Stakeholder research CoVE Water SA

CoVE Water SA the umbrella for all stakeholders

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Preface and acknowledgements

This report is written as part of the course CEGM3000 Multidisciplinary Project. The purpose of the report is to perform a project, on a Civil Engineering related topic, with a multidisciplinary group of students. The CoVE Water SA project aims to strengthen the network of the water sector in South Africa and improve the Vocational Excellence education.

During the project different individuals and companies were involved, which was a great contribution to the project. First of all, we would like to thank our supervisors Dr. J.A. Annema and Dr. L. Scholten for their support and feedback during the project. Besides our supervisors from the TU Delft, we would also like to thank Manuel Jackson and Renoir Hindley. They have helped us a lot during our research in South Africa. They provided us with useful information and assisted in setting up all the interviews. Without their help we would not have been able to identify and describe the gaps and opportunities of the CoVE Water SA project.

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Abstract

The water and sanitation sector faces issues that are challenging to address, leading to the establishment of the Platform of Vocational Excellence (PoVE) Water. This platform brings together five regional Centers of Vocational Excellence (CoVE) Water in Europe and South Africa to ensure high-quality skills and competencies in the water sector. These CoVEs Water facilitate collaboration among stakeholders, enabling the development of vocational education and training programs to increase awareness, enhance responsiveness to industry needs, and address sector challenges. A few months ago, CoVE Water SA was established in South Africa to achieve the previously mentioned goals. As the platform is in its initial set-up phase, the following research question is analysed in order to further establish the network: *What actions need to be taken to enhance the effectiveness of the CoVE Water SA?*

To answer the research question, interviews were conducted with several important stakeholders. Subsequently, the interviews were analysed thematically in order to extract the most important themes and quotes, PI grids were created to assess power and interest dynamics among stakeholders, and a Social Network Analysis was conducted to understand the CoVE Water SA network and potential clusters.

The research findings have unveiled key aspects for enhancing the effectiveness of CoVE Water SA. The current network in the water sector has a low density, implying that many collaborations are lacking. This leads to a high degree of interdependence within the network, resulting in a non-dynamic system. The lack of collaborations, such as connections with TVET colleges, schools, farmers and local communities, results in a lack of knowledge, funding, and connections to the labour market. Governmental stakeholders, like DWS, EWSeta, and BGCMA, have been identified as influential players with extensive networks and important resources, Local Authorities and Research Organizations also play important roles. Additionally, universities exhibit substantial international links, making them crucial contributors. These stakeholders have the potential to provide knowledge, collaboration, and power to the CoVE Water SA.

Furthermore, six key themes have been derived from the conducted interviews, addressing the needs of stakeholders and where CoVE can make a valuable contribution. These themes include raising awareness, reducing the skills gap in the water sector, fostering international collaborations, mitigating the labour shortage in the water sector, improving education material, and establishing desired collaborations. For each theme, the interviewed stakeholders have presented their views and numerous suggestions on how CoVE Water SA can assist in addressing these issues. Additionally, stakeholders have also mentioned possible failures of CoVE Water SA, which can aid in preventing any shortcomings of the platform. Furthermore, stakeholders mentioned ongoing initiatives related to the six themes, through which they can contribute to the platform.

From the Thematic Analysis, PI Grids and the SNA, a set of actions have emerged that are essential for enhancing the effectiveness of CoVE Water SA. These actions revolve around expanding and enhancing the network, organising activities, and contributing to educational improvement. In terms of broadening and strengthening the network, the platform should focus on enhancing the collaborations among educational groups, building stronger relations

with international institutions in Europe and Africa, involving TVETs and schools within the water network, improving stakeholder involvement and encouraging the involvement of Local Communities to increase awareness and knowledge about water issues. Furthermore, CoVE Water SA should play a role in organising activities to raise awareness of Water Resource Management. Additionally, it should assist in improving curricula, supporting students' preparation for the workforce, and making the education more practical instead of only theoretical. CoVE Water SA should also provide training and learning resources as well as comprehensive courses.

However, this study recognizes several limitations that should be considered in future research and when implementing recommendations for CoVE Water SA. These limitations encompass factors like a limited scope due to resource and time constraints, minimal varied interviewee responses, and potential biases in responses. Addressing these limitations will be crucial in guiding future research and actions for CoVE Water SA.

Content

List of Abbreviations

Abbreviation	Definition
AgriSeta	Agriculture Sector Education Training Authority
BCGMA	Breede Gouritz Catchment Management Agency
CMA	Catchment Management Agency
CMF	Catchment Management Fora
CoVE	Center of Vocational Excellence
CSIR	Council for Scientific Industrial Research
DEA	Department of Environmental Affairs
DHET	Department of Higher education and training
DWS	Department of Water and Sanitation
EWSeta	Energy Water Sector Education Training Authority
NGO's	Non-Governmental Organisations
PoVE	Platform of Vocational Excellence Water
QCTO	Quality Council of Trades and Occupations
SA	South Africa
TIA	Technology and innovation agency
TVET	Technical and Vocational Education and Training
UWC	University of Western Cape
UCT	University of Cape Town
VET	Vocational Education and Training
IWMI	International Water Management Institutions

1. Introduction

1.1 Context and relevance of the project

Literature shows that the issues within the water and sanitation sector are known, however tackling these issues proceeds with difficulty (Department of Water Affairs, 2013) (Knüppe and Meissner, 2016) (Malzbender et al., 2005). These issues cannot be solved by people on their own, but it requires collaboration between multiple disciplines. This is the main reason for setting up the Platform of Vocational Excellence (PoVE) Water. The platform brings together 5 regional Centers of Vocational Excellence (CoVE) Water in Europe and South Africa. The aim of the platform is to integrate Vocational Excellence in the water sector, thus ensuring high quality skills and competences that lead to quality jobs and careers, meeting the needs of an innovative, inclusive, and sustainable economy (PoVE Water, n.d.a). To realise this goal, CoVEs Water are established, providing a platform where different stakeholders can collaborate and share knowledge. This shared knowledge will be used for developing vocational education and training programmes. Through the collaborative platform and the vocational education and training programmes, PoVE Water aims to increase the awareness and interest in the water sector, improve the responsiveness of schools to companies and ultimately contribute to tackling the challenges within the water sector.

A few months ago, the CoVE Water SA was launched in South Africa. The platform will work as a medium to connect TVET schools, universities, public and private businesses, research institutions, governmental institutions etc. to reach the goals that are mentioned earlier. In South Africa the water sector is very conservative which makes it challenging to attract young people to enter the sector. Additionally, Water Resource Management is not a widely recognized subject at TVET colleges. Moreover, there is often a skills gap between the theoretical knowledge students have and the practical skills that are required in the workspace. The collaborations that emerge from the platform will hopefully foster an increase in interest and awareness of the water sector. Furthermore, the platform will serve as a place where knowledge can be shared, in order to improve the curricula and bridging the gap between theoretical knowledge and practical skills required.

This research will analyse what can be done to improve the platform in South Africa, what kind of stakeholders should be involved and how partnerships can be created. Therefore, it is important to understand what the needs and interests of the stakeholders are, what CoVE Water SA can offer, and what is needed to ensure this.

1.2 Objectives

Based on the previous information, the following main question can be formulated:
What actions need to be taken to enhance the effectiveness of the CoVE Water SA?

To be able to answer the main question, the following sub questions are formulