *(Not a total representation of the whole Fish River).*

There is a need for good water governance to manage water resources such as emphasizing collaboration with stakeholders when addressing governance and management issues however, a paradigm shift is essential in water governance; the drive to achieve good governance depends on the rights and responsibilities of stakeholders to collaborate within themselves and other collaborators (Galvez, Rojas, Bennison, Prats, & Claro, 2019). In general, even though collaboration is considered as the pillar of governance, there is a tendency by most countries in southern Africa to use the concept for political gains. Such that, collaboration and participation are not always reflected in practice, and neither are their inputs automatically considered in water governance (Harrington, 2017).

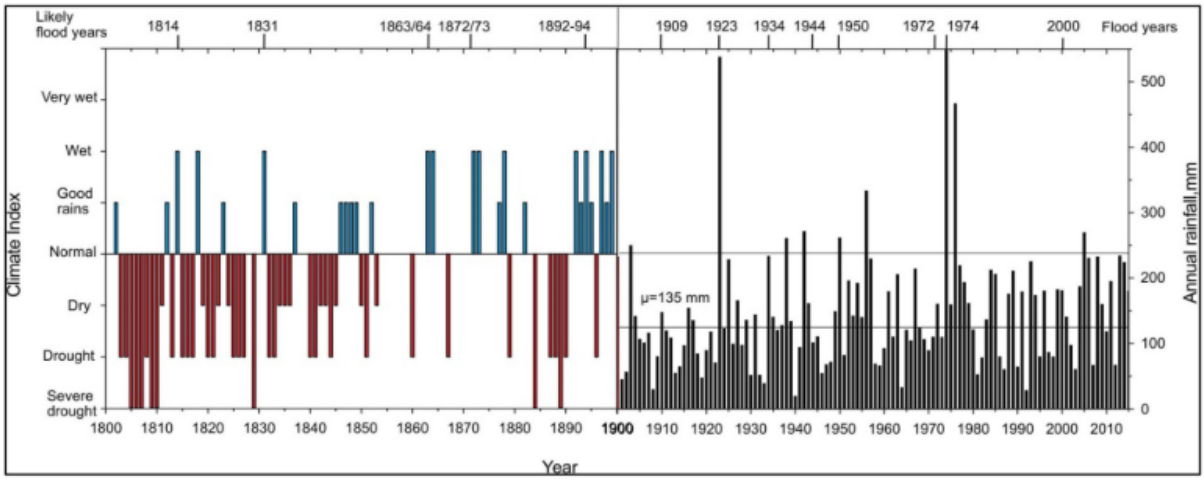

Figure 1: Flood and drought history (1800 -2010) recorded in Keetmanshop. Source: (Cloete et al., 2018)

1.1 Water governance in semi-arid environments

The term governance is an umbrella concept that recognizes both private and public society in the drive of politics (Hofstra, 2013). Water governance can be defined in a similar vein, as the system beyond water management, recognizing the links between societies and illustrations of how, who, where, and what in the water system (Franks & Cleaver, 2007). In contrast, the Global Water Partnership describes water governance as a paradigm of political, social, economic, and administrative setups used in water resource management & water supply at different societal levels.

In general, water governance faces challenges ranging from; power imbalances, legal constraints, and lack of funding for water institutions and stakeholder participation that are considered to be persistent drawbacks that need attention. If not addressed, the latter translates into conflicts whenever stakeholders differ in objectives, needs, and expectations, which in the end affect transparency and accountability in water governance (Harrington, 2017). Furthermore, Harrington highlighted that water governance is firmly based on collaboration that is either local, regional, national or international.

1.2 Problem statement

Semi-arid regions are being challenged by inadequate water availability throughout the year, such that there is a deficit in the water cycle that typically is characterized by short rainy seasons and long dry seasons (Houston et al., 2011). Therefore, flood plains attract dwellings and human activities driven by fertile land and seasonal water supply from rivers. In a way, the water deficit creates reliance on riverbeds or flood plains for social and human activities (Tanner, 2005). However, semi-arid regions also suffer from floods that cause enormous damages to infrastructures and humanity at large(Hoegh-Guldberg et al., 2018). In addition, a high deficit in the water cycle prompts the construction of dams to mitigate water shortages for the communities in and around flood plains (Milechin et al., 2009). Due to hydrological knowledge uncertainties, there is a lack of causal knowledge and uninformed water management planning. Thus, design interventions are less informed and pose a risk of failure (Cloete et al., 2018). Consequently, due to the system's complexity, institutions find it hard to balance between rights, values, opportunities, and institutional goals for communities living next to ephemeral rivers, including management of infrastructures along the rivers beds (Seely et al., 2003). The latter causes conflict between involved actors, whereby stakeholders differ in aspirations, goals, opportunities, and knowledge, leading to dissensus among actors (Vugteveen et al., 2010).

1.2.1 Scientific Problem

This study addresses two scientific problems: knowledge uncertainties as well as the undefined extent of community input in water governance. These two scientific problems challenge how water governance is structured such that, water authorities do not have the capacity to make informed decisions especially on issues regarding floods and droughts in semi-arid environments (Cloete et al., 2018).

With regards to the communities' input in water governance; it is believed that community participation does not always lead to the redistribution of power, or potentially influencing decisions making, albeit the aim firmly lies with decentralization; surrendering some political control into society (Arnstein, 1969). To some extent, local knowledge is excluded in decision-making, therein referred to as an act of formality that leads to lack of participation by the community, and prompting conflict between stakeholders (Rose, 2003). The study explored mitigation measures of the two scientific problems via the case study area, Mariental.

1.2.2 Societal Problem

Gradual environmental change and population change can be critical factors to consider in policymaking and water management. Moreover, low elevated areas are prone to flooding from surrounding rivers and tributaries; although, some are also affected by cascading floods due to overflow from the existing dams (Cloete et al., 2018). Disasters Risk Reduction programmes and organizations take up a substantial amount of national budgets in semi-arid environments, with flood being one of the major disasters second after Drought (UNDRR, 2020). The uncertainties in the water supply and drought occurring in semi-arid environments have since led to some economic outcry whereby, the business community feels neglected in talks about water management. Consequently, investors and insurers have revoked their services to some communities and towns in the alluvial fan (Hugo, 2013).

1.2.3 Wickedness of the problem

Floods in semi-arid regions may be considered opportunities to minimize the impact of drought by storing water in reservoirs. On the other hand, floods are a natural hazard that poses risks to exposed communities (Cloete et al., 2018). Besides flood and drought in semi-arid environments, there are knowledge uncertainties due to a lack of experts and hydrological data (Cloete, Basson, & Sinske, 2014). Recorded flood events might have originated from sources other than the known potential(s), and land uses could be affected at different scales. The complexity and uncertainties in understanding the water system lead to more water resource management issues; water authorities are finding it hard to balance goals with their objectives, communities' rights, and opportunities within flood plains (Seely et al., 2003). Further information about the wicked problem and its position in this study are provided in the discussion chapter.

1.3 Importance of water governance in semi-arid environments

A lot of water-related issues have been presented in the problem statement, those challenges require an approach that will mitigate the problem and make semi-arid environments more livable. Generally, about 780 million people worldwide did not have safe drinking water by the year 2015, although the statistics are expected to decrease (Romero, 2015). In addition, Romero further stated that population growth, industrialization, and increased demand for water has a significant impact in the world because it directly links to water availability and sanitation which are considered as global concerns. Therefore, it is of great importance that countries in semi-arid environments take water governance seriously given the nature of the environment but also to ensure effective use of water resources, responsible use of energy, and sustainable service delivery.

The Global Water Partnership indicated that countries located in dry regions have great challenges managing water resources that is why they need to take water governance seriously. Thus, it alluded to the importance of water governance by defining it as ''the ability to exercise legal rights, meeting obligations and mediating the differences. Indeed, the definition of water governance indicates its importance and values how it should take place as well as the expected outcomes.

***Keywords**: Exercise legal rights, meet obligations, and mediate the differences*

1.4 Research gaps

It is believed that experts and water authorities might not be aware of the vast hydrological understanding, beliefs, and practices of water management instilled in the local community, which could be used to enhance expert knowledge (Wolfe, 2009). In addition, even though some governments have made provisions of community participation, the effect and value of their involvement in decision-making are still in question. Therefore the gaps between policy-making and implementation are not well explored let alone the accountability of authorities to policies & regulations of water governance in semi-arid environments (Hegga, Kunamwene, & Ziervogel, 2020).

1.5 Research objectives and research questions

This study aims to determine if and how community participation could strengthen decentralized water governance in a semi-arid environment. Therefore, the following sub-objectives are used in the realization of the main objective.

1.To understand stakeholders' relationship in water governance.

2.To determine the level of community participation in water governance.

3.To identify the value of community participation in water governance.

4.To identify ways to improve community participation in decentralized water governance

1.5.1 Research Questions

Table 1 shows the sub-objectives and respective research questions that are answered in this study. The research questions are adapted from the Three Layer Model of water governance that is explained later in Chapter Four.

Table 1: Sub-Objectives and respective research questions

Sub-Objectives	**Research Question (RQs)**
To understand stakeholders' relationship in water governance.	1. What are the rights and responsibilities of stakeholders involved in water resource management?
	2. What are the challenges/conflicts facing stakeholders in water governance?
	3. What are the different factors that lead to possible conflict between stakeholders?
To determine the level of community participation in water governance.	4. What are the procedures for community participation in water governance?
	5. Do the community use the existing platforms to participate in water governance?
	6. How is the local community represented in water governance?
To identify the value of community participation in water governance.	7. Is tacit knowledge from the local community recognized in water governance?
	8. How is community participation financed in water governance?
	9. How can community participation contribute to knowledge gaps and minimize the wickedness in water governance?
To identify ways on how community participation can be improved in decentralized water governance.	10. How would an inclusive decentralized approach be structured in water governance?
	11. How can community participation be improved, reflect in practices, transparency, and accountability of water governance?
	12. Does the practice of community participation align with bylaws and procedures in water governance?
	13. Does Area-Based Policy stimulate community participation in water governance?

1.6 Research approach

This study is based on a case study in Mariental, Namibia, guided by a water governance framework adopted from the Netherlands. The framework acts as a checklist of good water governance and provides the structure used to collect & analyze data of the different stakeholders considered for this study. The data collection process was conducted through questionnaires, interviews, and officials documents from water governance institutions. The data analysis part comprised the water governance framework that guided the conceptual mapping of qualitative data in ATLAS.ti. Different concepts used in this study are indicated in the CodeBook and reflect how the analysis of qualitative data has been conducted in ATLAS.ti. The results are presented according to the framework that also forms the basis of discussions and recommendations made. A summary of the research approach is indicated in Figure 2. Refer to chapter four for more details about the framework and data analysis, such as Conceptual Mapping in ATLAS.ti and the CodeBook.

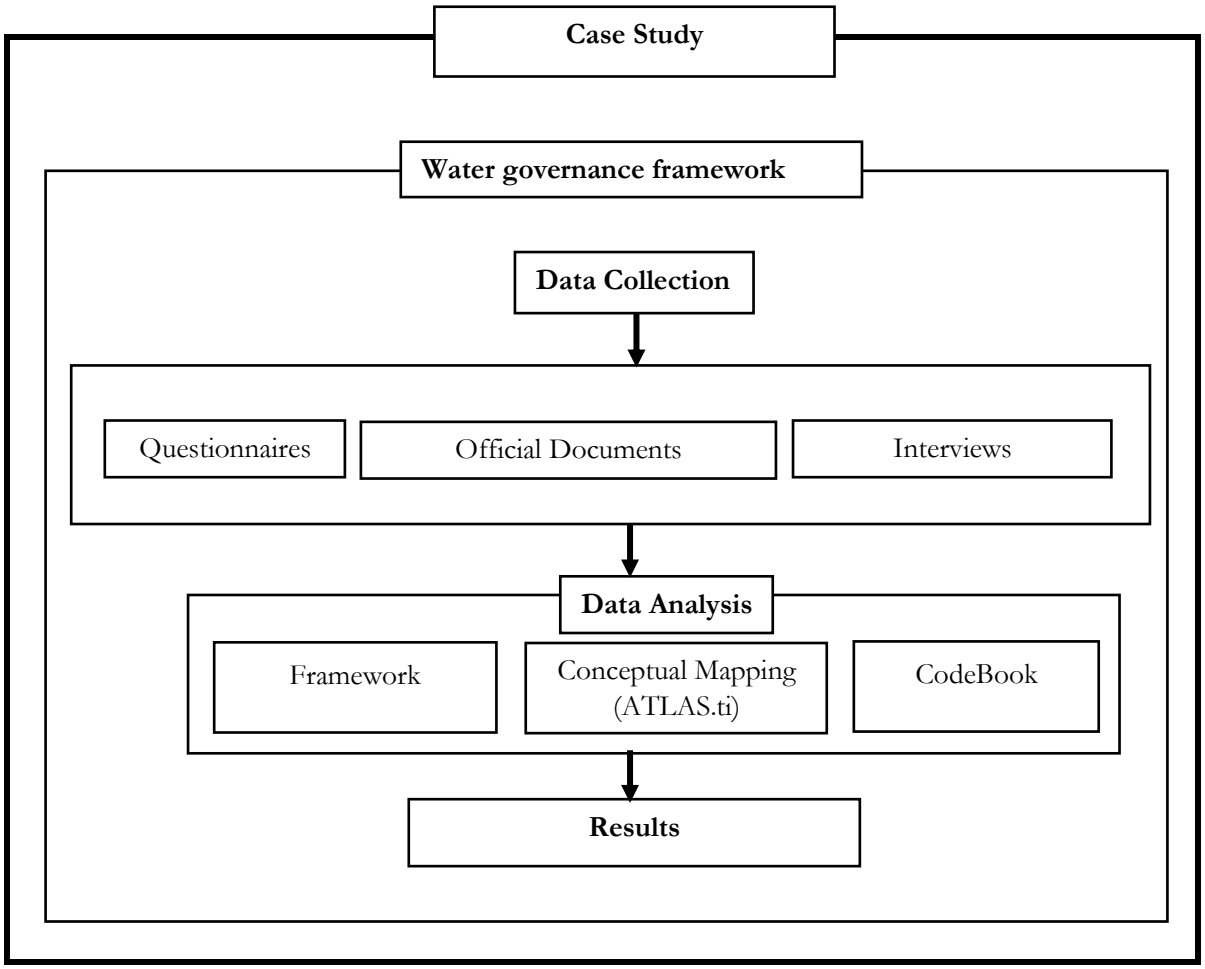

Figure 2: Research approach for the study (own construct)

1.7 Thesis Structure

Chapter One: Introduction
This section introduces the project and keywords such as water governance. It also gives a belief overview of the social and scientific research problem, after that introducing the main objective, sub-objectives, and respective research questions used in the realization of the different sub-objectives.

Chapter Two: Mariental as a case study
This chapter focuses on illustrating the case of Mariental, Namibia as a semi-arid environment and the characteristic of the study area in terms of water governance that is then used to achieve the research objective.

Chapter Three: Literature Review
This chapter scientifically introduces the different key concepts used in this study. The chapter further gives a scientific stance on water governance in general and that of a semi-arid environment. In addition, the Mariental water governance is briefly introduced as a case study based on available literature. The Three Layer Model, which is the foundation of this research, is also explained and connects concepts such as Area-Based Policies.

Chapter Four: Methodology
This chapter depicts the conceptual framework, research datasets, and the case study on which this study is based. The general concept of this chapter portrays the design of the study that will give output as results (presented in the next chapter).

Chapter Five: Results
The results chapter is an aggregated output of different methodological acts and analyses made from the previous chapters. The structural layout of this chapter is based on the sub-objectives and respective layers of the framework that align with the results as well as the addressed research question.

Chapter Six: Discussion
In this chapter, the result and literature are reviewed and discussed with a scientific sound. The discussion of research outcomes and the scientific significance of the study guides the recommendation part, making part of this chapter.

Chapter Seven: Conclusion
This chapter wrap-up up the research, and it scientifically depicts the success and failure or position of the study as a whole. By concluding, this chapter serves as the last chapter of scientific writing and reasoning. However, a few unstructured inserts may follow a backup for what has been discussed, such as references, appendix, and annexure.

2. Marietal as a case study

Mariental is named after Marie, the wife of Herman Brandt, who was the first colonial settler in that area (Mwinga, Siboleka, & Kavezuva, 2018). Mariental is in the Hardap Region and is located in the southern part of Namibia. The area lies within the alluvial fan of the Fish River, which, together with its tributaries is the source of flooding in Mariental and surrounding areas. The Fish River records the highest rainwater influx in Namibia and feeds into Hardap Dam; the primary water source for Mariental municipality, Hardap irrigation scheme, and nearby communities (OCHA, 2006). Ephemeral rivers such as the Fish River (in Figure 3) sustain local inhabitants' livelihood, such that most domestic activities are located and dependent on the flood plain (Mbaiwa, 2004).

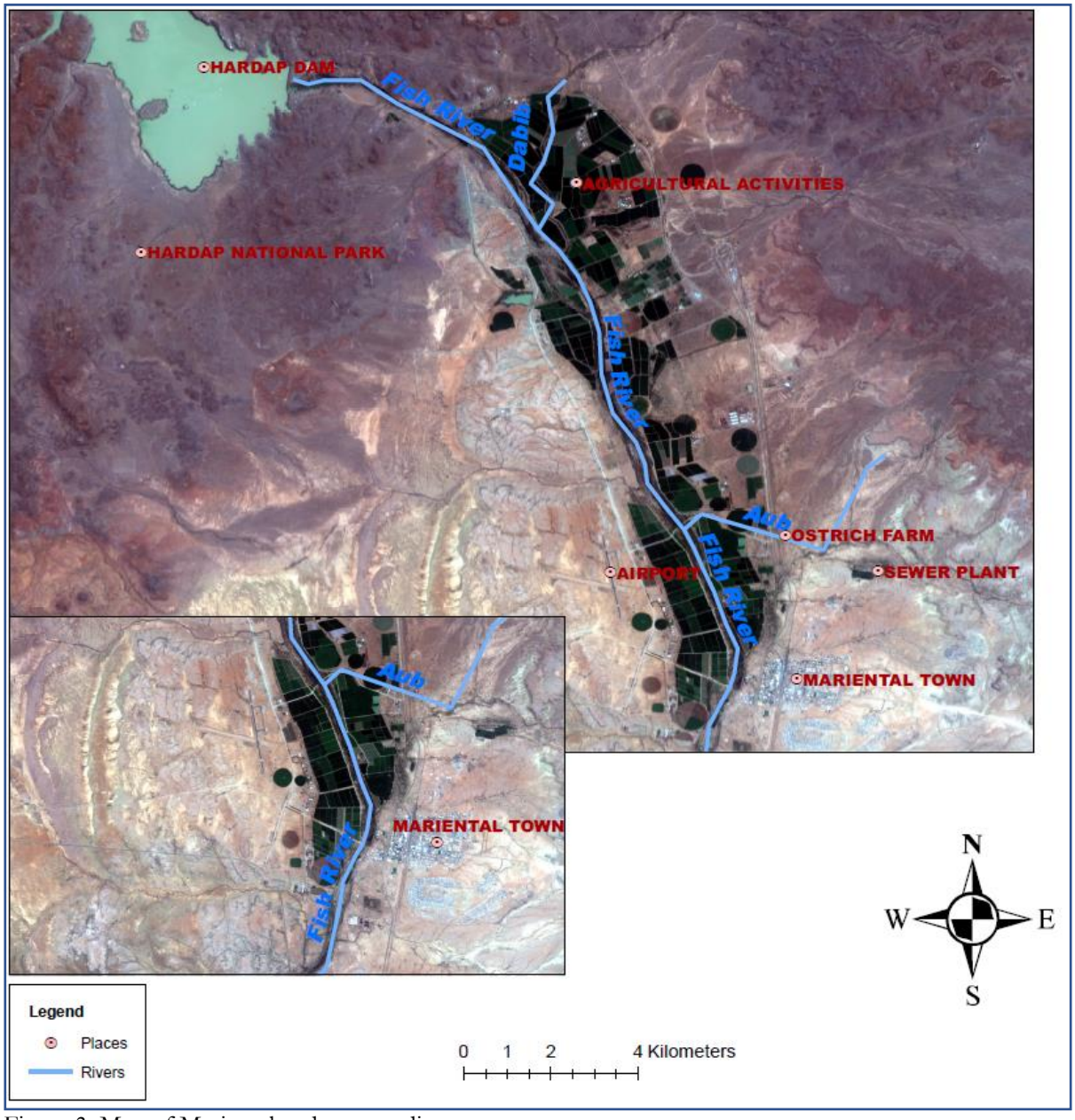

Figure 3: Map of Mariental and surrounding areas.

2.1. Mariental Climate

The southern part of Namibia is known for extreme weather conditions, both high and low temperatures as well as low rainfall. Mariental in particular receives rainfall of about 200mm per annum, which is below the national average of 300mm per annum. Due to climatic conditions, the Mariental area is only considered favourable to farm with game, sheep, and cattle although it is also known for producing grapes, cotton, and dairy product, which were made possible through the support of water supply from the Hardap dam (Mwinga et al., 2018).

The increased pressure to share water resources in semi-arid environments has triggers conflict among citizens, and water management organizations hence, what was termed as *Increasing Dependency* of human activities on alluvial fans in Namibia has now turned into absolute reliance (MAWRD, 2000). Flood plains are favorable for human activities, but most Namibian river basins experience water availability stress, due to low rainfall, and that includes the Fish River basin (Amakali & Shixwameni, 2003).

Farmers, abattoirs, and farmworkers suffer from severe agricultural drought and water shortages in dams/reservoirs due to prolonged dry seasons. Such that, farmers were unable to supply the Mariental Abattoir, and due to its high dependency on the farmers, the abattoir has since 2018 closed down. Some of the factors that contributed to the closing down of the abattoir are associated with economic losses and price hikes of small stocks. Consequently, an undisclosed number of workers in the abattoir and several farms have been laid off, creating another societal pressure in the community (Namibian Sun, 2020).

2.2 Mariental Water Supply: Hardap Dam

Hardap Dam was commissioned in 1962, to support irrigation schemes and the town of Mariental (Ministry of Agriculture Water and Forestry, 2007). With a carrying capacity of 294M cubic meters, Hardap Dam was the largest in Namibia until 2020 when Neckertar Dam was commissioned (Namibia Press Agency, 2020) The storage capacity of Hardap Dam has been lowered to 70%, and farmers dependant on it have since indicated dissatisfaction, wanting an increased carrying capacity for the dam. In contrast, residents and the Namibia Water Corporation, as the responsible authority, have supported the decision to keep the dam level at a reduced rate to prevent similar cases of 2006, which also led to insurers revoking their services in Mariental (Hugo, 2013). The decision to lower the dam's water level is to prevent both an overflow and an uncontrolled outflow when sluices are widely opened, in essence, the dam was not meant to stop flooding but mainly for the support of human activities within that area, and it has not been able to provide unlimited supply to both irrigation farmers and the Mariental town since the dam now operates at 70% carrying capacity (Namibia Press Agency, 2020).

2.3 Socio-economic profile of Mariental, Namibia

According to the report: *Economic Profile of Mariental (2018),* Mariental town came about as a railway stop in 1912 and was later proclaimed as a municipality in 1946. The National Census of 2011 reported a population of 12,478 and literacy rate at 94% higher than the national average of 89%. The Labour Force Survey of 2016 reported an unemployment rate of 46% (above the national average of 33%). In addition, Mariental is surrounded by commercial farms, that makeup about 16 % of the household income with the rest coming mainly from wages and pension.

The Namibia Water Cooperation provides water farmers with raw water (in bulk) for irrigation at N$18.34 within the first 1500 cubic meters and 18.59 for more. While purified water that is sold to Mariental municipality at 15.60 per cubic meter is then sold to the residents at an increased rate of 18.85 per cubic meter and to businesses or factories at 18.85 per cubic meter (Anne et al., 2015). Table 2 summarizes the statistics about Mariental as explained in this section.

Table 2: General statistics of Mariental

Variables	**Statistics**
Population	12, 478
Unemployment rate	46 (%)
Financial contribution by commercial farms	16 (%)
Financial contribution by wages, pension, and others	84 (%)
Average annual rainfall	200 mm
Water charges (per cubic meter)	N$ 18.34 for irrigation (first 1500 cubic meters), sold by Namibia Water Corporation
	N$ 18.54 for irrigation (more than 1500 cubic meters), sold by Namibia Water Corporation
	N$ 18.85 for domestic use (sold by the municipality)
	N$ 18.85 for business & factories (sold by the municipality)
	N$ 15.60 Namibia Water Cooperation rate for selling to the municipality
The permissible operational capacity of the Hardap Dam	70 %
Overall damages caused by the 2006 flood	N$ 100 Million

2.4 Water problems and related disasters in Mariental

In 2006, severe flooding occurred in Mariental; thus, the government has since raised concerns about flood risks in the future (Hugo, 2013). The flooding happened after heavy rain filled up Hardap Dam (HD) in the Fish River, about 20KM outside of Mariental (Cloete, 2015). Indeed, a cascading flood was subsequently triggered by increased water volume and power failure in the dam, which led to an overflow. The flood had a huge economic impact on Mariental with overall damage of about N$100 million (Milechin et al., 2009). Besides the 2006 torrent, similar flood events have been recorded in the Fish River catchment during 1923, 1934, 1974, (Cloete et al., 2018). The recent flood event in 2020 was also a nuisance to the town of Mariental; unlike the other flood events, it occurred as a cloud burst (Cloete, 2020), while other inflows might have originated from the side tributaries and not necessarily the Fish River.

After the 2006 flood event in Mariental, the Ministry of Agriculture Water and Forestry commissioned a task force that was aimed at advising the minister on the safety, upkeep, and rehabilitation of the Hardap Dam and the mitigation of future floods (Ministry of Agriculture Water and Forestry, 2007). *Flood Risk Reduction: Mariental and Hardap Irrigation Scheme Report* has since been compiled, stipulating possible causes and recommendations on what should be done to the dam, town, and Hardap Irrigation scheme. Besides the latter, an earlier gesture was proposed by the Hardap Farmers, although it was not recognized by the office of the prime minister, and the local authority (Hattingh et al., 2017).

Apart from floods, droughts are persistent hazards in Mariental (Figure 1). Agricultural droughts are the main concern for farmers and storage dams are built to mitigate the effects of drought on the area (Hattingh et al., 2017). Hence, the reduced carrying capacity of the Hardap Dam put Mariental in a tight situation in case of drought. In general, storage dams constructed before countries' independence were not designed to accommodate complete urban setups, but rather an alternative for white farmers during drought periods (Hellum, Ikdahl, & Kameri-Mbote, 2015).

Figure 4 shows an abstract representation of the water management approach and challenges in the case of Mariental, Namibia. As a semi-arid environment, Mariental is faced with floods and droughts challenges that affect the local community. The water authorities (ministry, parastatals, and municipality) in the area are the custodians and supply water to the users. The Mariental Flood Task Force was created to mitigate the effects of floods in the area; The task force has an advisory role regarding floods, including the management of a storage dam used to harvest and store water. However, the way in which the dam is operated has created tensions between different stakeholders (Amwaama, 2021). More details about the general water governance including the water resource management in Mariental are further described in Chapters Three & Four.

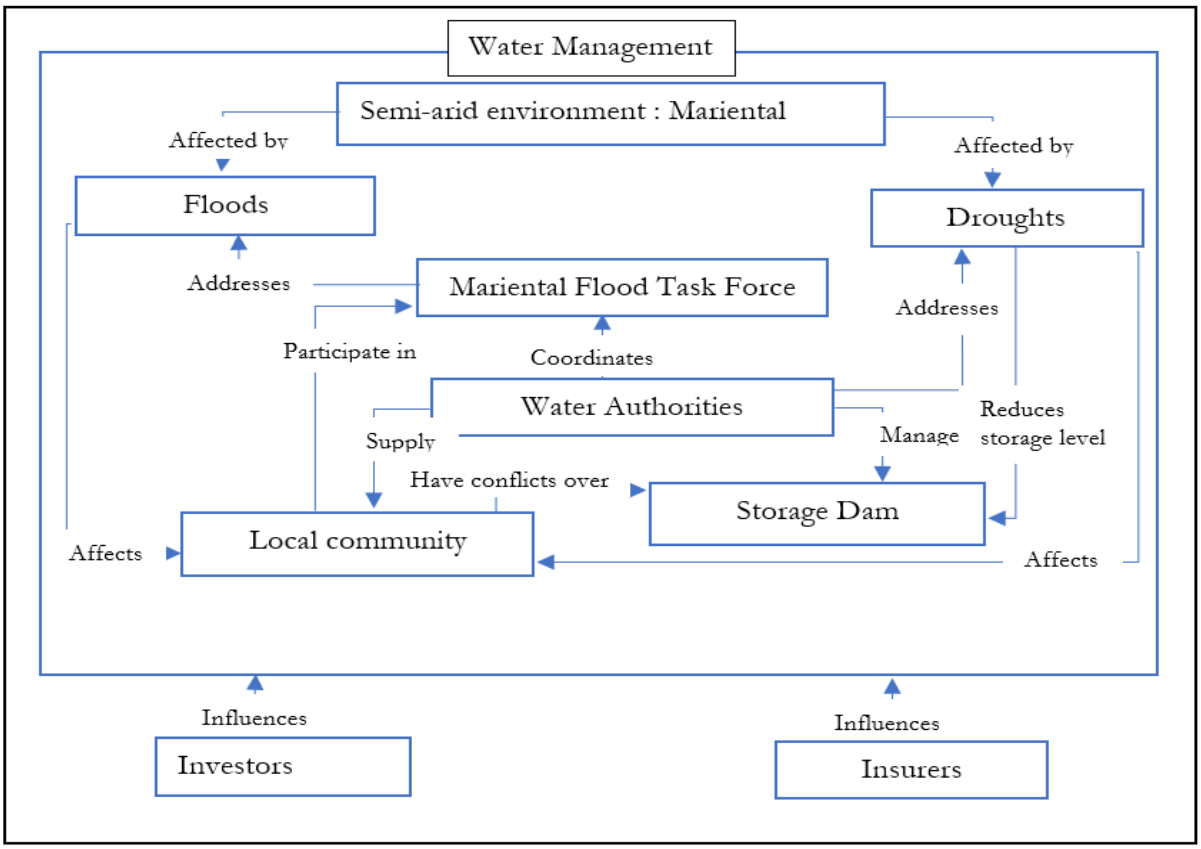

Figure 4: Abstract representation of the water management approach and challenges in Mariental

3. LITERATURE REVIEW

This chapter reflects on the existing pool of knowledge within the arena of water governance, in general, and as a case study. The chapter comprises five sections that explain the different water governance frameworks, community participation, and then building onto the water governance structure in Namibia. In addition, the concept of Area-Based Policy in planning, and handling spatially related problems are also explained. Greater emphasis was made on the Three Layer Model as the preferred framework for this study.

3.1 Water governance frameworks

Just like the word governance, there is no definite definition of water governance, however, scholars are attracted to governance because of its ability to incorporate all aspects of institutions, relationships, and associated procedures (Pierre & Peter, 2000). There are different water governance framework that seeks to explore the definition of inclusivity as it appears to when referring to governance, the shorter version of water governance concerning the framework can also be referred to as what is needed to give water its place in society (Hofstra, 2013). In the report " Water Governance, A Framework For Better Communication" Hofstra made a comparison of different frameworks used in water governance. The framework is explained as follow:

3.1.1 The OECD's multi-level governance framework

The multi-level governance framework is centered around seven "gaps analyzes". The gaps described in Table 3 act as reference points, guide and they are arranged in line with the Content, Institutional and Relational layers. The OECD Regional Development Committee adopted the OECD principle in 2015 and until 2019 the framework has received acknowledgment from about 34 member states as well as other stakeholders (Keller & Hartmann, 2019). The seven gaps are centered around the premise that there is no one-size-fits-all approach for good governance (OECD, 2015).

Table 3: Seven gaps used in the OECD multi-level governance framework, (adapted from Hofstra, 2013)

Gaps	**Description**
Policy Gap	Identifying success and failure in the established institutions, or fragmentation of water policies to build incentives and allow for cross-sectoral coordination.
Accountability Gap	Making sure that stakeholders' involvements are respected. And also, those decisions are made transparently, by enforcing the monitoring and evaluation approach.
Capacity Gap	To track down and assess the capabilities of human resources, as well as technologies required to successfully design and implement sustainable water policies.
Funding Gap	The funding gap tackles misallocation of funds that recognizes; underfunding or excess funding of responsibilities, but also projecting the sustainability of the allocated funds in the future.
Information Gap	This gap addresses the accessibility of water-related information; concentrating on the coherence, consistency, and reliability of the shared information for public consumption.

Administrative Gap	This gap concentrate on making sure that, administrative boundaries managing water resources are affordable and created at an efficient operational scale. Assessing the cost-benefits and also integrating with other factors involved in administration works.
Objective Gap	Realization of the objectives, in line with the goals, and making sure the set priorities are attended to, whilst acknowledging trade-offs for the coherence of water policies.

3.1.2 The Building Block framework

The Building Block framework has five key elements that are complementary to the OECD principles and gaps. (Havekes et al., 2016). The Building Block framework is developed by the Water Governance Centre (WGC) that also works with the WGC Academic Panel Assessment; aimed to explore the whole width of water governance, by identifying changes and actions needed to bring about good governance (Water Governance Centre, 2013). The five Building Blocks are summarized in Table 4.

Table 4: The five building blocks for good governance (adapted from Havekes et al., 2016)

Building Blocks	**Descriptions**
Administrative Organizations	Refers to powerful and well-established organizations of water management
Water Laws	A legally embedded system of water laws that controls and guide all activities regarding water resources
Financing System	Refer to the financial assurance, that provides an adequate financial system
Systematic Approach	A systematic approach indicates the what, when and how planning should take place
Stakeholder Participation	Refers to citizen and other actors involvement and the accountability of organizations to stakeholders' input

3.1.3 The Three Layer Model of water governance

The Three Layer Model is a common Dutch approach, which is a summary of the previous frameworks described earlier. Therefore, it is beneficial in a way that it aggregates the resemblances of the other frameworks, and is inclusive of their differences, making it comprehensive to analyze the composition of good water governance. The model is used as a checklist for good water governance, comprising of; content layer, institutional layer, and relational layer. (Hofstra, 2013) , a comparison of all three water governance frameworks discussed in this chapter is indicated in Table 5.

The content layer :
Symbolizes policymaking platforms and the approaches used to govern water resources; the water uses, and the capacity of the system to operate accountably and transparently.

The institutional layer:
Refers to the responsible organizations tasked to carry out water resources management: Including the human capital and financial capacity to carry out responsibilities. In addition, the institutional layer includes legislations, that define the scope of operation and organizational mandates.

Relational layer:
Refers to the set platforms that allow for communication between stakeholders, as well as sharing of knowledge and practices in water management. This layer also includes the process of promoting accountability in water governance.

Table 5: Shows a comparison of water governance frameworks (Hofstra, 2013)

	Three Layer Model	**OECD Multi-Level governance framework**	**Building Block**
Content layer	Clear policy	Policy	
	Knowledge and skills	Capacity	
	Information	Information	
Institutional layer	Organization	Administration	Administrative organization
	Legislation		Water law planning
	Financing	Funding	Financing system
Relational layer	Code and ethics	Objectives (motivational)	Stakeholder participation
	Communication and coordination	Accountability	
	Participation		

3.2 Community Participation in water governance

Participation and collaborative approaches are key elements to practice good water governance (Harrington, 2017). From the three water governance frameworks in Table 5, the OECD's multi-level governance has not indicated participation as it is with the Three Layer Model and the Building Block. Therefore not all water governance framework has included participation or value community's input in decision-making.

In a broader context, the aspects of community participation are reflected in the Sustainable Development Goals (SDGs) target 6.5 and 6.4 respectively; whereby, countries are encouraged to apply the Integrated Water Resources Management approaches and cooperate over transboundary water needs (United Nation, 2020). The Government of Namibia adopted the Decentralization Policy in Water Governance through the Decentralization Enabling Act, 2000 (Act No.33 of 2000) that, was enacted to promote and create a blueprint for the redistribution of power. The Enabling Act included access, implementation of community participation, while managements at grassroots levels (regions, constituencies, and local authorities) were mandated to take responsibilities in decision making for areas within their jurisdiction (Government of Republic of Namibia, 2001).

3.3 Water governance structure in Namibia

Water management in Namibia is structured according to the *Water Resource Management Act of 2013* (Act No. 11 of 2013). There are four levels: National, water basins, regional and local, and the Ministry of Agriculture, Water, and Forestry is responsible for legislation and governing of all water resources in Namibia (Figure 5). The minister appoints a Water Advisory Council, to provide advice on water safety management and governance. The Water Advisory Council is superior to the Basin Management Committee (BMC) and, oversees all basins in Namibia. BMCs were enacted through the Decentralization Policy to incorporate community participation at high governmental levels, and to deal with issues in the river basins (Government of Republic of Namibia, 2013). *Ministry of Agriculture, Water and Forestry is also referred to as the Ministry of Agriculture, Water, and Land Reform.*

The Namibia Water Corporation is a parastatal responsible for bulk water supply countrywide and collaborates with other actors such as Regional Councils, Local Authorities, and community representative bodies (Water Point Committee& Water Users Association). Both Water Point Committee (WPC) and Water Users Associations (WUA) are recognized in the Water Resources Management Act No. 11 of 2013. Thus, mandated to represent communities and deal with water point administrations, including water payments. In essence, water tariffs are not entirely dependent on the supplier as prices are controlled by the Water Regulator, appointed by the minister (Government of Republic of Namibia, 2013).

Despite having a well-defined water governance structure, the water sector has failed to capacitate the workforce as well as reflecting communities' input in decision making; hence the lack of hydrological experts and much still needs to be done to reflect transparency and accountability in water governance (Remmert, 2016). Like other countries, Namibia collaborates and is a signatory to international policies such as the Dublin Summit held in 1992 and has since shaped its water governance and approaches accordingly. Indeed, the national government drafted a *White Paper* in 2000 as a roadmap for water governance in an independent Namibia (MAWRD, 2000).

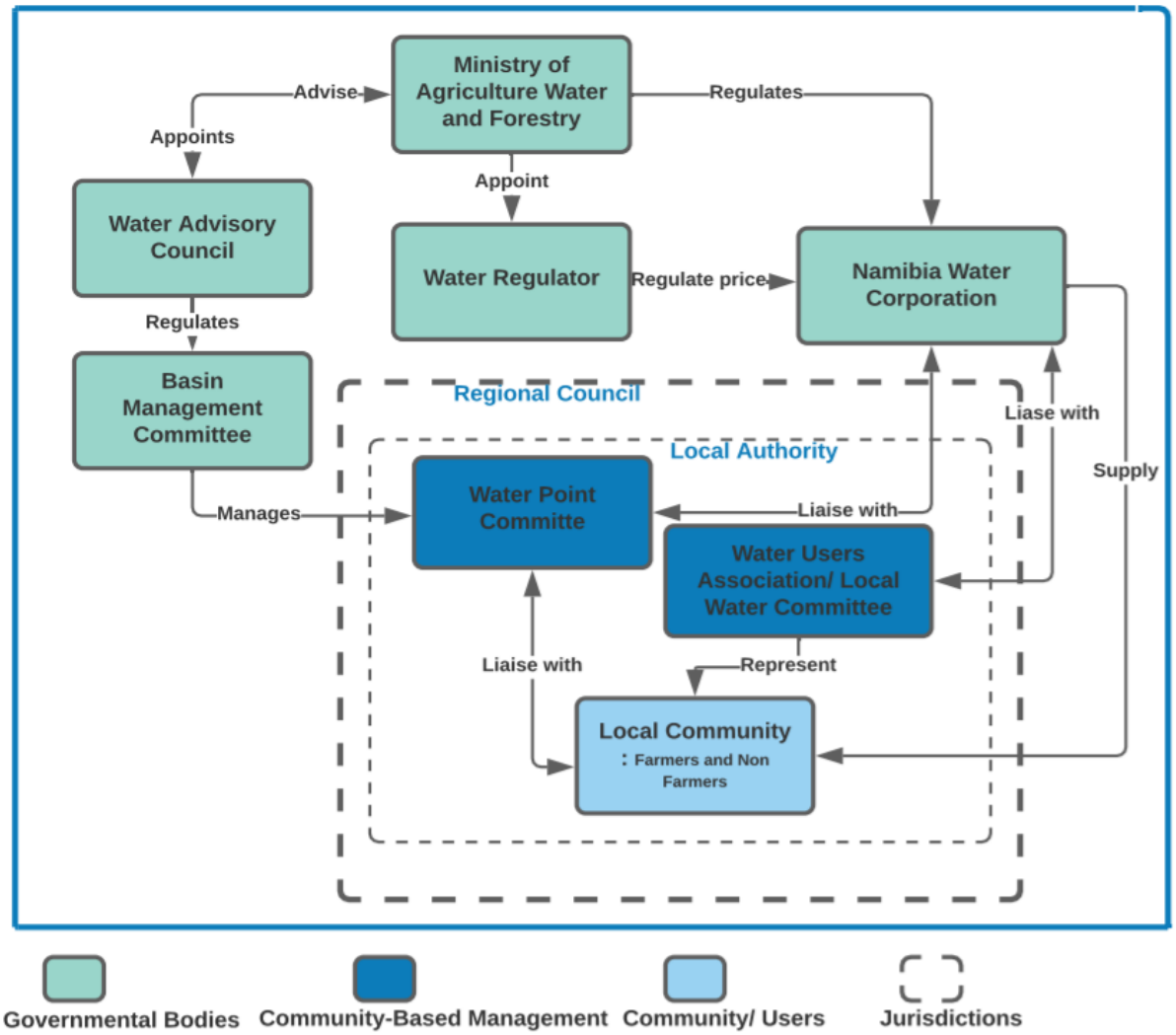

Figure 5: Relation between water governance bodies in Namibia (constructed from Government of Republic of Namibia, 2013; MAWRD, 2000).

3.3.1 National Water Policy of Namibia (*White Paper*)

The White paper was one of the first steps taken by the national government in 2000, as a blueprint of water governance from pre-independence into post-independence, which included paving ways to replace the then *Water Management Act of 1956* with a new Bill. It recognizes that some problems were inherently passed on from the apartheid era; thus, there was a need to reform. A policy framework was established through the White paper, which is based on equity, efficiency, and sustainable water resource management.

The policy framework also broadly highlights the importance of integrated management that allows all Namibians to participate, stimulating dialogue between actors and a good working relationship between private and public entities in water governance. The latter was aimed at encouraging political will, and support for good cooperation with riparian neighbors. It also acknowledged the importance of water as a fragile natural resource, thus strongly emphasized the need for water security, maintaining and developing of water infrastructure to include the rapid increase of water use. The White Paper suggested maintaining sustainable water supplies in rural and urban areas since about 90% of the country is classified as arid or sub-arid.

As a summary the, following topics were discussed in the *National Water Policy of Namibia (2000)*:

- Guiding principles of water policy,
- Institutions and community participation,
- Institutional capacity building and human resources
- Legislative and regulatory framework
- Economic and financial implications

3.4 Legislation and policies in water governance of Namibia

The decentralization policy is meant to empower regional and local authorities in terms of financial strength and decision-making in Water Management (Helmsing, 2002). However, as it is with many developing countries, laws are hardly implemented in reality; hence it is sometimes not reflected in practice (Heyns, 2004). Besides the efforts made to adapt the Decentralization Policy, both regional councils and local authorities still depend on the national government to make decisions and support water management (IWRM Plan Joint Venture Namibia, 2010). Details about the listed documents are presented in 4.3, as part of the methods used for qualitative data analysis.

Legislations and official documents considered in this study include:

- National Water Policy of Namibia (2000)
- Integrated Water Resource Management Plan for Namibia 2010
- National Climate Change Strategy and Action Plan 2013 – 2020
- Ministry of Agriculture Water and Forestry; Strategic Plan 2017/18 -2021/22
- Mariental Town Planning Scheme
- Flood Risk Reduction: Mariental Town and Hardap Irrigation Scheme report 2006
- Water Management Act of 1956
- Decentralization Enabling Act, 2000 (Act No 33 of 2000)

3.5 Financial aspects of water governance in Namibia

The national government provides funds to the relevant institutions and controls prices through the Water Regulators (Government of Republic of Namibia, 2013). Moreover, it is highlighted in the *White Paper* that:

- Tariff settings should consider environmental degradation and opportunity costs during tariff policy negotiations.
- Tariffs should consider affordability in the sense of minimum wage, balancing equity with efficiency, in competing for water use.
- All community members' rights to be supplied with a minimum quantity of water for production and domestic use.

3.6 Relation of Spatial planning and water governance in Namibia

The Namibian government uses the Town Planning Ordinance of 1958 to govern all establishments and spatial aspects within the regional or local authorities' jurisdiction (Republic of Namibia, 1960). The ordinance gives direction for planning in terms of development and water management. Hence, some spatial aspects of water management in Mariental operate through the guidance of a Town Planning

Scheme and a Master Plan. The latter includes Area-Based Policies or activities undertaken by the Mariental Flood Task Force and Hardap Emergency Team.

Area-Based Policy (ABP) is a concept in spatial planning used to mitigate problems in a defined geographical area, through an integrated approach by bringing together the relevant actors, to share knowledge and practices on overarching issues as well as setting policies. Another definition refers to ABP as a network-like or network society that is a continuum of postmodernity in the western environment, for public and private entities to work together in a society (De Rynck & Voets, 2006). The primary objective of ABP is to support generic policy through networking. Until 1980, ABP has recorded a relatively low implementation level in some areas, such as environmental policymaking (Padt, 2007).

The *White Paper* by the Ministry of Agriculture Water and Forestry indicated that there is a need to break the stigma of apartheid in water governance, to pave ways for new policies that will guide water management. Hence, the ABP implementation heavily depends on the national government's financial and political will (Clemnsius, 2005). Like with most developing countries, implementing policy is one thing, practicing accordingly is another thing, although the dilemmas could be improved (Heyns, 2004). The water sector in Namibia is constrained by a lack of experts and minimal interest in community participation in water management. For example, besides the Water Point Committee being administrators, local participants are left out due to a lack of finance and coordination. As a result, the spatial aspect served by ABP in water governance has failed and needs to be revived to genuinely redistribute power, promote transparency and accountability in existing structures (Hegga et al., 2020).

3.7 Illustration of Area-Based Policy in Namibia

The Area-Based Policy concept is not commonly used in Namibia. However, it complements the idea of Decentralization and Community-Based Management of water management in Namibia (Hegga et al., 2020), hence its use in this study. Below are some of the existing concepts and policies used in water management that can be linked to ABP.

3.7.2 Decentralization Enabling Act (Act No. 33 of 2000)

Decentralization in this act means devolution of power and administrative functions from national government ministries to lower-level structures such as the regional council and local authorities. This act made provision and encourages the establishment of bodies or organizations at lower governmental levels to address specific issues in a defined geographic area and involving communities in the decision-making processes (Government of Republic of Namibia, 2001).

3.7.1 Community-Based Management (CBM)

The CBM was introduced from the Community Based Natural Resource Management (CBNRM) to fit Namibia's water management aspect, by involving communities in water administration at local levels (Remmert, 2016). The approach is such that local communities will have control over water resources, and access funds to develop and maintain infrastructure in their vicinity. Therefore, using the CBM approach and the Decentralization Enabling Act, the Basin Management Committee was established (MAWRD, 2000).

3.8 Coherence of Area-Based Policy with other legislations

There are different legislations considered in this study, as mentioned earlier in section 3.5. The White Paper referred to in this study indicates that, even though Namibia is a signatory to international policies. It did not agree with border countries on the use of the Fish River that it shares with South Africa (MAWRD, 2000) until July 2020 when a new commission was formed.

The delay in compliance contradicts Namibia's obligation to both the Southern Africa Development Commission (SADC) on the shared watercourse, as well as the Dublin Rio Principle (ICWE, 1992), and the United Nations Convention on the Law of Non-Navigational Uses of International Watercourses (United Nations, 1997). An effort is developing to remedy riparian issues including the Fish River, addressed via the Orange-Senqu River Commission (ORASECOM); a commission agreed upon between Namibia, Botswana, Lesotho, and South Africa (ORASECOM, 2021). There are different legislations considered in this study, as mentioned earlier in section 3.5. The White Paper referred to in this study indicates that, even though Namibia is a signatory to international policies. It did not agree with border countries on the use of the Fish River that it shares with South Africa (MAWRD, 2000) until July 2020 when a new commission was formed.

3.9 Importance of a clear water governance framework and ways to implement it

The Stockholm International Water Institute describes water governance as the solution to increasing pressure on water resources, which could lead to challenges in implementing water policies if effective frameworks are not in place (Stockholm International Water Institute, 2018). The importance of a well-structured water governance framework does not only depend on its functionality but also its ability to accommodate dynamic characteristics such as socio-economic and the quality of administration, therefore a framework must be inclusive to achieve the intended goals (Solanes & Jouravlev, 2006). Water governance frameworks such as the OECD's Multi-level governance framework and the Building Blocks are structured in a way that promotes and enhances effectiveness, efficiency, trust, and participation among different actors involved in water governance (OECD, 2021).

That is why water governance frameworks must be clear, inclusive, and appropriate. Newer frameworks such as the Three Layer Model of water governance emulates the concepts discussed earlier, taking a bold decision of aggregating older frameworks; merging the similarities, whilst taking into account the differences (Hofstra, 2013). In conclusion, the water governance framework should be clear, effective, and inclusive to serve the intended purpose, then the challenges of implementing water policies can be reduced.

4. METHODOLOGY

The methodology chapter explains the water governance framework and the different methods used to realize the main objective through the four sub-objectives explained in chapter one. In addition, it adds to the literature review and discussion of the Three Layer Model, which is an introductory guide for this study. The study is focused on a case study of Mariental in Namibia, discussed in this chapter. The conceptual mapping approach, as mentioned earlier, is one of the approaches discussed in this chapter; to analyze qualitative data, preceded by the sampling method and data collection process in Mariental.

4.1 Data collection

The data was collected from stakeholders in Mariental and surrounding areas around Hardap Dam. There were two target groups: 1. Community members: Mariental residents and those around Mariental, such as farmers residing in the alluvial fan, below Hardap Dam. 2. Organizations and committees: water authorities & committees, insurance companies, farmer's unions/representatives, municipality, meteorological services, and national government ministries. Data was collected during the global pandemic of COVID-19; hence, the researcher could not travel to Namibia but coordinated the data collection process from the Netherland and also did several online interviews with some stakeholders. Two local assistant researchers were hired to carry out part of the data collection process, mainly targeting stakeholders that could not be reached remotely. Therefore, data collection was done in two ways; physical interviews by assistant researchers, online interviews mainly for organizations, and online questionnaires using Maptionnaire.

Both interviews and online questionnaires were promoted via national radio media platforms, water authorities, and posters at crucial areas in Mariental (Appendix 13). As a result, 209 responses were recorded, of which 202 responses were received from community members, and seven were received from organizations involved in water governance. The collected data were analyzed in Maptionnaire for graphical representation and ATLAS.ti, a software that provides a platform to analyze qualitative data. All seven (7) officials and 197 of the 202 community members filled in open-ended questions, that were analyzed in ATLAS.ti. In this study, the conceptual mapping approach is adapted, highlighting keywords relevant to research and in conjunction with the research questions.

Limitations: According to the communication with Mariental municipality and Namibia Statistics agency, Mariental, is still in the process of demarcating suburbs, and parcels, thus no GIS data are available. The Mariental Scheme Index Map (Mariental Municipality, 2011) was used to provide the names of suburbs in the questionnaire. Respondents' coordinates were not recorded, because of privacy issues and the sensitivity of the topic in Mariental. Therefore, to give a spatial component, respondents were asked to indicate the suburbs in which they live.

4.1.1 Link between the different forms of questions used in the study

Three different forms of questions were used for this study (predefined, research, and questionnaire) as indicated in Figure 6. The predefined questions in the Three-Layer Model guided the construction of four sub-objectives, relevant to realize the main objective as indicated in 1.5. Each sub-objective has different research questions which form the basis of questionnaires for the two stakeholder groups.

The layout of the questionnaires was according to the structure of the framework, preceded by general questions which were aimed at providing background information of the respondents. The sub-objectives and research questions are addressed in the results chapter.

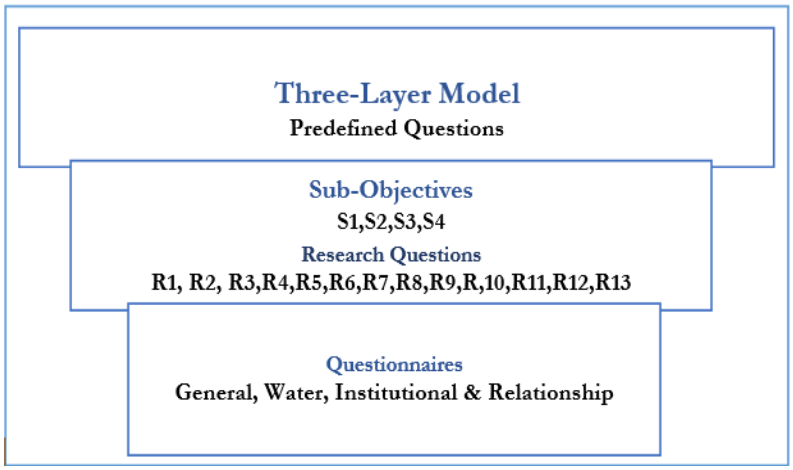

Figure 6: General overview of the different types of questions used in the study (own construct)

4.1.2 Description of Questionnaires

Each stakeholder group had a specific questionnaire (in the same context) that was deemed relevant for the respondents in terms of knowledge, the ability to answer questions but also providing reliable information concerning the sub-objectives. All questionnaires were embedded with a privacy policy, which detailed out the rights of the respondents and the researcher during and after data collection. The composition of the questionnaires was as follows:

General questions
This section comprises questions about the general overview of the respondents, as an introduction to understanding aspects of water governance including associations, literacy level, gender, and water use.

Water Issues
This section was equated to the content layer in the Three-Layer Model of water governance. It comprised of questions about water policies and how they relate to community participation. The section also addressed issues of respondents' capacity to effectively participate (skills and knowledge) in the relevant bodies. Open-ended questions provided space for the respondent to extend and support their choices of answers or comment on general issues related to water governance in Mariental (same for all the sections).

Institutional Issues
This section equated to the institutional layer, and the questions addressed sub-objective one. In answering the questions, it dealt with understanding of stakeholders' rights and objectives as well as the different challenges or factors that transpire among individuals or between organizations. In addition, this section is also comprised of questions on water administrations and financing of community participation in water governance.

Relationship between water stakeholders

The fourth and last section of the questionnaires was equated to the relational layer. Aligned with sub-objectives two and three. The questions were aimed at addressing issues of community participation, in terms of relationships among individuals and between stakeholders as well as the value of participation in water governance. The communication aspects were also addressed in this section, specifically, the different forms of communication used and the effectiveness of existing platforms meant for the community to reach relevant authorities.

4.1.2 Sampling Method

A stratified sampling method was used to be inclusive and representative of the groups within the population of Mariental. Four different strata shown in Figure 7 were chosen and made it possible to reach different population settings; classes, and land use. The allocation of days for data collection was guided by the size of the strata and its population. Although this sampling method was only applicable to physical interviews and not the online questionnaires. The reason behind strata was to make sure all target groups are reached but, also considering the spatial properties and composition of the study area, which is later used in assessing how the community participates in Mariental water governance. The spatial data used for strata were obtained from the Namibia Statistic Agency, hence the classification of strata is based on the census mapping classes defined for the Mariental constituency.

The sampling method provided the basis for collecting data, even though some alterations had to be made such that some strata took more time than the allocated one. Some respondents opted to take the questionnaires, and fill them in the next day or so while others instructed the assistant researchers to come back when they are free, which resulted in extra time and resources to pick up outstanding questionnaires or return for scheduled interviews. In general, the data collection process was delayed by two more days, to allow for the collection of outstanding questionnaires and pending interviews.

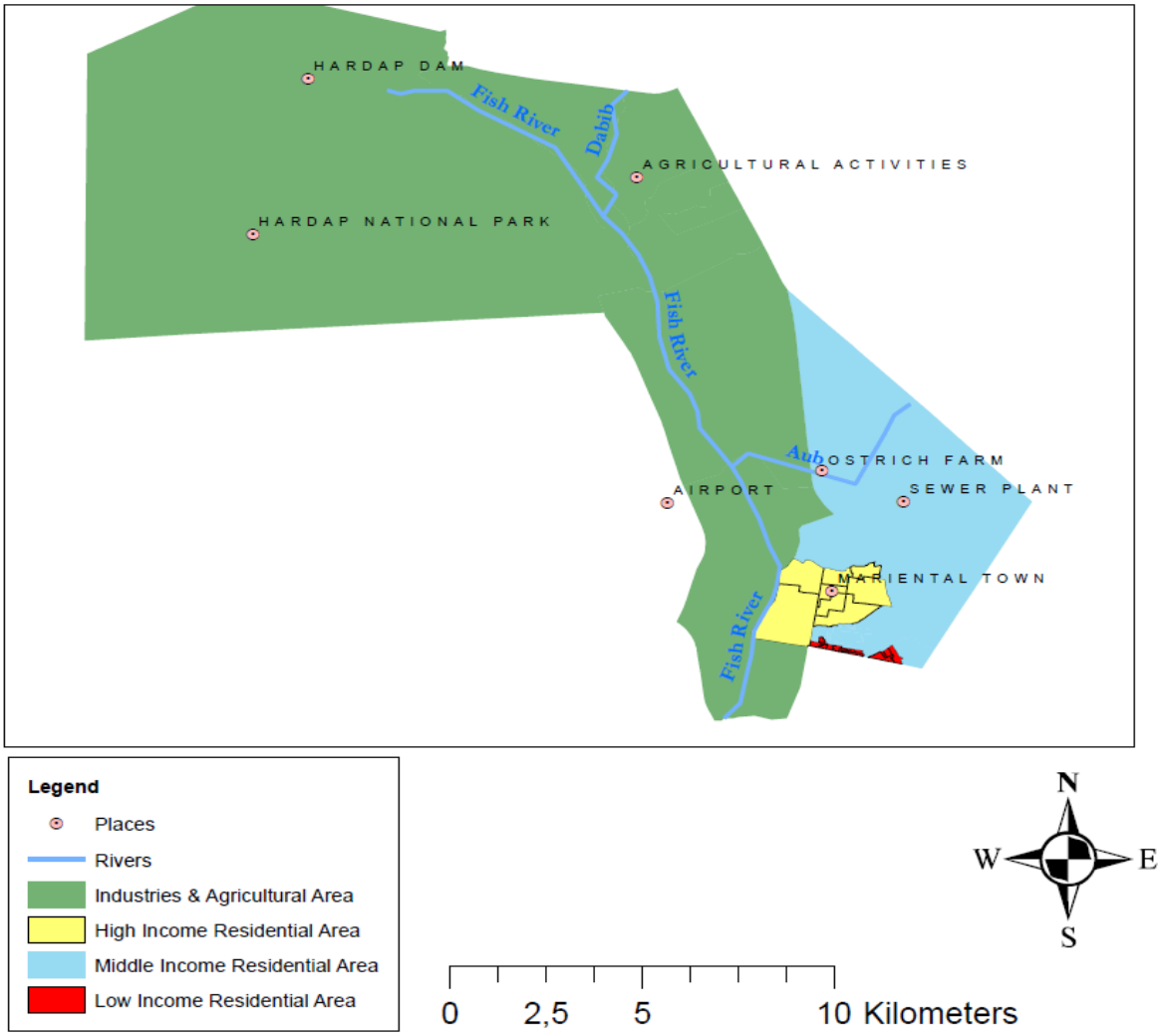

Figure 7: Strata used to guide the sampling process (own construct)

4.1.3 Description of the data collection processes

The combined sum of respondents reached by the two assistant researchers (in Table 6) and online questionnaires was 202. Seven (7) responses were collected by the main researcher from respondents working for different organizations or committees involved in water governance. The researcher had to make an appointment to interview the officials and questionnaires were filled in with a shared screen or by the researcher, directly on a hard copy as the respondent answers the questions. Other activities involved in data collection included advertising and engaging the community on social media platforms (Facebook and Instagram). Thirty posters (Appendix 12) were placed around Mariental and surrounding areas, in addition to the radio adverts on three national radio stations; encouraging people to be receptive to the assistant researchers and to fill in the online questionnaires.

Validation for the data collection process was done by the researcher, whereby assistant researchers had to report at 08H00 when going in the field, 12H00 before lunch to update on the progress, and at 17H00 for the daily update as well as sending pictures while performing the duties (Appendix 13). There was frequent communication with the assistants and, in some cases, the researcher had to explain in detail, over the phone to the respondents mainly for validation purposes. About seven (7) respondents wanted to hear directly from the main researcher, why assistant researchers were hired, and the aim of the study. There were some days where the assistant researchers had to go beyond 17H00 because respondents

could not be reached during the normal working hours, which indeed helped to reach respondents from all strata. Overall, the assistant researchers were fit for the job and their dynamic characters helped in making sure the study received substantial responses from the target groups. The applicability of the two assistant researchers to this study was considered essential for the success of data collection in Mariental.

Table 6: Descriptions of assistant researchers and responses from the two target groups

Assistant Researchers	**Applicability and credentials for data collection**	**Interviews conducted**
Mr. Reginald Elsie	Community activist Resident of Mariental Speaks all local languages: English, Afrikaans, and Damara-Nama Drivers license Experience in community engagement and data collection	160/209 by the assistant researchers 42/209 from online questionnaires 7/209 by the main researchers
Mr. Frans Nekongo	BSc Geo-Information Technology holder Working knowledge of National Spatial Data Infrastructure (NSDI), data collection, and data privacy Speaks local languages: English and Afrikaans	
Total interviews received		**209**

4.2 Conceptual Mapping of Qualitative Data

This conceptual mapping approach is to analyze qualitative data in ATLAS.ti. The data analysis includes transcribed interviews and responses from questionnaires. ATLAS.ti provides a platform to create and map practical concepts (Codes) that can be further analyzed to interpret the content of individuals or collective responses (referred to as quotations). Therefore, codes were created in line with the sub-objectives; to represent critical aspects of the studies, such as participation or financing of community participation. However, the codes are classified hierarchically such that; Code depicts the Associated Concept, whereas the assigned code (sub-code) defines the nature or meaning of the quotation (responses from respondents). Furthermore, this study's citation for respondents/ quotations uses the word "CMC_Number" for community respondents and "OCC_Number" for organizations and committees. The first three letters indicate the target group while the number refers to the *Case Number;* that is, the location/path of that respective quotation in the primary dataset.

Predefined concepts (Associated Concepts) were derived according to the Three Layer Model as shown in Figure 8. Different codes were created in ATLAS.ti to define the quotations/ responses linked to each of the related concepts and realize new concepts not previously defined. More details about the different concepts and codes are explained in the results chapter and also in the CodeBooks (Appendices 8&9).

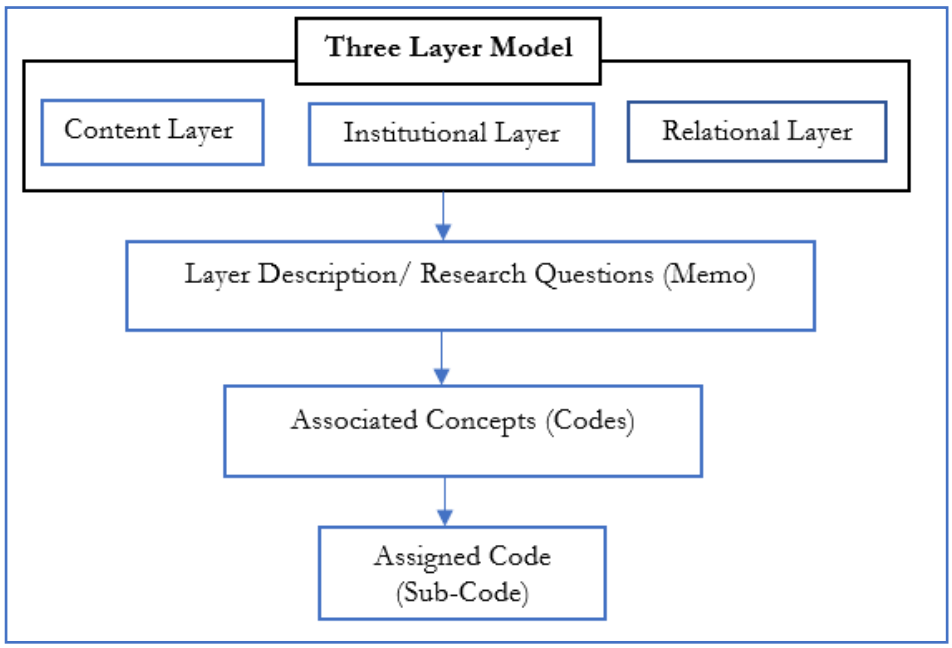

Figure 8: Conceptual overview to map qualitative data (own construct)

4.2.1 Example of the analysis in ATLAS.ti

ATLAS.ti provided an environment to analyze qualitative data that was imported as a survey document (CSV). The software supports different data types such as CSV, PDF, Word, and Picture formats. Moreover, the general procedure of working in ATLAS.ti (Figure 9) required identification of texts (quotations) that appeared in the documents; the quotations were assigned a code(s) that described the text; different codes could be linked to a single quotation referred to as Grounded. Whereas, the number of intra-linkages (description) between code groups (associated concept) and sub-codes (assigned code) is referred to as Density; descriptions of concepts and research questions presented in the document could be linked to the codes using the Memo function.

Summary of all functions (*concepts, assigned codes, quotations, and memos)* could be presented in an automated project report or by creating a network: a semantic representation of the relationships. Further descriptions of ATLAS.ti functions used in this study are indicated in Appendix 7. Concepts and codes referred to in this document are written in italic.

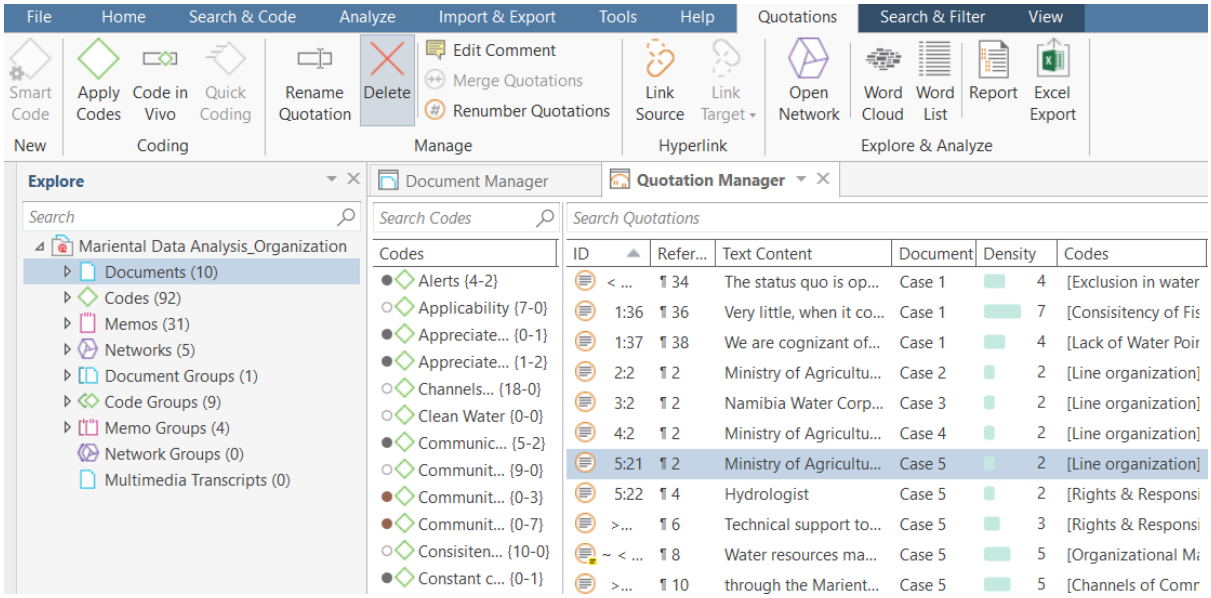

Figure 9: Example of a project workspace in ATLAS.ti (own construct)

4.3 Analyzing official documents

The study involved analyzing official documents which is an extension of the literature review, more specific and only covering content about Mariental water governance. This method was related to the content layer; assessing the content of water policies and reports in terms of community participation and water governance in general. Some documents were received directly from organizations and others from the relevant websites. Information received from these documents was not analyzed in ATLAS.ti like the responses from the two target groups. However, it was used to support and validate arguments made in this study. Official documents seen and used included but were not limited to:

***National Water Policy (White Paper)* as explained in 3.3.1**

***Decentralization Enabling Act, 2000 (Act No.33 of 2000)* explained in 3.7.2**

Flood Risk Reduction: Mariental Town and Hardap Irrigation Scheme Report
The report was made in response to the 2006 flood event in Mariental through a commission called Mariental Flood Task Force. The role of the task force was to assess flood damages and provide guidance on how to mitigate the effects of flooding in Mariental and surrounding areas. Also, to educate the community by creating awareness (Ministry of Agriculture Water and Forestry, 2007).

Integrated Water Resource Management Plan for Namibia 2010
This plan was created with an overall objective to lead and move the country toward sustainable water resource management, with a specific focus on social equity, economic efficiency, and environmental sustainability (IWRM Plan Joint Venture Namibia, 2010). *Still in use until a new one is drafted*

Groundwater Monitoring in the Orange-Fish River Basin Namibia: Recommendation Toward a Monitoring System
This document was prepared IN 2010 by EAW Tordiffe in collaboration with the Desert Research Foundation of Namibia (DNRF). The document came about as an output of a joint effort, among other

objectives to strategize on shared watercourses and promotion of IWRM between Boteti River Basin in Botswana, Buffalo River Basin in South Africa, and Fish River Basin in Namibia (Tordiffe, 2010).

Mariental Town Planning Scheme

The document was prepared by Stubenraunch Planning Consultant for Mariental Municipality in 2012 and was approved by parliament in November 2015. This amendment scheme was made in accordance with Section 26(2) of the Town Planning Ordinance, 1956 (Ordinance No.18 of 1956), to guide and regulate planning activities within the boundary of Mariental (Mariental Municipality, 2012).

Water Management Act (Act No.11 of 2013)

This Act was passed by parliament on the 19th December 2013 to serve as a national guide for water resource management in Namibia. The act made provision for the establishment of the Water Advisory Council, Water Regulator, and Basin Management Committee (in Figure 5), and also the first water act passed after independence to replace the old *Water Management Act of 1956* (Government of Republic of Namibia, 2013).

National Climate Change Strategy & Action Plan 2013 – 2020

This was a national document initiated in 2011 and finalized in 2013 for the sole purpose of addressing the impact of climate change, through adaptation strategies and creation of mitigating interventions that were meant to guide and provide a baseline of operation at a national level (Ministry of Environment and Tourism, 2015).

Ministry of Agriculture, Water, and Forestry: Strategic Plan 2017/18 – 2021/22

This serves as a ministerial plan, articulated to guide the implementation of developmental projects, to address the needs and values of relevant stakeholders. Consultations have been made at both regional and local authorities which provided input used to draft the plan. Also, the plan was made in support of the national Harambee Prosperity Plan (HPP) which is geared toward achieving the long-term objective, to overcome water and agricultural challenges as per the country's Vision 2030 (MAWAF strategic plan, 2017). *All these documents are reflected in the result and discussion chapters, and building onto the conclusion*

4.4 Ethical Consideration

This study observes and applies the concept of Kantian ethics, which is widely used in the European context and accepted by the University of Twente. The philosophy behind the Kantian concept is based on always recognizing and respect for human dignity (Westacott, 2019). The Kantian concept was applied during and after data collection, whereby respondents have to consent to process any data that can trace back to individuals as personal data. A Data Privacy declaration was presented to respondents for online questionnaires and conducted interviews. Organizations that provided official documents or participated were presented with a letter from the University of Twente, signed by the main supervisor for credibility and commitment of data protection (Appendix 6). The Namibia Water Corporation had requested that a non-disclosure form (Appendix 5) must be filled in: the documents (Water Management Act of 2013 and the IWRM Plan of 2010) and information provided by their organization shall only be used within the university domains for academic purposes. Overall, this study observed the data privacy protection processes during data analysis and archiving of research datasets through the university's repository.

5. RESULTS

The results chapter indicates the outcomes of the different methods used in this study to realize the main objective through the four sub-objectives adopted in this study. The outline of this chapter comprises the background information on the respondents and the four sub-objectives, with sub-sections of the associated research questions.

5.1 Background information on respondents

Four responses were received from the Ministry of Agriculture Water and Land Reform, the highest national body in the water governance structure. Two other responses were received from Namibia Water Corporation, a parastatal mandated to manage and maintain water resources in Namibia. The other organizations availed each one representative except for the Basin Management Committee, Water Point Committee, and Water Users Association that are dormant while the Hardap Famers Union which represents large scale farmers in Mariental declined to participate in the study. From the data collection, it was learned that there were three other organizations, the Hardap Green Scheme, Hardap Emergency Team, and Orange-Senqu River Commission, details of these three organizations are explained in the next section. Figure 10 shows the association of respondents from organizations identified before the data collection process.

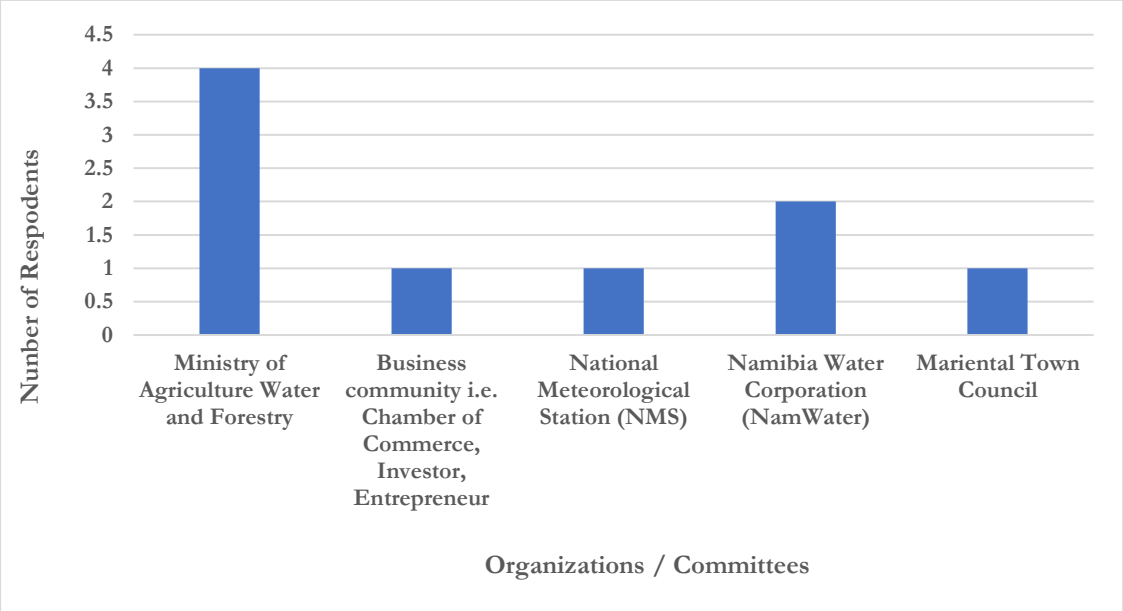

Figure 10: Association of respondents from different water governance organizations (own construct)

The number of responses received from community members is shown in Figure 11 together with their respective locality. Mariental Proper part of the high-income suburbs and Aimablagte in the middle-income suburbs recorded the highest turnout, according to the research assistant who is also a member of the Mariental community; these two suburbs are some of the oldest and prominent residential areas that host most residents in Mariental. A sizeable number of responses were recorded from Empelheim proper (low Income), Mariental Extension 1(high income), and Hardap (Agricultural site). An undisclosed number of respondents indicated that they live in Mariental and have agricultural activities in Hardap along the Fish River.

In summary, high-income residentials had a collective majority of respondents, while industries and agriculture recorded the least, these could be influenced by the number of suburbs and population size in comparison to other strata. Figure 11 can be linked to Figure 6 for the location of the different strata and not the suburbs as there are no spatial data available. The Mariental Scheme Index Map is a drawing for the envisaged plan and layout of Mariental that was drawn as part of the Town Planning Scheme (Mariental Municipality, 2011), different suburbs shown were used as a reference to connect suburbs and strata.

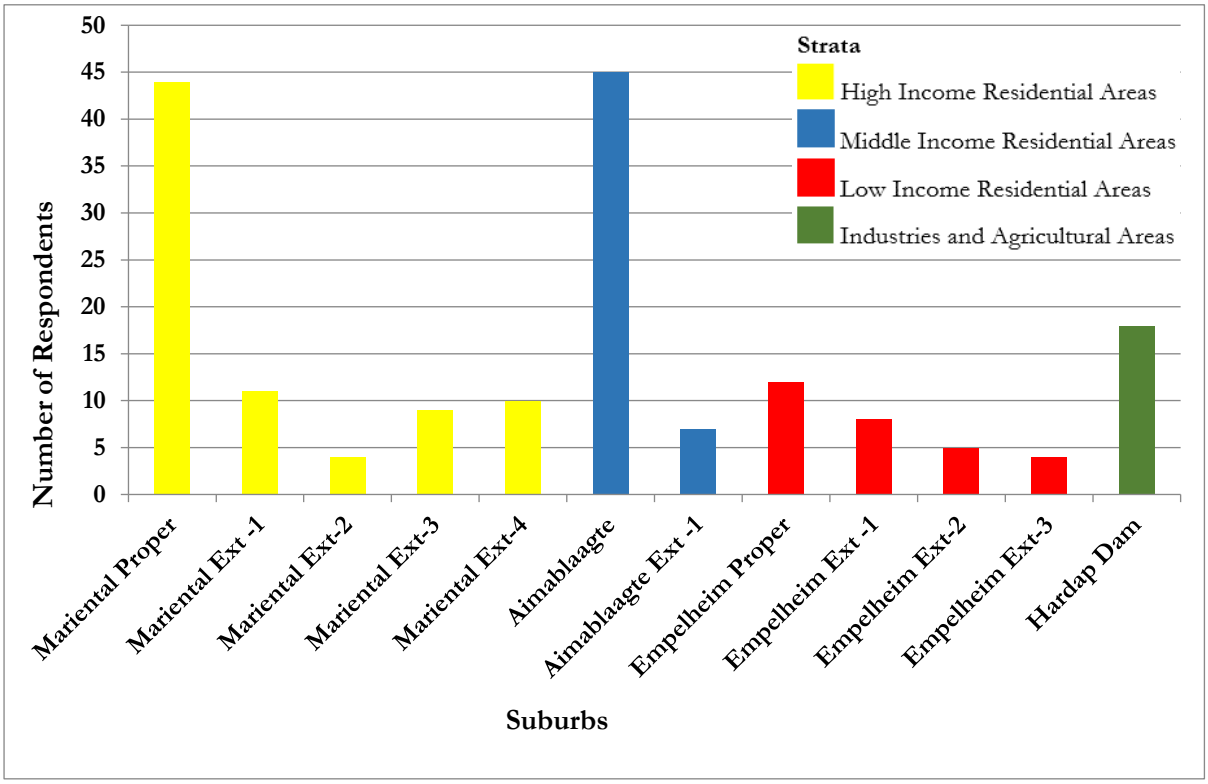

Figure 11: Responses from each sampling strata based on the suburbs in Mariental (own construct)

5.1.1 Water Use within community respondents

Table 7 shows water use for the different community respondents. A total of 189 respondents indicated water usage for domestic/household activities making it the highest water consumption among others. Water use for agricultural purposes had the second-highest number with 13 respondents whereas commercial and industrial water use both recorded less than 10 respondents. The number of respondents per water use category in this study does not indicate the amount of water used. A representative from the Hardap Green Scheme indicated that the agricultural activities in Hardap used an unquantified amount of water which is more than any other sector supplied by the Hardap Dam.

Table 7: Response of community members per category of water use in Mariental (own construct)

	Domestic Use/ Household	**Agriculture**	**Industrial**	**Commercial**
Respondents	182	13	2	6

5.1.2 Communication skills and ability to fit in an inclusive water governance

While it is crucial to have inclusive, integrated water governance, respondents from two organizations in water governance indicated that most employees are too technical and thus lack the governance aspect. In general, there is a need for more experienced water experts who will be able to guide and interact with community members in policymaking as they currently work in silos (OCC_3&7). Five (5) of seven(7) respondents in Figure 12 indicated that organizations do not have enough or necessary experts in water governance, necessary for communication with other stakeholders.

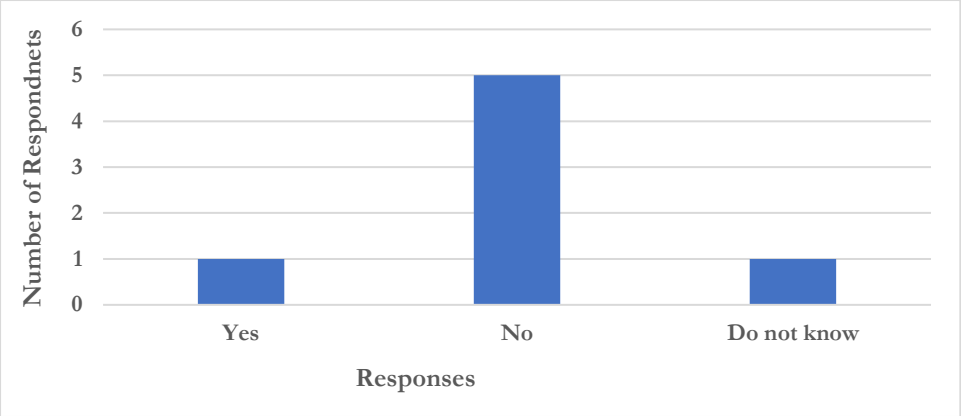

Figure 12: Officials' views on whether organizations have enough water governance experts (own construct)

Community respondents showed interest and willingness to participate in water governance and at least 96 % had acquired basic secondary education which could be considered necessary for communication skills. More than half of the respondents also indicated that the community needs training for their participants in water governance, to enhance their communication skills while about 40 % indicated the need to do more community participation sessions and to provide accessible information on water governance (Figure 13). Overall, both stakeholder groups are not fit for inclusive water governance, due to the lack of experts organizations and the need to improve communication skills for community members

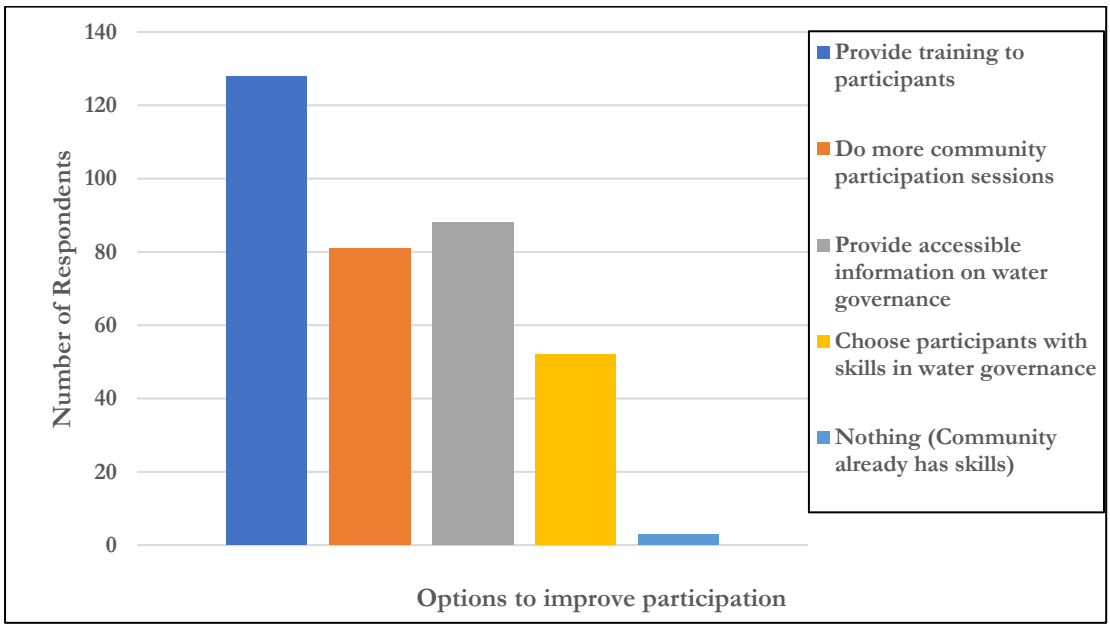

Figure 13: Community's views on how to improve their communication skills

5.2 Stakeholders' relationship in water governance

This section is comprised of three sub-sections with respective research questions that addressed organizational issues in the institutional layer through RQ1 and provided an overview of the right and responsibilities for organizations involved in Mariental water governance. The combination of RQ2 and RQ3 addressed challenges and relations between stakeholders in water governance, which aligns with the relational layer.

5.2.1 The rights and responsibilities of stakeholders involved in water resource management

Identified stakeholders in this study ranged from inclined government bodies (local authorities, parastatals, and intergovernmental commissions), and also individuals involved in water governance, such as the business community, farmers' representatives, and parastatals. A summary of the different stakeholders is presented in Table 8. The collective descriptions of stakeholders' rights and responsibilities are derived from the *Water Management Act of 2013*, responses from Interviews, and policy documents provided by the Namibia Water Corporation.

The *Water Management Act of 2013* stipulates different roles and responsibilities for actors involved in water governance, albeit not all stakeholders presented are mentioned. Responses from organizations show that institutions such as the Namibia Water Corporation and the Ministry of Agriculture have the highest administrative power in water governance. Whereas municipality, farmers union/representatives act more as mediators between National Government, bulk water supplier and end-users who are farmers and residents in municipal areas.

Table 8: Stakeholder's rights and responsibilities in water governance (own construct)

Stakeholders	**Rights &Responsibilities**
Ministry of Agriculture, Water, and Land Reform	To promote effective management of water resources. Act as guardian over Namibia's water resources, administrate water legislation, control water abstraction, facilitate equitable allocation of water resources to all users; execute strategic water resource development planning, and regulate and control activities in the water sector.
Namibia Water Corporation	Parastatals responsible for the design, construction, and maintenance of water supply infrastructure. Supply and administering bulk water to local authorities and individuals.
Orange-Senqu-River Commission (ORASECOM)	Promoting intergovernmental coordination and management of the Orange-Senqu river basin. The commission is agreed between Botswana, Lesotho, Namibia, and South Africa on 03 November 2000, Windhoek.
Basin Management Committee	To provide hydrological support and management of the basin: Routine hydrological tasks. Legal and direct channel of community participation in water governance. Provided in the Water Act of 2013.
Mariental Municipality	Supply and distribution (selling) of water to the residents of Mariental.

Mariental Flood Task Force	Commissioned after the 2006 flood event to assess and overlook the flood situations in Mariental. Mandated to come up with the long-term and short-term flood intervention for Mariental and surrounding area.
Namibia Meteorological Services	Provide rainfall seasonal forecasts and advice on possible above normal rainfall expected. Provides day-to-day weather forecasts issued on voice, print, and visual media.
Hardap Green Scheme	Represent farmers' interest with regards to water use and supply t the irrigation scheme. Also, part of the Hardap Emergency Team.
Hardap Emergency Team	To advise the minister through the regional governor on critical issues he should take up and give attention to drought, flood, or damages from any emergency in Hardap.
Chamber of Commerce	Represent the interest of the business community in matters that directly or indirectly affect the business atmosphere.
Local community	Consumers or end-users. Supposedly represented through the Basin Management Committee.

5.2.2 Challenges facing stakeholders in water governance

The local authority representative in OCC_1 indicated that they are challenged by high water tariffs from the supplier which are then passed on to the residents. In addition, the respondent indicated that local authorities are not properly consulted *(exclusion in water governance)* on the formulation of water policies, regardless of them being key players in the water supply. OCC_ 7 criticized Mariental municipality for not having enough water storage facilities which made the organization dependant on the Namibia Water Corporation for bulk water supply.

Respondents from the Ministry of Agriculture, Water and Land Reform in OCC_2 & OCC_4 indicated that the ministry is challenged with a *lack of experts* in water governance and *gaps in data* (hydrological). They also outlined *poor coordination* amongst actors*, deliberate exclusion* of some actors, and poorly defined mandates as some of the challenges that affect stakeholders in water governance. Another respondent in OCC_7 indicated deliberate exclusion in water governance, and emphasized that the lack of community participation is due to lack of funds for committees where community members are supposed to be represented, and also overshadowing of small players by financially and politically advanced stakeholders.

OCC_5 represented the Namibia Water Corporation and indicated that they are challenged by the lack of policy *implementation* but also grey areas of *undefined responsibilities* between Namibia Water Corporation and local authorities in the *Water Management Act of 2013* about water supply. The National Meteorological Station as the custodian of weather data has indicated in OCC_6 that they are faced with a challenge in communication that affects the process of issuing timely early warnings to the target population. Table 9 shows a summary of challenges facing different stakeholders in water governance and the different codes used to analyze responses in ATLAS.ti. Challenges presented in Table 9 include only organizations identified before data collection and had representatives interviewed.

Table 9: Challenges faced by organizations and concepts/codes associated (own construct).

Stakeholders	**Challenges**	**Associated concept /codes**
Ministry of Agriculture, Water, and Land Reform (OCC_2&4)	More technical oriented staffs and lack of governance experts	Lack of experts need attention
	Gaps in hydrological data	Gaps in data
	Poor coordination among stakeholders in water governance	Poor coordination, exclusion in water governance
	Poorly defined mandates	Undefined responsibilities, rights, and responsibilities
Mariental Municipality (OCC_1)	The municipality or local authorities are not properly consulted	Engagement strategies, exclusion in water governance
	Implementation of policies without community participation	Implementation, deliberate exclusion
	High water tariffs	High water tariffs, water affordability
Namibia Water Corporation (OCC_3&5)	Grey areas in the *Water Management Act of 2013* to address water supply	Undefined responsibilities, guiding document, participation & water policies
	Lack of implementation for water policies	Implementation
National Meteorological Station (OCC_6)	Communication gaps to deliver timely early warnings	Engagement strategies, alerts, channels of communication
Business community: Hardap Green scheme, Chamber of Commerce (OCC_7)	Lack of community participation and obligation to include them in decision making	Exclusion in water governance, lack of information, implementation, participation &water policies
	Overshadowing of small players by financially and politically advanced players in water governance	Deliberate exclusion
Basin Management Committee (OCC_2&4)	Lack of funds and lack of implementation for water policies	Consistency of fiscal and pricing support, Funding, implementation
Water Point Committee (OCC_7)	Lack of funds and lack of implementation for water policies	Consistency of fiscal and pricing support, Funding, implementation

Respondents from the community have also indicated their challenges as part of the stakeholders in the Mariental water governance. Figure 14 shows a reflection of how they responded. Overall, a greater number of respondent shows that their conflicts with water authorities and fear floods &droughts in the future are the common challenges within the community. Community members also indicated their loss of confidence in water authorities and declined agricultural produces, while about 42 respondents indicated the loss of investors/service providers.

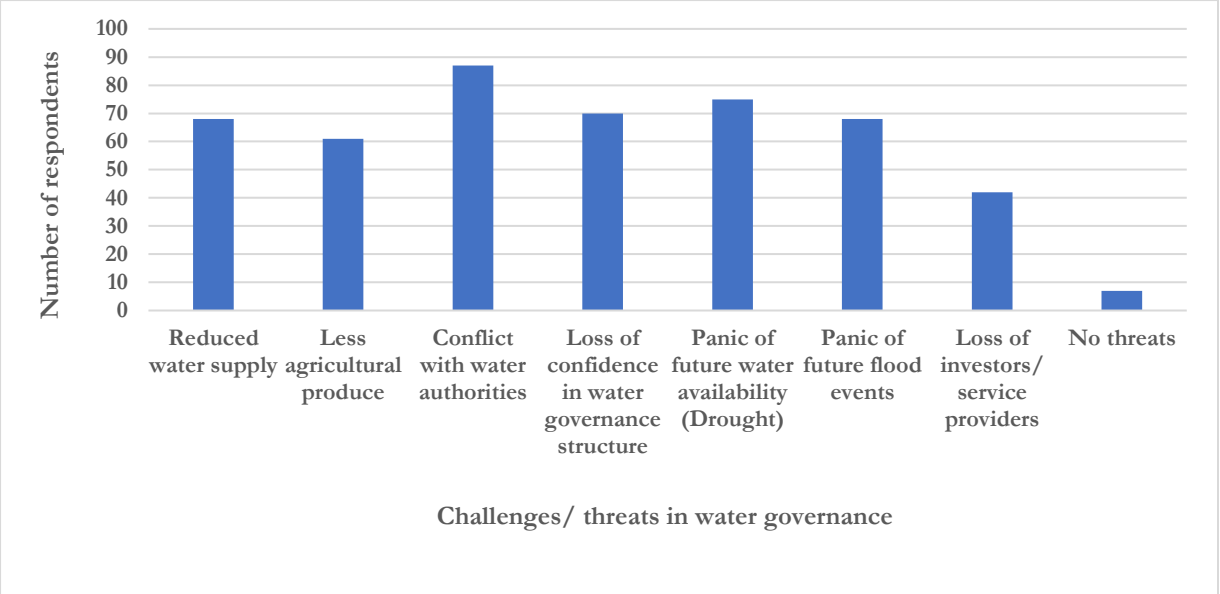

Figure 14: Challenges/threats faced by community members in water governance (own construct)

5.2.3 Relations & possible factors of conflicts between stakeholders in water governance

Based on the responses and experience from fieldwork, different relational aspects of water governance can be defined within organizations, community members, and between the two stakeholder groups. By understanding the stakeholders' relationship, this sub-section also addresses possible factors that lead to conflicts between stakeholders and how they are resolved.

Relationship within& among organizations in water governance

The relational issues within or between organizations in the Mariental water governance are shown in Figure 15. It indicates that poor coordination, poorly defined mandates, and gaps in water resource datasets are the drivers of tension between & within an organization. The latter supports literature on the lack of expertise and hydrological data in Namibia (Cloete et al., 2018) as well the exclusion of key stakeholders in decision-making that leads to poor coordination in water governance (Rose, 2003).

The court case between Namibia Water Corporation and Hardap Farmers Union is the most spoken and overarching relational issue observed in Mariental. Interviews with farmers, and an official from the Ministry of Justice indicated that a case was opened between the two organizations, whereby complainant one (Hardap Farmers Union) alleged an inconsistent billing system and high-water tariffs by the defendant (Namibia Water Corporation). Notable responses were received from community respondents supported by OCC_7 indicating the commotion between the Hardap Farmers Union and Hardap Green Scheme. The Hardap Farmers Union (large-scale farmers) is accused of overshadowing the Hardap Green Scheme (small-scale farmers). The validity of this notion could not be reached since Farmers Union refused to take interviews or fill in the questionnaires after several attempts.

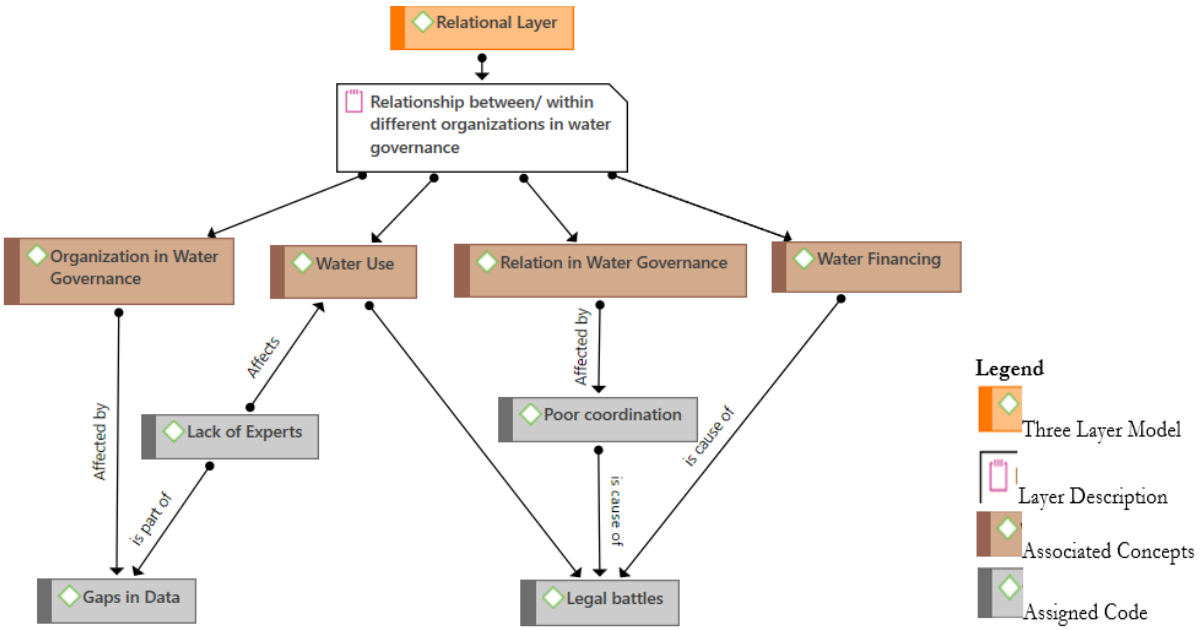

Figure 15: Relationship within and among different organizations in water governance (own construct)

Relationship between community members and organizations involved in water governance

Concepts used to analyze the relational aspects were *community participation, community awareness, water financing, population group, and water use*. For *community participation &community awareness*; the Ministry of Agriculture Water and Land Reform indicated that they have a solid relationship, and community members are usually informed and involved in water resource management. On the other hand, Namibia Water Cooperation indicated that there is a need to be more inclusive, to communicate frequently, and strengthen the bonds between the two stakeholder groups. The positive relationship between organizations allows community members to alert organizations on water-related issues, and the organization appreciates their efforts to participate in water governance (OCC_6). An official from Mariental municipality supported the view of respondent OCC_6 who indicated the need to strengthen communication between organizations and community members.

In terms of *water use*, the relationship between the two groups has also yielded significant results for the supply and use of water within the area of Mariental and its surroundings. The farmers assisted Namibia Water Corporation by optimizing the location of boreholes, relative to the intensity of water use in that area. However, in some cases, the development of wells and boreholes leads to conflict between water authorities and community members, resulting in delays or calling off developmental activities. A farmer's representative indicated that deteriorating relations between Namibia Water Corporation and farmers usually lead to disruptions in the water supply.

Responses from community members have a different tone than that of the organizations. Water affordability is at the center of complaints and conflicts between community members and different organizations in water governance. More than half of the respondents from the community indicated domestic water shortages and inconsistent water billing systems which results in escalated water bills. These two mainly affect the elderly people that are dependant on pension, and the low-income residents (OCC_1, CMC_106 & CMC_118).

Another factor that causes conflicts is when Namibia Water Corporation closes or interrupts water supply to the users by closing irrigation canals or adjusting rules to operate the dam without informing citizens as well as ignoring the community's complaints and challenges. On the other hand, one respondent in CMC_6 singled out the Hardap Watering Scheme (same as the Hardap Green Scheme) which has a history of ignoring and disobeying set regulations. The act of ignorance and disobedience were not well-taken by other water users, because the responses from water suppliers affected the whole community. At least half of the officials indicated that conflicts between the two groups are solved through stakeholders' consultation or by consulting experts as indicated in Figure 16.

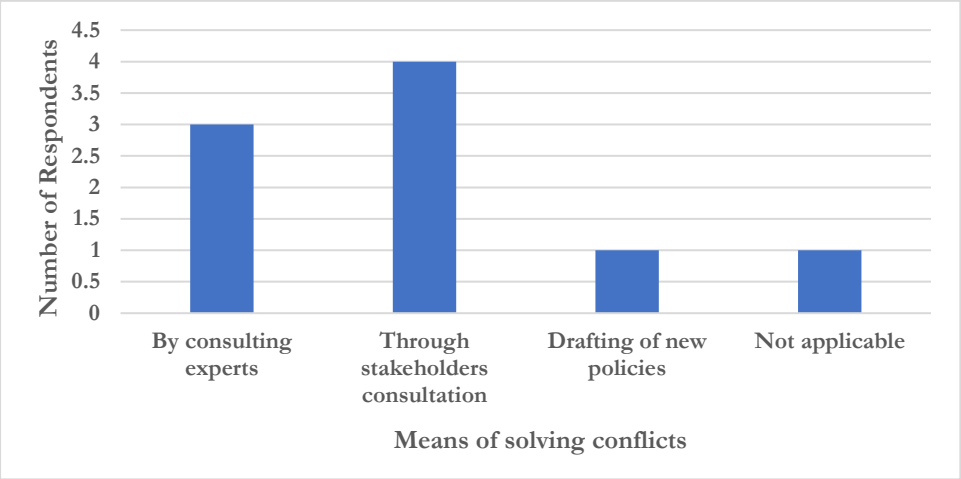

Figure 16: Officials responses on how conflicts are solved between the two stakeholder groups (Own construct)

Observations from community members' responses showed that conflict between the two groups always prevails because their interests are not heard and as shown in Figure 17, at least half of the respondents did not know if conflicts between the two groups have been resolved while about 20 % indicated that conflicts are not resolved. In addition, the voluntary work basis in Basin Management Committee, Water Point Committee, and other community participation platforms discourage community members to participate which in return leads to their *exclusion in water governance*. Graphical presentations of relations between the two stakeholder groups are shown in Appendices 10&11.

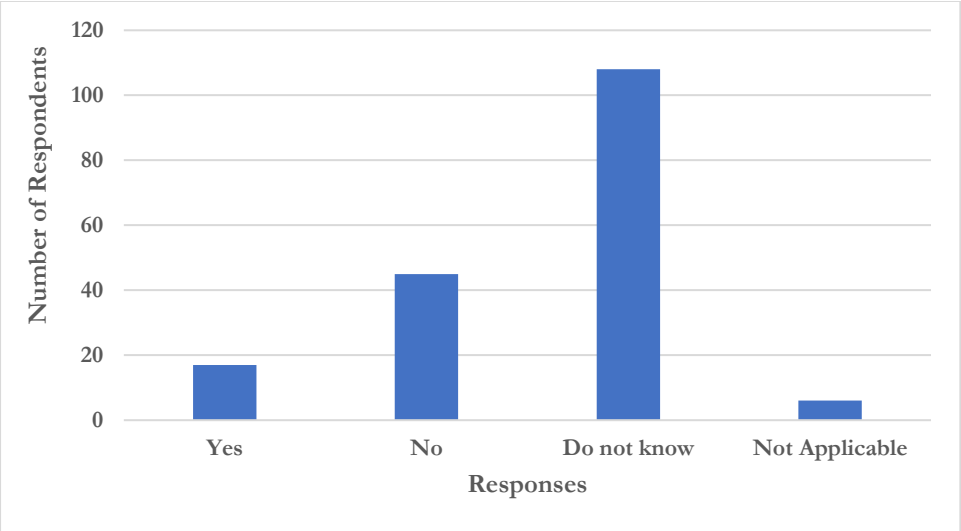

Figure 17: Views on whether conflicts between the two stakeholder groups have been resolved (own construct)

Relationships among community members in Mariental

Overall analysis indicates that communities' relation to water governance has been characterized by discontent and lack of water points. As a result, community members steal water from each other's taps and even from other people's households (CMC_44&130). Another water-related conflict erupted within traditional authorities due to water accessibility. CMC_133 indicates that traditional authority members had a conflict on the ownership and accessibility of surface water; however, this commotion has been solved through dialogue between traditional leaders in those areas. Figure 18 illustrates a network of how community members interact according to the respondents. *Water use* is the primary concept that aligns with the content of quotations about relationships among community members, collectively represented by the connected sub-codes.

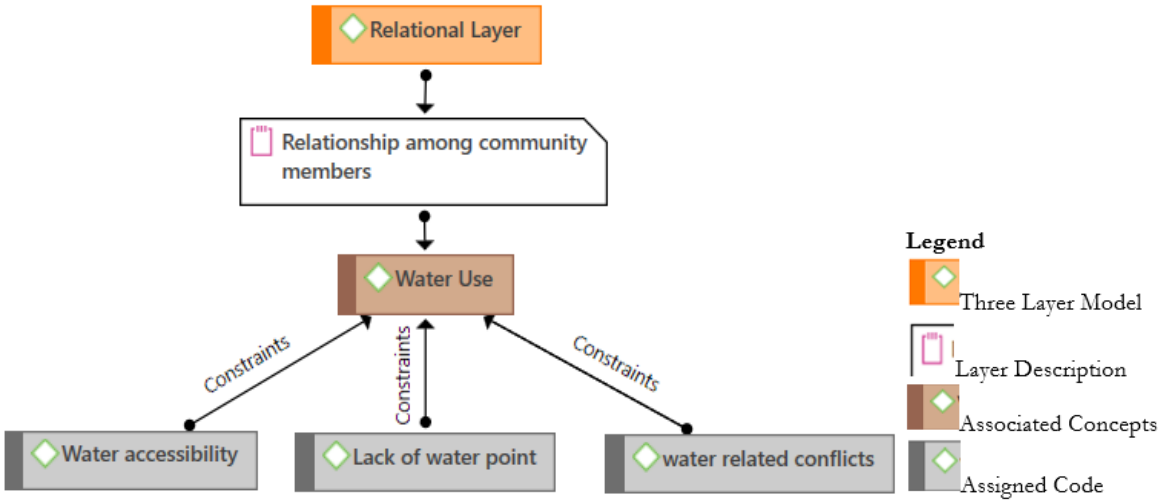

Figure 18: Relationship between community members based on water use (own construct)

5.3 Levels of community participation in water governance

This section has three sub-section that jointly leads to the realization of the second sub-objective of this study. The first subsection in 5.3.1 addressed RQ4 which in the Three-Layer Model aligns with the relational layer. Sub-section 5.3.2 addressed RQ5 related to the institutional and content layer while 5.3.3 addressed RQ6 that aligns with both content and relational layer.

5.3.1 Procedures and means of community participation in water governance

Through analysis of official documents in 4.3, the study has established that standard procedures for community participation in water governance are through membership of either Basin Management Committee, Water Point Committee, or Water Users Association (Government of Republic of Namibia, 2013). The *Water Management Act of 2013* provided procedures and platforms for community participation at a national level, but other platforms exist at a local authority level such as the Hardap Emergency Committee and Mariental Flood Task Force in Table 8. Community members can join through representation by their affiliated organizations such as the Hardap Green Scheme representing small-scale farmers in (OCC_7). Procedures for community participation in water governance are supported by the *Decentralization Enabling Act, 2000 (Act No. 33 of 2000)* and uses a bottom-up approach (Government of Republic of Namibia, 2001).

Responses from the two stakeholder groups in Figure 19 revealed that three (3) out of seven(7) officials from the organizations were not aware of the procedures on how the community can participate in water governance, same as the 142 out of 179 community respondents. Two conclusions can be made on the latter: The first one is that organizations in water governance do not practice or promote community participation, otherwise, they are barely reachable or do not exist, validating the point that established platforms are dormant or only exist in papers as observed during data collection. The second conclusion will be that community members are not informed on how to participate in water governance, given that the organizations involved also do not make a greater effort in making sure that community members are involved.

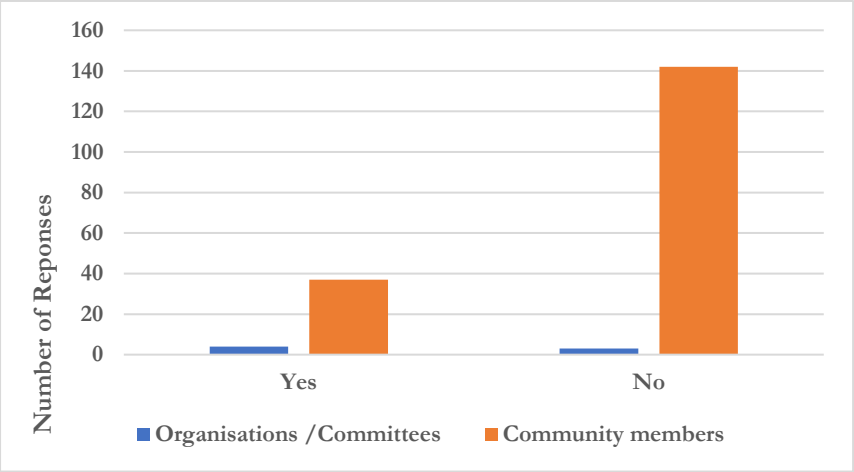

Figure 19: Respondents awareness on procedures for community participation (own construct)

5.3.2 Representation of local community in water governance

The Water Management Act of 2013 a statutory guide of water resource management in Namibia provided the legal platform of establishment and operationalization of the Basin Management Committee, Water Point Committee, and Water Users Association as line institutions or bodies through which community participation can take place in water governance. In Mariental, two organizations that are not in the Water Management Act have been established (Mariental Flood Task Force and Hardap Emergency Team).

Figure 20 shows how respondents from different organizations responded to whether local communities are represented in various organizations that are involved in water governance. In all the six organizations at least half of the respondents did not know whether local communities are represented, which then points out to lack of awareness on water governance issues amongst officials that represented the organizations. No responses were recorded for absolute exclusion in both Water Point Committee and Basin Management Committee although only half of the respondents could confirm absolute inclusion of community representation in each of the two organizations. Moreover, there are equal chances of having community representation in the Mariental Flood Task Force. The overall observation of the results from officials indicates that community representations are not visible in Mariental Water governance since they could barely confirm its existence or inexistence.

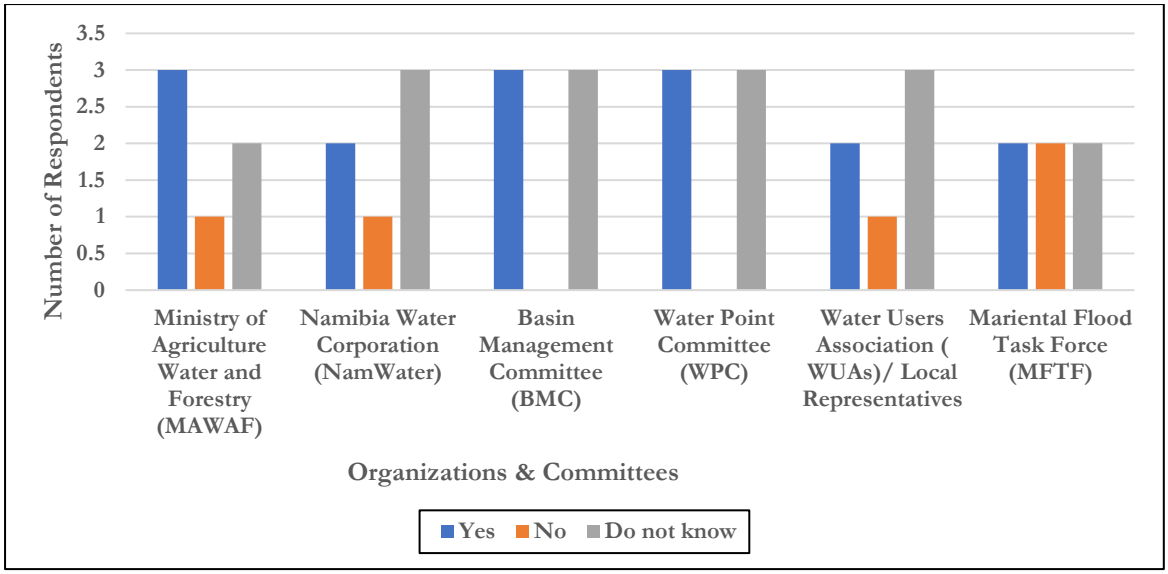

Figure 20: Views of officials on whether local communities are represented in water governance (own construct)

Responses received from community members are in support of the two conclusions made in 5.3.1 A total of 73% of the respondents are not represented in any of the organizations as indicated in Figure 21. Representation in all listed organizations recorded below 25% each. Based on the results from both stakeholder groups a conclusion can be drawn that representation of local communities in the Mariental water governance is very low and questionable if it at all exists, based on the uncertainties of officials from the six organizations.

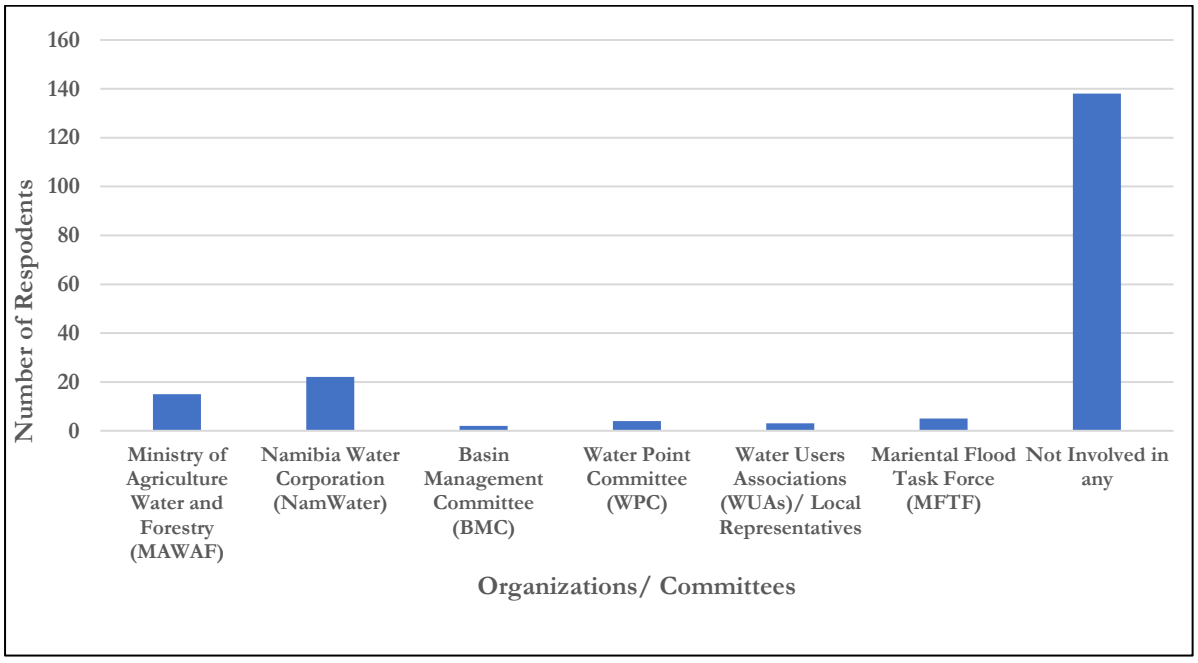

Figure 21: Communities responses on their representation in water governance (own construct)

5.3.3 The use of existing platforms in water governance

The views of officials in this section are inferred from the conclusion made in the previous section about community representation. Therefore an assumption is made that, officials are not certain on whether community members do make use of existing platforms or which ones are used by each organization for community participation. In contrast community members indicated that the majority of the respondents per organization did not know what/which platforms are used to participate in water governance (Figure 22). The conclusion is similar to the previous section which strengthens the notion of lack of awareness on issues related to water governance for both stakeholders group and also validating the claims by Municipal officials that there is a lack of water governance experts in the organizations involved.

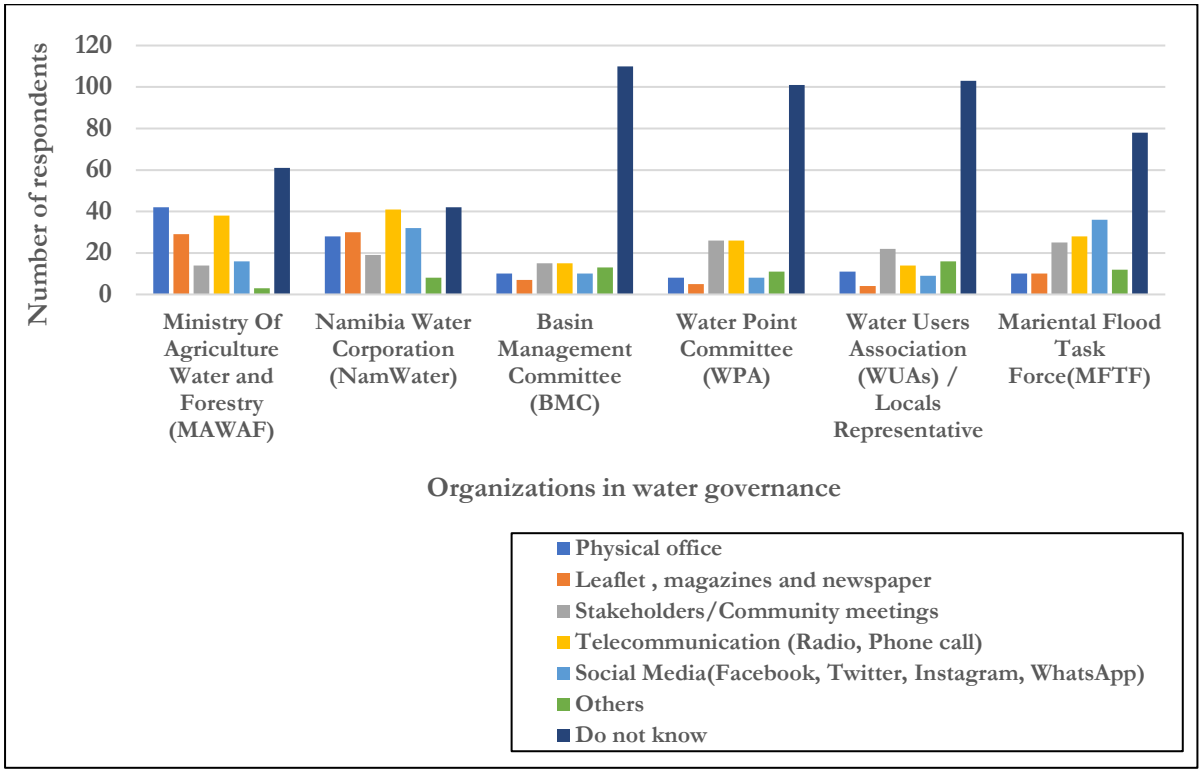

Figure 22: Community members responses on the use of existing platforms in water governance (own construct)

5.4 The value of community participation in water governance

This section comprises three sub-sections, and each one of them addressed a specific research question. Addressing the three research questions in this section were meant to realize the third sub-objective of this study. RQ7 is aimed at recognizing the knowledge of local community members and identifying their values to participate in water governance, this research question aligns with the relational layer. RQ8 refers to how community participation is being financed in water governance, which makes part of the institutional layer. RQ9 indicates how community participation can be related to the wicked problem in water governance, and it involved aspects of the relational layer.

5.4.1 Recognizing knowledge of local community members in water governance

Knowledge instilled in local community members can be helpful in water governance, but it first needs recognition from the relevant authorities to be considered in decision-making processes. Namibia Water Corporation for example indicated that they recognize tacit knowledge (inherent knowledge acquired by local community members). Hence, they consult with community members for boreholes site selection, which is based on the premise that the locals understand potential water sources, and community water needs OCC_4. Local small-scale farmers had a different view on the fact that organizations in water governance recognize knowledge from the community. OCC_7 stated that their views and knowledge toward water resource management are instead considered as a nuisance by the Namibia Water Corporation and large-scale farmers.

The national government made the first step to recognize the knowledge of community members by ensuring that water policies made provision of community participation, to allow for the transfer of knowledge from the community to organizations and vice-versa. A policy-implementation gap can be confirmed in water governance and it hinders the recognition of knowledge from the locals as cited by several respondents in CMC_93&130 and OCC_4&7.

5.4.2 Financing of community participation in water governance

The two officials from the Ministry of Agriculture and Land Reform indicated that community participation in Basin Management Committee is usually budgeted for and receives funds directly or indirectly. Moreover, some funds are arranged through the travel allowance claims which covers costs incurred when traveling to meetings. On the other hand, a farmer's representative denies any financial support for community participation, citing that he uses his funds to attend meetings, and does not even get support from fellow farmers even though he represents them. In addition, respondents from the National Meteorological (OCC_6) Service and Namibia Water Corporation (OCC_3) indicated that their organizations have no specific component or support system to finance community participation. A collective overview of organizations' commitment to fund community participation is shown in Figure 23. At least two respondents have indicated that no funds are allocated for each of the listed organizations. Ministry of Agriculture, Water, and Forestry was the only organization that recorded a response for their commitment to fully fund community participation even though the majority of the respondents indicated it only provides partial fundings.

Community members did not/barely talked about financial support for community participation in water governance. Instead, the majority of the responses are centered around billing and high-water tariffs, making water affordability and access to water in Mariental very low, specifically to elderly and economically inactive individuals. Respondent in CMC_18 &96 indicated apart from lack of support for community participation, the only financial aspect heard are for water meter readings and cutting the flow of water when there are due payments. OCC_7 claimed to have funded his participation in water governance due to lack of funds even when participation is made on behalf of other farmers in the irrigation scheme.

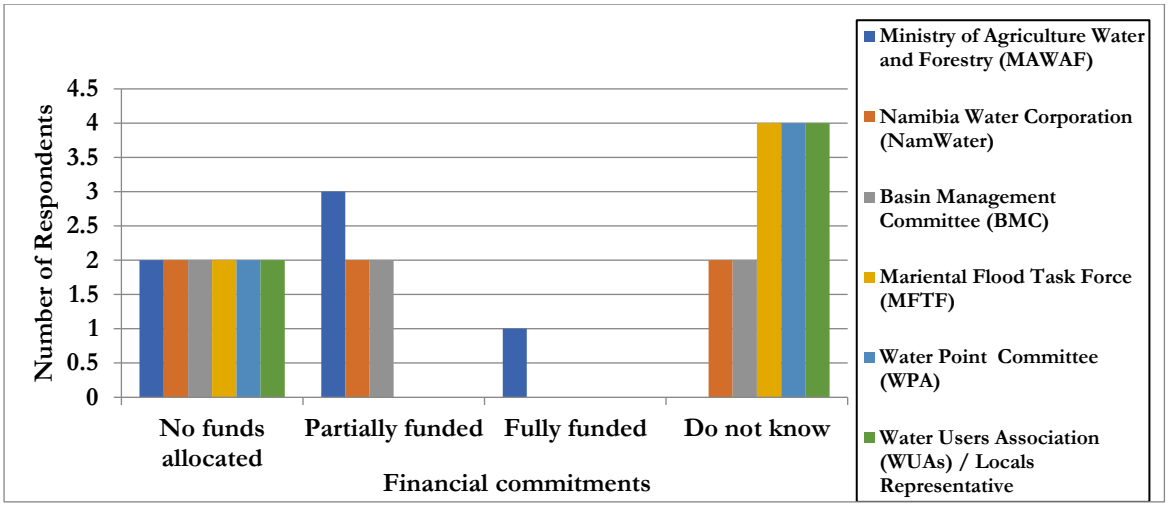

Figure 23: Officials views on financial commitments of funding community participation (own construct)

5.4.3 Relation between community participation and the wicked problem in water governance

Based on the results presented in section 5.3, it's evident that Mariental water governance has not prioritized or explored means of mitigating the wicked problems through community participation. The general impression observed in community members during data collection and data analysis is that the respondents are willing to participate in water governance, Therefore, incorporating community participation could be the first step to address knowledge uncertainties bridging the gap in hydrological data, access to water, or even flood & drought management, whereby community inputs could be used to support explicit knowledge.

Community participation could also be used by organizations to inform decision-making processes since they work in silos (in CMC_18,19,36 supported by arguments from OCC_1 &7). Through informed decisions, organizations might be in a better position to handle challenges of different stakeholders that are outlined in section 5.2 and could lead to the ability to balance stakeholder's needs and values which is considered to be part of the wicked problem in water governance. The literacy rate of respondents from community members shows that about 80% had acquired basic education and are they are not just willing to participate but also able to relay tacit knowledge accordingly, especially for issues related to flood and drought management that are persistent in Mariental.

5.5 Improving community participation in water governance

It is evident from the previous section that, community participation in Mariental water governance barely exists. This section addresses the fourth sub-objective of this study and is subdivided into four sub-sections. The first subsection serves as an introduction to the section, and it is based on the composition of community participation in water governance. Building on the first sub-section is the reflection on how to improve community participation in water governance to answer RQ10 &11 which jointly aligns with all layers of the Three-Layer Model. The third one is a reflection of the relation between community participation and existing policies which answers RQ12 falling under the content and relational layers. The fourth one implies whether ABP stimulates community participation in water governance, which addresses RQ13 and is in line with both institutional and relational layers.

5.5.1 Structuring effective community participation in water governance

Four codes *(representation in committee, rights and responsibilities, exclusion in governance, and water policies)* were associated with different quotations in line with how respondents viewed effective community participation to look like. *Representation in committee*, in this case, was associated with views that community members felt that, some representatives are lazy and incompetent by not living up to the expectations of the group being represented (supported by CMC_25 and OCC_7). One respondent indicated that water policies are used as a hindrance for community participation even though the aim is to support participation, in so doing inactive policies serve as barriers for community participation in water governance.

Water authorities could not be held accountable because of the policies; that calls for the need to address the policy-implementation gap to enable effective community participation to take place (CMC_117). Participants, also needed to be motivated and supported therefore, the lack of human capital should be addressed because community members are discouraged to take part in water governance because the work is voluntary said CMC_102 and OCC_7. An official from the Namibia Water Corporation indicated that they welcome community inputs and community members are always happy to join. Therefore, good gestures and being accommodative to participants can be a key player, also for other organizations to attract effective community participation.

In summary, structuring effective community participation will need to start by relooking at the existing water policies. According to Figure 23, not more than half of the officials have rated the water policies to be Good or better, except for the 2017/18 to 2021/22 strategic plan adopted by the Ministry of Agriculture Water and Forestry. Also, all other policies have been in existence for at least more than 5 years but failed to make a notch for community participation in water governance.

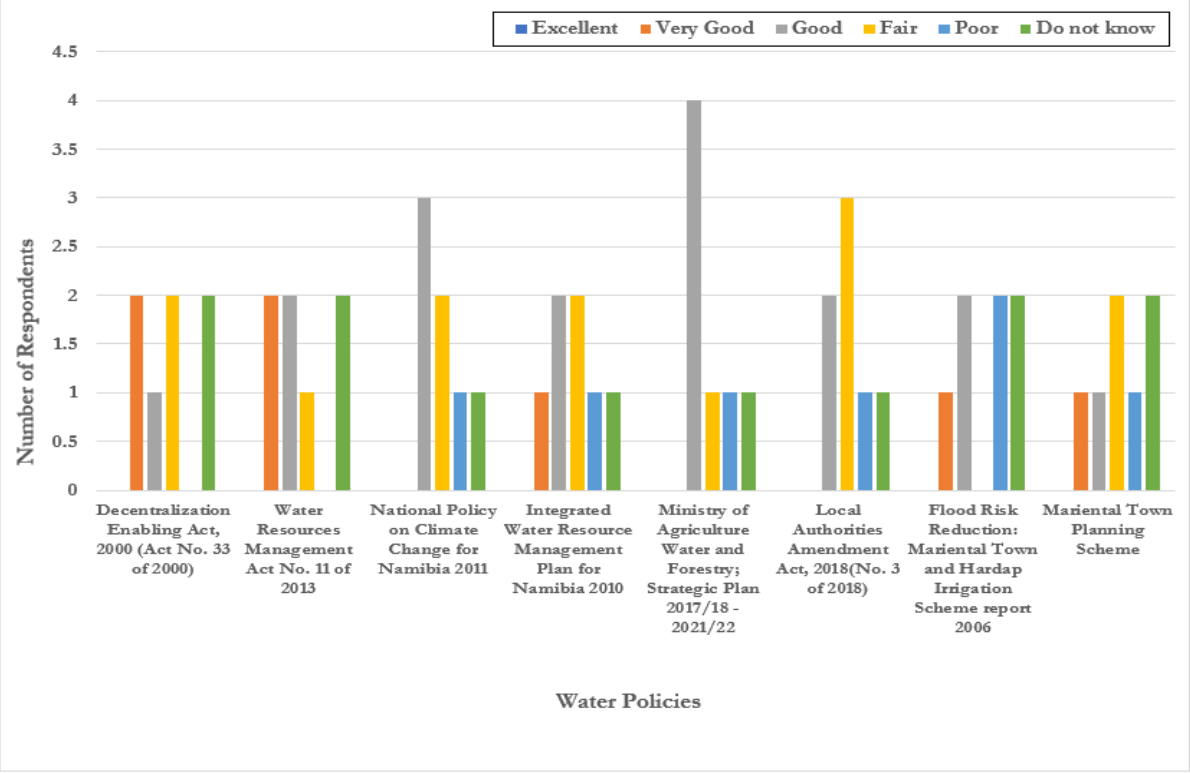

Figure 24: Views of officials on the inclusiveness of community participation in water policies (own construct)

5.5.2 Improving community participation in water governance

Community participation can be improved by promoting stakeholders to work together said the respondents in CMC_120 &138. *Lack of information* is one of the barriers cited by respondents who also indicated that community participation could be improved by educating potential participants or those representing the interest of their group in water-related matters (in CMC_32 & 98). Once the community members are educated and have the necessary skill set they must be allowed to participate and contribute their input (CMC_122 & 131). One particular respondent (CMC_94) argued that better discussion and decision takes place when community members are involved in water governance, which calls for the need to promote attendance. And also, informing stakeholders about the benefits of participation or current issues directly or indirectly affecting them.

5.5.3 Relation between community participation and existing policies in water governance

Policies in water governance are already in place, including the provision of community participation, starting from the level of the Basin Management Committee down to the end-users (Amwaama, 2021). However, community members (in CMC_71, 93 & 137) and OCC_ 4 indicated that the existence of good laws does not necessarily translate to community participation in water governance. Policies such as the *White Paper* has a defined clause which made provision for community inputs in water governance, the *Water Management Act of 2013* has a more extended power that should be adhered to although the adjudication of its regulations has not been completed for about seven years since it was passed in parliament (Mutorwa, 2021).

Generally, water policies support community participation, the implementation and adherence of users is the one creating chaos in water governance. The case between Namibia Water Cooperation and Hardap Farmers Union, inactive *Water Management Act of 2013*, and dormant ABP (such as Basin Management Committee) are examples that should trigger a different approach in water governance for Mariental but also Namibia at large. The spatial aspects of water resource management in Mariental are guided by two official documents (Master Plan and Town Planning Scheme). The latter include ABP or activities such as Mariental Flood Task Force and the Hardap Emergency Team. An official from Mariental municipality and a farmer's representative both indicated that, Mariental Flood Task Force and Hardap Emergency Team are active and that they have included community representatives.

5.5.4 Do Area-Based Policies stimulate community participation in water governance?

Area Based Policies are spatial planning guidelines or concepts used to tackle defined geographical problems, through an integrated approach (Smith, 1999). The Decentralization Enabling Act is the pillar of support for ABPs in Namibia which formed the basis of creation for ABPs such as the Community Based Management in water resource management, the Local Authority Act, and the Town Planning Ordinance. Guiding documents were also considered as ABPs such as the Flood Reduction Report and Mariental Town Planning Scheme in 4.3.

As presented earlier in this chapter, policy-implementation gaps and lack of awareness for procedures to participate by the two stakeholder groups had a direct impact on the effectiveness of existing policies in water governance including ABPs. Hence, the difficulties to substantiate whether ABPs do stimulate community participation in water governance. A conclusion can be made based on the results in 5.2 and 5.3 that current ABPs had a rather insignificant role to stimulate community participation in the Mariental water governance.

6. DISCUSSIONS

This chapter is an extension and review of the previous chapters. A reflection on the applicability of the Three Layer Model is provided, as well as a critical assessment of the results which is based on the framework and known literature. Discussions also dived into the strength of community participation in the case study and a reflection on the current and future wickedness of Mariental water governance including possible interventions in general and improving community participation. Furthermore, the closure of this chapter comprises outlined the reproducibility of this study and recommendations. The overall discussion summarised if and how community participation could strengthen decentralized water governance, in a semi-arid environment which is the main objective of this study.

6.1 Community Participation in Mariental water governance

Community participation in Mariental discussed in this study is based on the Three-Layer Model of water governance, the results can however be critically compared to renowned literature on citizen participation on a more generalistic approach. The results presented in chapter five indicates that community participation did not yet make a mark in water governance due to rhetoric water policies such as the *Water Management Act of 2013* and the *White Paper*. A conclusion can be made that, equate it to the "Degree of Tokenism" described in (Arnstein, 1969) indicating the state of allowing citizen participation as is the case in Mariental. Regardless of the policies, community participation does not happen in practice which refers to a *policy-implementation gap*, a term that is spoken about by several authors in water governance ((Ménard, Jimenez, & Tropp, 2018; OECD, 2015). Lack of effective community participation in Mariental has contributed to a lack of service delivery & accountability of water authorities to the users, which goes against the Sustainable Development Goals, specifically Goal 6 &17 (United Nations, 2020). The latter needs to be adjusted accordingly or finding an amicable solution to improve community participation in Mariental water governance.

6.2 Applicability of the Three-Layer Model of water governance to this study

The Three-Layer Model has proven to be effective in this study, given the ability to contextualize and visualize different aspects of water governance through content, institutional and relational layers. Each of the three layers provides key questions that guided the structure and content of the questionnaires for the two stakeholders group. The questionnaires proved to be appealing to the respondents, and at least 90 % provided answers to all questions.

6.2.1 Content layer

This layer provided the focus on defining whether there are clear policies, sufficient knowledge, and also if the information is available on if and how community members can participate. As indicated in the results chapter, water policies are clear on participation except for the grey area in the *Water Management Act of 2013* on the rights and responsibilities of water supply, between the Namibia Water Corporation and local authorities. Community members proved to have sufficient knowledge and capacity to participate in water governance, which is reflected by the literacy rate. However, at least more than half of the respondents are not well informed about water governance issues specifically on water policies and existing structures which can be referred to as a *lack of information* in society.

6.2.2 Institutional layer

This layer focuses on the organizational component, legislation, and financing in water governance. The institutional layer could be the most critical section of the framework such that all other layers depend on the existence of well-structured organizations to deliver and reflect good governance. Namibia as a country has a well-defined water governance structure (in Figure 5) supported by international agreements such as ORASECOM, Paris agreement 2015, and commitments to the Sustainable Development Goals. Even though structures are in place, their dormant state, lack of accountability to the users, and inconsistent financial support for community participation remain the biggest backlogs in the history of Mariental water governance.

The Basin Management Committee and Water Point Committee are dormant partially because the Ministry of Agriculture, Water and Land Reform, and Namibia Water Corporation that are responsible have not yet ironed out their financial commitment of funding these structures. The *Integrated Water Resource Management Plan of 2010* which is still in use, referred to the gap in existing water policies on the commitment to finance Basin Management Committees, and other similar structures; the latter is also reflected in the structure of the *Water Management Act of 2013* which does not have a solid clause on funding (Government of Republic of Namibia, 2013; IWRM Plan Joint Venture Namibia, 2010). Accountability of existing structures seems to be the biggest threat experienced in the institutional layer. For instance, the Water Regulator and Advisory Council which are critical high-level structures are still not operational even though the day-by-day water use is still going on without the input or guidance of these structures. One could also argue that the transition between the old water policies and current ones was not smooth, given that the general water resource management is based and guided by an Act with no legal power. The *Water Management Act of 2013* provided for the establishment of the Basin Management Committee and Water Point Committees in Namibia (Government of Republic of Namibia, 2013) which are considered as the entry point for community participation in water governance, yet the Act's legal status is still in limbo.

6.2.3 Relational layer

The general impression from the framework is that, the relational layer is more focused on implementation and how individuals connect in water governance. Results show a negative relationship between community members and water authorities, with occasional instances where the two stakeholders had worked together. The same applies to the relation between community members themselves, where some respondents indicated issues of stealing water from others. Water accessibility, water affordability, and lack of water points were the main codes associated with quotations that defined the relationship among community members and it validates some of the water issues faced in Namibia and semi-arid environments at large (Remmert, 2020).

Moreover, the organizations involved in Mariental water governance also have their ups and downs, mainly characterized by dissatisfaction among different organizations. The legal battle between Namibia Water Corporation and Hardap Farmers Union was the most spoken. Based on the resistance of Hardap Farmers Union to participate, it can be assumed that their court case might have been the drawbacks, even though other factors may have contributed such as the bureaucracies and sensitivity of water governance in Mariental (observed from data collection and the respondents). Mariental municipality and Hardap Green Scheme have also shown the existence of negative relationships with other organizations, in terms of communication: to share information and give inputs without being sidelined or disregarded in decision-making processes.

6.3 Strengths of community participation to improve Mariental water governance

Mariental is affected by both floods and drought which is evident from literature (Malapi, 2013; Ministry of Agriculture Water and Forestry, 2007; UNDRR, 2020) and validated by the results from all stakeholder groups. Community participation could be used in the planning and development of interventions for flood and drought management but also, it could increase acceptability by the society when their inputs are considered for the desired or appropriate solution including issues of relocation, adaptation strategies, or required support. The current dissatisfaction of community members in terms of water resource management has been linked to the absence of community participation because water authorities work in silos. The data gap in water management (Hattingh et al., 2017) has been proved by respondents from all stakeholder groups, details about flood events could not all be documented with regards to flood source, intensity, or possible damages. Hence, some of the uncertainties can be overcome by using local knowledge through community participation.

The Three-Layer Model also works as a checklist of good water governance and based on the results community participation needs to be strengthened to improve the relational layer. Indeed, water authorities should be accountable to water policies and commitment to value and include community inputs in decision making. Improving community participation could also enhance communication between stakeholders and access to information which according to the results is still a challenge in water governance.

6.4 Reflecting on the current and future of Mariental water governance

This is a summative reflection of the overall position of Mariental water governance with relation to the wicked problem framework. Figure 25 depicts the initial position, current position, and envisaged position in which community participation has been involved. The x-axis represents the implementation of policies and applicability of policies thereof; the y-axis indicates the extent of community participation; however, not numerical support summarizes responses and analysis made in previous chapters.

The starting position is initiated from recognizing the values of community participation, and building inclusive water governance that results in passing laws such as the National water policy (White paper) and the Water Management Act of 2013. In contrast, the second position refers to the perceived actions and responses to water policies that are supposedly inclusive of community inputs. The second position is associated with what is termed as *gain* if the correct procedures are taken and then *losses* if the opposite happens. Based on this study, the current position of Mariental lies in the second position and is associated with losses rather than gains. The third position is the envisaged position, which is suggested by most respondents in order to strengthen community participation in decentralized water governance.

In conclusion, the general summary regarding the wicked problem framework is that: There is low consensus and low knowledge among stakeholders involved in the Mariental water governance, and high consensus with high knowledge is required to reflect good water governance that is also based on the checklist provided by the Three-Layer Model of water governance.

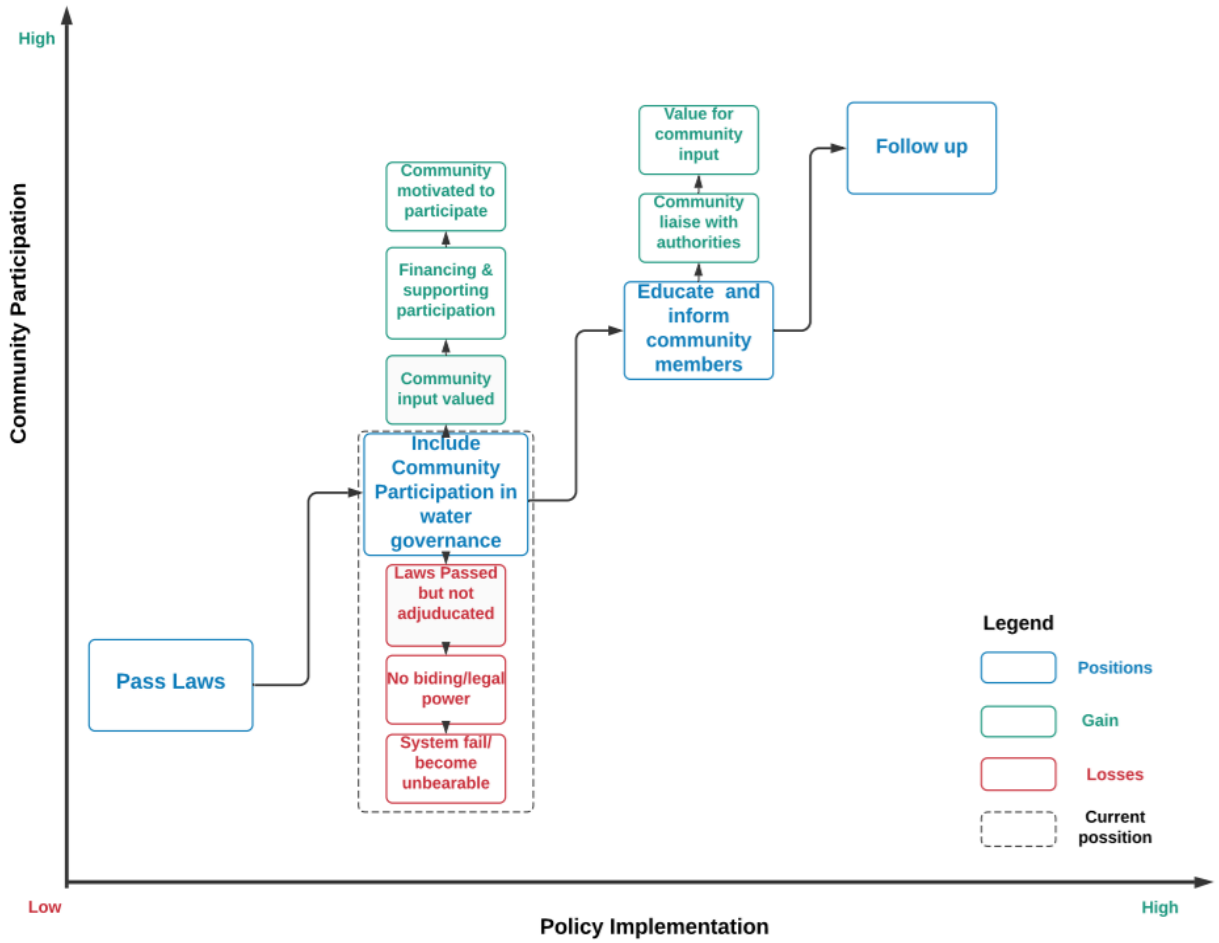

Figure 25: Overview of the current position with relation to the wicked problem in water governance (own construct)

6.5 Reproducibility

The reproducibility of this study is per the University of Twente rules and regulations. The research approach in Figure 2 serves as the overall guide, to reproduce the work done in this study. Particularly the order and fashion in which the framework has been used. With regards to datasets: all data used in this study are stored and archived in the university's repository.

The Codebooks in Appendices 8&9 guide the ability to recreate and reuse the dataset: A list of all functions used for qualitative data analysis are shown in Appendix 7, i.e., codes (concepts)and quotations. Additional materials are provided in the appendix, including the links to the questionnaires of all target groups, and excel sheets containing all responses. However, due to data privacy, raw data can only be accessed from the university's repository. In addition, the dataset went through data minimization, hence records can not be traced back to individuals, although the adopted citation of respondents provides access to the archived dataset.

7.1 Limitations

Few challenges have been accrued amid the study, however, these could not limit the progression to achieve the main objectives. Limitations include the effects of COVID-19, whereby the researcher could not travel to Namibia; a provision was made for external researchers that are based in Namibia. While collecting data, few organizations refused to corporate and give information on water governance.

It is important to allude that the national status, at the time of data collection in Namibia; The ongoing court cases between Farmers Union and Namibia Water Corporation might have contributed to the resistance from some organizations. The political climate in Namibia was at the time going through scrutiny, targeting corruption and maladministration. Two, cabinet ministers and four other notables were jailed for an act of corruption; an assumption was made that these could have instilled fear of recognition in society, particularly if there are acts of corruption and maladministration in natural resource management such as water. On a more personal level, the researcher had an emotional disturbance during the first quarter of the thesis because of the sibling's death and not being able to pay respect at the funeral due to COVID restrictions, which subsequently impacted the progress of the study in a negative way.

7. Conclusion

This chapter recaps the general overview of what has been learned in this study based on the four sub-objectives, leading to the attainment of the main objective.

The study observed that stakeholders' relation in water governance is one of the key aspects to effective water resource management. When a particular group is sidelined or left out of participation, it is a matter of transparency and a hindrance of inputs that could be valuable in water governance. The latter prevents commotions which could lead to legal battles and distrust among stakeholders. A healthy relationship amongst actors strengthens the bond and promotes communication and value for water governance inputs.

Community participation plays a vital role in water governance by connecting service providers with users and vice-versa. The level of community participation in decentralized water governance is set as close as possible to the community to provide them with access to participation. The Decentralization Policy supports the establishment of lower-level structures in water governance where communities are allowed to take responsibilities in water resource management, promoting the bottom-up approach. Nevertheless, these structures need to be operational, and community members should participate for any level of community participation to be relevant in water governance.

The value of community participation in Namibia and particularly in Mariental is certainly underrated and not exhausted to full capacity. Moreover, it is also not directly proportional to the existence of water policies or organizations without effective participation and accountability. One key aspect that stood out in this study was the lack of awareness amongst the two stakeholder groups. Without awareness in water governance, community participation will continue to be visible on paper and not in action. In a nutshell, the policy-implementation gap in Mariental water governance has obscured the value of community participation.

There is a need to prioritize awareness of water governance-related aspects in Mariental and Namibia at large. Being knowledgeable could mitigate challenges faced by both service providers and users at all lengths, triggering accountability and tackling the policy-implementation gap. Therefore to improve community participation, all stakeholder groups need to play their part. Taking responsibilities, in this case, will include financing participation and promoting a working relationship by making sure set platforms are operational, and actors at all levels comply with the policies.

This study could not establish whether community participation can strengthen decentralized water governance, given that participations are dormant. In addition, both stakeholders proved not to be informed or knowledgeable about water governance aspects, which was relevant to assess their values. On the other hand, the question of how community participation could strengthen decentralized water governance was explored. The lack of awareness amongst stakeholders and policy-implementation gap obscure participation by addressing these two presented potential to strengthen community participation. Currently, Mariental water governance does not yield benefits of community participation which could be addressed by strengthening working relations and recognizing the value of participation in policies and practice.

6.6 Recommendations

It is now clear if and how community participation can strengthen decentralized water governance in a semi-arid environment, based on the case study of Mariental, Namibia. While the study also researched the value of community participation in water governance, it will be beneficial to discuss further the extent to which local knowledge is considered in decision making given that participation has taken place.

Further studies could also look into the significance of community participation against other factors that are equally considered in water governance to either conclude a certain decision, adopting an approach or as a means of transferring information. Given the results in this study, there is a need to assess the compatibility and reliance of local knowledge brought up through community participation, and to weigh the proportion of how much credit is given to each explicit and local community member's knowledge in case of differences.

This study applied the Three-Layer Model of water governance which is a Dutch approach, the differences in economical and environmental setup between the Netherlands and Namibia have not been discussed though an assumption is made that it would not have a significant impact when used to understand water governance in Mariental. It is thus recommended to further investigate in another semi-arid environment other than Mariental to validate the findings of this study, and the applicability of the Three-Layer Model of water governance in a semi-arid environment.

8. REFERENCES

Ahmad, S. (2016). Managing Water Demands for a Rapidly Growing City in Semi-Arid Environment: Study of Las Vegas, Nevada. *International Journal of Water Resources and Arid Environments*, *5*(1), 35–42.

Amakali, M., & Shixwameni, L. (2003). River basin management in Namibia. *Physics and Chemistry of the Earth*, *28*(20–27), 1055–1062. https://doi.org/10.1016/j.pce.2003.08.047

Amwaama, A. (2021). *Personal communication; interview*. Windhoek.

Anne, H., Kameri-Mbote, P., & Barbara, van K. (2015). The Human Right to Water and Sanitation in a Legal Pluralist Landscape: Perspectives of Southern and Eastern African Women1. In *Water Is Life*. https://doi.org/10.30835/2413-7510.2012.59833

Arnstein, S. R. (1969). A Ladder Of Citizen Participation. *Journal of the American Planning Association*, *35*(4), 216–224. https://doi.org/10.1080/01944366908977225

Clemnsius, T. (2005). *Decentralization in Nambia: A case study of the Hardap Regional Council*. University of the Western Cape.

Cloete, G., Benito, G., Grodek, T., Porat, N., Enzel, Y., & Y. (2018). Analyses of the magnitude and frequency of a 400-year flood record in the Fish River Basin, Namibia. *Geomorphology*, *320*, 1–17. https://doi.org/10.1016/j.geomorph.2018.07.025

Cloete, G. C., Basson, G. R., & Sinske, S. A. (2014). Revision of regional maximum flood (RMF) estimation in Namibia. *Water SA*, *40*(3), 535–548. https://doi.org/10.4314/wsa.v40i3.18

Cloete, Gert Christiaan. (2015). *Risk-based dam safety in Namibia : a quantitative approach*. Stellenbosch University.

Cloete, L. (2020, April 3). Cloudburst floods parts of Mariental - The Namibian. *The Namibian*, p. 3.

De Rynck, F., & Voets, J. (2006). Democracy in area-based policy networks: The case of Ghent. *American Review of Public Administration*, *36*(1), 58–78. https://doi.org/10.1177/0275074005282585

Franks, T., & Cleaver, F. (2007). Water governance and poverty: A framework for analysis. *Progress in Development Studies*, *7*(4), 291–306. https://doi.org/10.1177/146499340700700402

Friese, S. (2020). *ATLAS. ti 8 Windows Manual*. Retrieved from http://downloads.atlasti.com/docs/manual/atlasti_v8_manual_en.pdf

Galvez, V., Rojas, R., Bennison, G., Prats, C., & Claro, E. (2019). Collaborate or perish: water resources management under contentious water use in a semiarid basin. *International Journal of River Basin Management*. https://doi.org/10.1080/15715124.2019.1634083

Government of Republic of Namibia. (2001). *Decentralization Enabling Act, 2000 (Act No. 33 Of 2000)*. Windhoek.

Government of Republic of Namibia. (2013). Water Resources Management Act (No. 11 of 2013). *Government Gazette*, (5367), 1–72.

Harrington, C. (2017). The political ontology of collaborative water governance. *Water International*, *42*(3), 254–270. https://doi.org/10.1080/02508060.2017.1309507

Hattingh, L., Cloete, G., Mostert, A., & Muir, C. (2017). The impact of hydrology on the adequate of

existing dams to safety standards- the Namibian experience. In *Dam Maintenance and Rehabilitation* (2nd ed., pp. 383–385). https://doi.org/10.1201/9781315140728

Havekes, H., Hofstra, M., Kerk, A. Van Der, Teeuwen, B., Cleef, R. Van, & Oasterloo, K. (2016). *Building blocks for good water governance.The Hague:Water Governance Centre*.

Hegga, S., Kunamwene, I., & Ziervogel, G. (2020). Local participation in decentralized water governance: insights from north-central Namibia. *Regional Environmental Change*, *20*(3). https://doi.org/10.1007/s10113-020-01674-x

Hellum, A., Ikdahl, I., & Kameri-Mbote, P. (2015). Turning the Tide: Engendering the Human Right to Water and Sanitation. In *Water Is Life*.

Heyns, P. (2004). Water institutional reforms in Namibia. *Water Policy*, *7*(1), 89–106.

Hoegh-Guldberg, O., Jacob, D., & Taylor, M. (2018). Chapter 3: Impacts of 1.5°C global warming on natural and human systems. In: Global Warming of 1.5 °C. An IPCC special report on the impacts of global warming of 1.5 °C above preindustrial levels and related global greenhouse gas emission pathways [...]. In *Special Report, Intergovernmental Panel on Climate Change*.

Hofstra, M. (2013). Water governance: a framework for better communication. *Building Blocks for Good Water Governance*, 8–21.

Houston, D., Werritty, A., Bassett, D., Geddes, A., Hoolachan, A., & McMillan, M. (2011). *Pluvial (rain-related) flooding in urban areas: the invisible hazard*. Retrieved from http://www.jrf.org.uk/sites/files/jrf/urban-flood-risk-full.pdf

Hugo, S. (2013, February). Insurer revokes flood cover for Mariental, Namibia _ RISKAfrica Magazine. *Risk Africa Magazine*, 2968.

ICWE. (1992). *1992 Dublin Statement On Water And Sustainable Development Introduction Scarcity*. *19*(5), 463–466.

IWRM Plan Joint Venture Namibia. (2010). *Integrated Water Resources Management Plan for Namibia*.

Jon Pierre and Guy Peter. (2000). *Governance, politics and the state / Jon Pierre and B. Guy Peters*.

Keller, N., & Hartmann, T. (2019). OECD water governance principles on the local scale–an exploration in Dutch water management. *International Journal of River Basin Management*. https://doi.org/10.1080/15715124.2019.1653308

Malapi, W. (2013). *Mariental Municipality ' Creating a Safe Haven for all Residents, especially vulnerable groups like women .'*

Mariental Municipality. (2011). *Mariental Scheme Index Map*.

Mariental Municipality. (2012). *Mariental Town Planning Amendment Scheme No.7*.

MAWAF strategic plan. (2017). *Ministry Of Agriculture, Water & Forestry Strategic Plan 2017/2018 - 2021/2022*. (February), 1–5. Retrieved from https://www.mofa.go.jp/mofaj/area/namibia/data.html

MAWRD. (2000). *National Water Policy White Paper - Policy Framework for Equitable, Efficient, and Sustainable Water Resources Management and Water Services*.

Mbaiwa, J. E. (2004). Causes and possible solutions to water resource conflicts in the Okavango River

Basin: The case of Angola, Namibia, and Botswana. *Physics and Chemistry of the Earth*, *29*(15-18 SPEC.ISS.), 1319–1326. https://doi.org/10.1016/j.pce.2004.09.015

Ménard, C., Jimenez, A., & Tropp, H. (2018). Addressing the policy-implementation gaps in water services: the key role of meso-institutions. *Water International*, *43*(1), 13–33. https://doi.org/10.1080/02508060.2017.1405696

Milechin, D., Sanguinet, W., Soderbom, L., & Terry, M. (2009). *Investigation of Income-Generating Opportunities from River reeds for Mariental, Namibia.* (May 2009). Retrieved from https://www.wpi.edu/Pubs/E-project/Available/E-project-051009-181125/unrestricted/REEDS_IQP_Report.pdf

Ministry of Agriculture Water and Forestry. (2007). *Flood risk reduction on Mariental town and Hardap irrigation scheme*.

Ministry of Environment and Tourism. (2015). *Ministry of Environment & Tourism Republic of Namibia National Climate Change Strategy & Action Plan 2013 – 2020*.

Mutorwa, J. (2021). *Namibian Parliament Session; Reporting on the Water Act of 2013*. Windhoek.

Mwinga, M., Siboleka, M., & Kavezuva, C. (2018). Economy profile for Mariental. *First Capital Treasury Solutions, Windhoek*, (4). Retrieved from http://www.firstcapitalnam.com/cms/upload/Economy Profile of Mariental.pdf

Namibia Press Agency. (2020). Hardap Dam to stop water supply to irrigation schemes end of this month – Namibia News Digest. *Namibia News Digest*. Retrieved from https://www.namibianewsdigest.com/hardap-dam-to-stop-water-supply-to-irrigation-schemes-end-of-this-month/

OCHA. (2006). *Namibia_ Floods in Mariental OCHA Situation Report No 1*. Retrieved from https://reliefweb.int/organization/ocha

OECD. (2015). G20/OECD Principles of Corporate Governance. In *G20/OECD Principles of Corporate Governance*. https://doi.org/10.1787/9789264257443-tr

OECD. (2021). Ensuring good water governance. Retrieved from https://www.oecd-ilibrary.org/sites/d1323208-en/index.html?itemId=/content/component/d1323208-en

ORASECOM. (2021). Regional and International Agreements. Retrieved from Orange-Senqu River Commission (ORASECOM) website: http://www.orasecom.org/about/agreements.aspx

Padt, F. J. G. (2007). Green Planning: An Institutional Analysis of Regional Environmental Planning in the Netherlands. In *Dissertation*.

Remmert, D. (2016). Water Governance in Namibia: A Tale of Delayed Implementation, Policy Shortfalls, and Miscommunication. *Democracy Report - Special Briefing Report No. 13*, (13), 1–20. https://doi.org/10.13140/RG.2.2.29746.43209

Remmert, D. (2020). *Weak Policies & Conflicting Visions : Drought, water shortages and climate change in Namibia Weak Policies & Conflicting Visions : Drought, Water Shortages and Climate Change in Namibia*. (March). https://doi.org/10.13140/RG.2.2.24488.39684

Republic of Namibia. *Town Planning Ordinance 18 of 1954*. , 1954 § (1960).

Romero, A. (2015). The Importance of water governance. *Academia*, 1–9. Retrieved from https://www.academia.edu/search?q=The Importance of Water Governance

Rose, P. (2003). Community participation in School Policy and Practice in Malawi: Balancing local knowledge, national policies, and international agency priorities. *Compare*, *33*(1), 47–64. https://doi.org/10.1080/03057920302597

Sagarika, S., Kalra, A., & Ahmad, S. (2014). Evaluating the effect of persistence on long-term trends and analyzing step changes in streamflows of the continental United States. *Journal of Hydrology*, *517*, 36–53. https://doi.org/10.1016/j.jhydrol.2014.05.002

Seely, M., Henderson, J., Heyns, P., Jacobson, P., Nakale, T., Nantanga, K., & Schachtschneider, K. (2003). Ephemeral and endoreic river systems: Relevance and management challenges. … *Rivers, Sovereignty* …, 187–212. Retrieved from http://www.anthonyturton.com/admin/my_documents/my_files/157_Chapter_9.pdf

Smith, G. R. (1999). Area-based Initiatives : The rationale and options for area targeting. *LSE STICERD Research Paper No. CASE025*, (May), 1–78.

Solanes, M., & Jouravlev, A. (2006). Water Governance for Development and Sustainability. In *Recorsos Naturales e Infraestructura Serie 111*.

Stockholm International Water Institute. (2018). *New framework on water governance for practitioners*. Retrieved from https://www.siwi.org/latest/new-framework-on-water-governance-for-practitioners/

Tanner M. (2005, August 30). The Importance of the Annual Nile Flooding for the Nile River Valley Civilisation.

Tordiffe, E. (2010). *Groundwater monitoring in the Orange-Fish River Basin, Namibia : Recommendations towards establishing a monitoring system*. (April). Retrieved from www.drfn.org.na/erb/index.html

UNDRR. (2020). *Namibia for Disaster Risk Reduction*. Retrieved from https://www.preventionweb.net/files/70698_namibiadigital.pdf

United Nation. (2020). The Sustainable Development Goals Report. In *Design for Global Challenges and Goals*. https://doi.org/10.4324/9781003099680-3

United Nations. (1997). The UN Convention on the Law of the Non-Navigational Uses of International Watercourses: Prospects and Pitfalls. *World Bank Technical Paper*, *49*(49), 1–18. Retrieved from https://www.unece.org/fileadmin/DAM/env/water/cwc/legal/UNConvention_McCaffrey.pdf

Vugteveen, P., Lenders, H. J. R., Devilee, J. L. A., Leuven, R. S. E. W., van der Veeren, R. J. H. M., Wiering, M. A., & Hendriks, A. J. (2010). Stakeholder value orientations in water management. *Society and Natural Resources*, *23*(9), 805–821. https://doi.org/10.1080/08941920903496952

Water Governance Centre. (2013). *Read for you User's guide on Assessing Water Governance*. 67–68. Retrieved from https://silo.tips/download/wgc-nieuwsbrief-special-voorugelezen-usersguide-water-governance

Westacott, E. (2019). Moral Philosophy according to Immanuel Kant. *31 August 2019*, 1–5. Retrieved from https://www.thoughtco.com/kantian-ethics-moral-philosophy-immanuel-kant-4045398

Wolfe, S. E. (2009). What's your story? Practitioners' tacit knowledge and water demand management policies in southern Africa and Canada. *Water Policy*, *11*(4), 489–503. https://doi.org/10.2166/wp.2009.059

9. APPENDIX

Appendix 1 : Questionnaire; Organizations and Committee
http://app.maptionnaire.com/en/8680

Appendix 2: Questionnaire; Community members
http://app.maptionnaire.com/en/9860/

Appendix 3: Excel sheet; responses from organizations and committees
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Appendix 4: Excel sheet; responses from community members
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Appendix 5: Non-Disclosure Form: Namibia Water Corporation
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Appendix 6: Request for data assistance
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Appendix 7: Description of the different functions used in ATLAS.ti, adapted from (Friese, 2020)

Functions	Descriptions
Documents	Data added to ATLAS.ti project (text, video, audio, or geographic elements
Quotations	Texts or content in the document that are relevant to the user (Text Quotations)
Group Codes	High-level classifiers or concepts that can be sub-divided into multiple codes
Codes	Classifiers or an abstract of quotation meanings
Network	Semantic representation of different functions (codes, quotations, memo, and groups); express relationship in a visual diagram
Group Memo	High-level description of quotations and can be sub-divided by memos.
Memo	Description of quotations, usually longer than codes

Appendix 8: Codebook to analyze responses from the organizations in water governance

Legend

Content Layer Institutional Layer Relational Layer

Concepts	Codes	Comment/ further description
Community Awareness	Channels of communication	Approaches used for awareness might not be effective, need to be revamped, and be more inclusive and outreaching. Water authorities need to be content with community participation as there are no obligations to hold them accountable
	Communication frequency & Constant communication needed	
	Mode of communication	
	Need to be more inclusive, Need for more awareness	
Community Capacity	Financial capacity	Structures for community participation underfunded
	Representation capacity: Skills	Community members have enough skills and knowledge about water governance, consulted through existing structures
	Representation capacity: Knowledge	
	Resource management capacity	
Community Participation	Alerts	Community alerts water authorities
	Appreciate community participation	Water authorities appreciate community participation in water governance
	Channels of communication	These are not welcomed or noticeable to community members, though in existence. Participation needs to be strengthened by adjudicating the Water Act of 2013. most structures are dormant
	Communication frequency	
	Information on participation	
	Mode of communication	
	Need to be more inclusive, Deliberate Exclusion, Exclusion in water governance	The status quo needs to be revived, currently exclude community participation
	Need to strengthen the bond, Motivation to participate	The bond between different actors in water governance needs to be strengthened and motivated
	Participation and water policies	The connection between community participation and

		existing water policies
	Representation capacity: Skills	Ability to communicate and understanding water governance; Community have skills and knowledge
	Representation capacity: Knowledge	
	Solving conflict	Who, where, and how conflicts are solved
	Volunteers	Community participate voluntarily
	Willingness to participate	The community is willing to participate in water governance
Organizations in water governance	Lack of experts	Constrained by lack of experts
	Organization/ committee upkeep	Support of organizations structure to engage in community participation
	Engagement strategies	This need to be improved within organizations, currently not effective
	Gaps in data	Missing data, inability to produce data
	Guiding documents	Existing documents that refer/guide organizational procedures
	Resource management capacity	This is a challenge especially with the lack of experts, and gaps in data.
	Organizational Mandates, Rights and responsibilities, Undefined responsibilities	Mandates not always fulfilled, undefined responsibilities causing havoc in water governance
Population group	Erdely	All affected and need to be consulted for improved water governance.
	Farmers	
	Non-farmers	
	Participation and water policies	Participation of defined group and the connection to water policies
	Proximity to the water source	Grouping based on access to water sources/points

	Traditional leader, Include Traditional Authorities	Involvement of traditional authorities /leaders in water governance
	Young	Not active in water governance
	Economically active	
	Economically inactive, Informal Settlement, Uneducated /Illiterate	Most economically inactive residents live in informal settlements and are illiterate on water governance issues
Relation in water governance	Relation between the water authorities	Poor coordination, redundant and undefined responsibilities are the main challenge between water authorities
	Relation within communities	Connection within communities themselves and how they connect with water-related aspects
	Communities & water authority relation	Relationship deteriorating due to water tariffs
	Poor coordination	Coordination between authorities is a problem in water governance
	Water-related conflicts	The main challenge in Mariental
Water Financing	Consistency of fiscal &pricing support	No obligation to fund or support community participation despite the Water Act. Can not be held accountable due to lack of power in the act
	Economically active	Not complaining much compared to the inactive ones
	Economically inactive, High Water Tariffs	Water affordability is the main issue in Mariental.
	Financial capacity	A committee such as BMC is not adequately funded
	Legal battles	Existing legal battles between organizations due to water financing

	Remuneration	Paying for community participation and cost endured by participants
	Volunteership	Voluntary work
	Water affordability	Water not affordable in Mariental, legal battles because of financing approaches used
Water Policies	Applicability	Applicability of water policies is a concern for community participation
	Guiding Document	Documents guiding different organizations, procedures, rights, and responsibilities
	Implementation	Sound water policies are in existence but lack implementation
	Participation and Water policies	
	Policies on Decentralization	
Water Use	Consistency of Fiscal &Pricing Support	Inconsistency of organizations in water billing and no support or funds for community participation
	Delayed establishment of wells	Water use in Mariental is affected by the delay in establishing new wells
	Dirty Water, Lack of Water Point, Shadowing other small entities,	One of the problems facing Mariental
	Domestic Water Use	Most users are domestic water users although they use the least relative to others.
	Lack of Experts Need for flood intervention	Water use is constrained by a lack of experts in water authorities and inadequate flood interventions
	Legal battles	Legal battles constraints water use. Registered between farmers union and Namibia Water Corporation
	Save Water	Community need to save water, also need to be taught how to save it

	Successful establishment of wells, Working Together	Mariental community also contribute to locating suitable well
	Successful establishment of wells	The community helped in the establishment, working together has been fruitful
	Water Accessibility	Factors affecting water use in Mariental
	Water Affordability	
	Water Dependency	
	Water-Related Conflict	
	Water Supply, Threats on water supply, Operation of Dam	

Appendix 9: Code Book to analyze community members' responses

Legend

Content Layer Institutional Layer Relational Layer

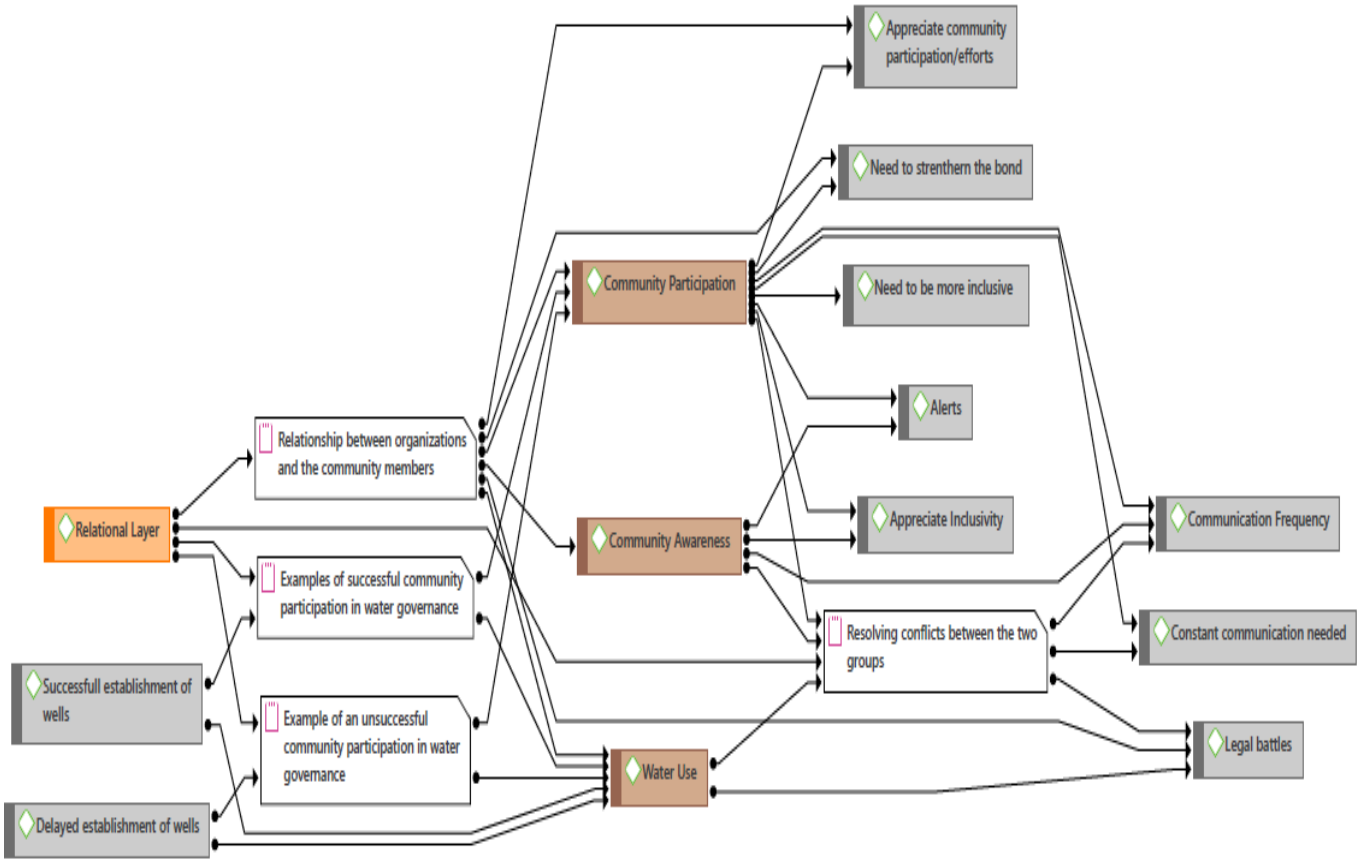
Concepts	**Codes**	**Comment/ further description**
Community Awareness	Channels of communication	Most respondents do not know of the channels to communicate in water governance
	Communication frequency & Constant communication needed	The commitment to communicate with water users is not observed and needs to be improved
	Mode of communication	Media, radio are used more often
Community Capacity	Financial capacity	Ability to pay water tariffs and contribute to water governance
	Representation capacity: Skills	ability to contribute and knowledge about water governance in respondents
	Representation capacity: Knowledge	
	Resource management capacity	
Community Participation	Channels of communication	These factors need to be revised. Negative sentiments were recorded from the respondents
	Communication frequency	
	Information on participation	

	Mode of communication	
	Need to be more inclusive	
	Participation and water policies	The connection between community participation and existing water policies
	Representation capacity: Skills	There are enough skills and knowledge in the community to contribute to water governance
	Representation capacity: Knowledge	
	Volunteership	Community participates voluntarily and they do not like it.
	Willingness to participate	The community is willing to participate in water governance
	Rights and responsibilities	Community members unaware of rights to participation in water governance
	Erdely , Farmers, Non-farmers	Most of the responses/complaints or concerns are about the elderly and farmers in Mariental
	Participation and water policies	Participation of defined group and the connection to water policies, most respondents do not know about policies on community participation
Organizations in water governance	Communities & water authority relation	Most responses have negative sentiments on the relationship between water authorities and community members
	Engagement strategies	Current engagement strategies need to be revived as an organization are not visible to the community
	Water-related conflicts	Involved in conflicts
	Consistency of fiscal &pricing support	No sign of community support from water organizations for most respondents, complaints on inconsistent billing, and lack of communication from organizations

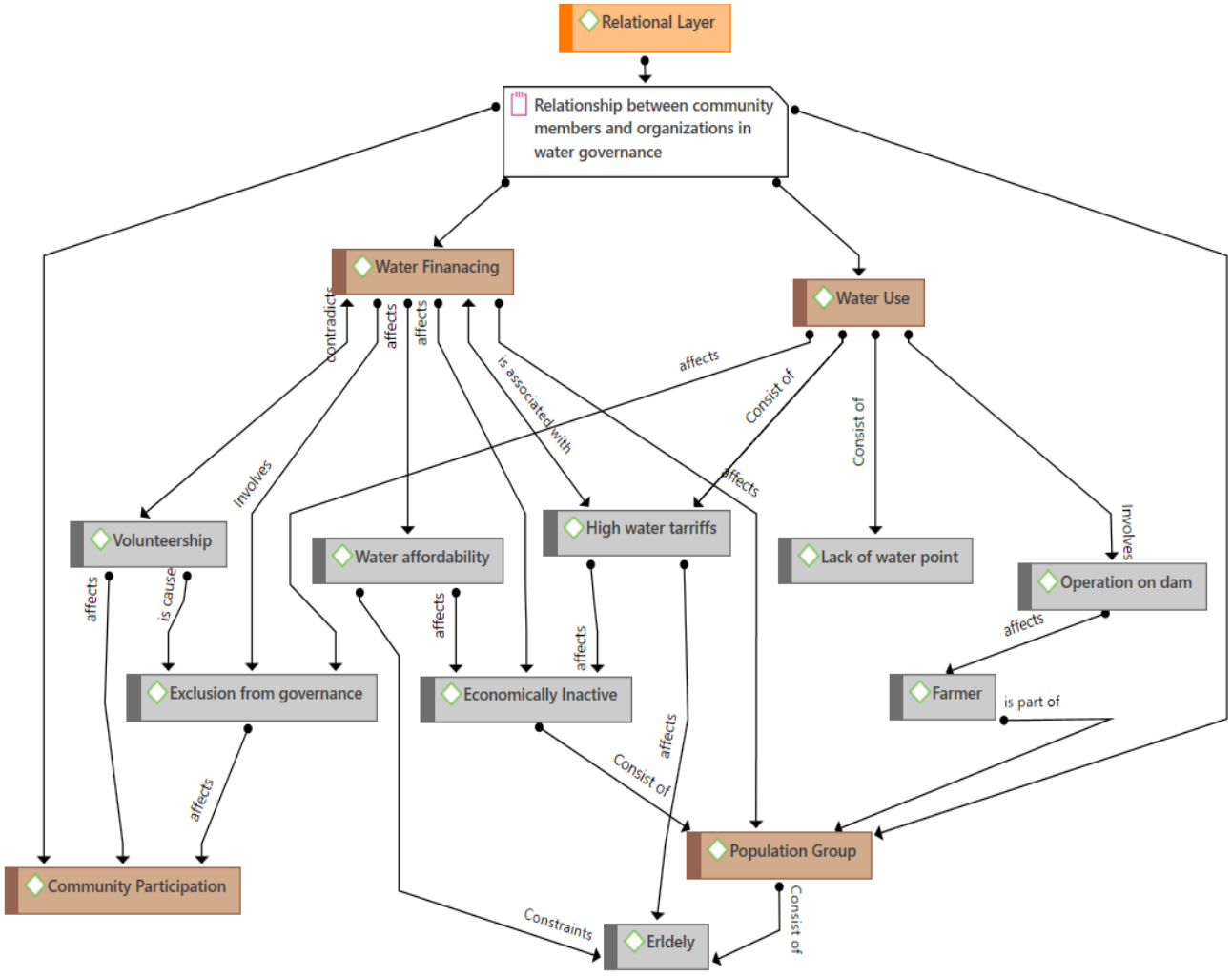
	Organizational mandates, Rights &Responsibilities	Most respondents do not the rights and responsibilities of organizations in terms of their involvement in water governance
Population group	Economically active	Do not care
	Economically inactive	Most affected by the current water governance in Mariental, and those further away from water points
	Elderly	
	Farmers	
	Proximity to the water source	
	Young	Not active in water governance
Relation in water governance	Relation of Community & organization/Committee	Not much is done from an organization especially in recognition or accountability of community participation
	Consistency of Fiscal &Pricing Support	Organizations are working in silos. Inconsistence in water billing has been observed
	Relation Within Community	Stealing water from each other, agitated by lack of water point
	Willingness to participate	The general impression is, community members are willing to participate
Water Financing	Consistency of Fiscal &Pricing Support, Financial Capacity	No support from institutions
	Economically Active	Do not care about the current situation
	Economically Inactive	Most affected by water financing
	Exclusion from governance	Organizations do not consult with community members on water tariffs
	High water tariffs	Tariffs are high and unaffordable

	Remuneration	No remuneration for community members participating in water governance
	Water Affordability	Water is not affordable in Mariental.
	Volunteership	Community members are discouraged by the voluntary work, to participate or have their input heard.
Water Policies	Applicability	Most respondents do not know of existing water policies and the applicability govern/guide water resources in Mariental. Implementation is seen as a problem and rights to participate in water governance are not well communicated
	Implementation	
	Participation Policies	
	Policies on Decentralization	Respondents feel the national government is still in control and decentralization policy is not working.
Water Use	Clean water, Dirty water Save water,	Community need clean water, need to be taught how to save water
	Lack of water point	The main problem for community members
	Exclusion from governance	The overall expression indicates total exclusion from governance, and thus affect the use of water to community members
	Operation on dam	One of the drivers of water use in Mariental
	Water accessibility	Water accessibility is also an issue
	water-related conflicts	Water use is bloated with conflict among and different actors especially within community members due to lack of water point.

Appendix 10: Relationship between organizations in water governance and community members (computed from officials in organizations)



Appendix 11: Relationship of Mariental community members and organizations in water governance (computed from community members).



Appendix 12: Advertising poster

February 8, 2021

ITC

Invitation to take part in a water governance questionnaire

Topic : Strengthening decentralized water governance in a semi-arid environment. The case of Mariental, Namibia

Researcher's details

I'm Michael Shipepe David, a student at the University of Twente in the Netherlands, pursuing a MSc in Spatial Engineering. As part of my academic obligation this study is meant to determine if and how community participation could strengthen or add value to water governance.

Participation

I humbly request the community of Mariental and nearby establishments to take part in this study.

1. Through the interview conducted in Mariental, from the 8th- 22nd February 2021.

2. Or following the links

- *https://app.maptionnaire.com/en/9860/* (Community members) ,
- *https://app.maptionnaire.com/en/8680/* (Water authorities & organizations involved in water governance) .

Note: The links above can also be accessed by scanning the QR codes below

Data Protection: All information or data supplied through the questionnaire are solely meant for academic purpose ,and will be handled according to GDPR, Data Protection.

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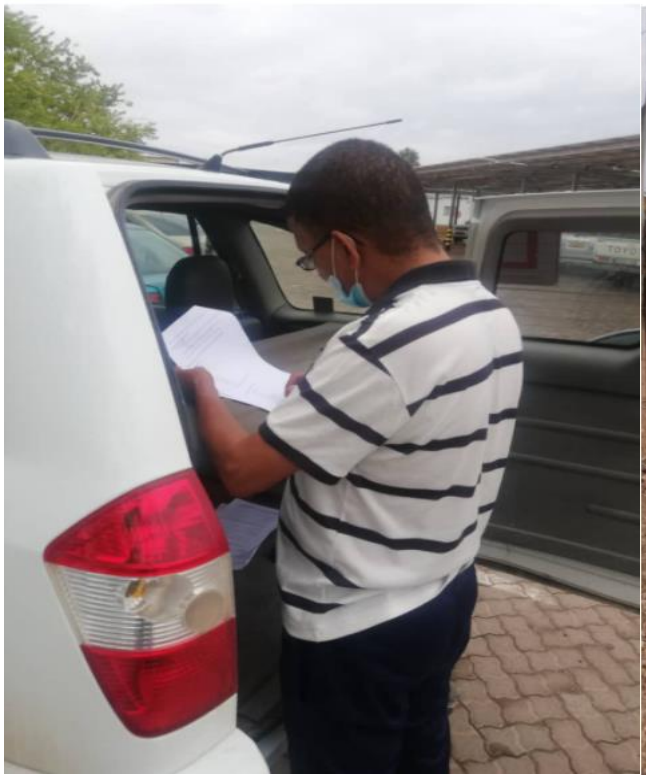
Community members

Water Authorities and other organizations involved in water governance

Appendix 13: Pictures from fieldwork




MARIENTAL PIGGERY


HARDAP POLICE REGIONAL
HEADQUARTERS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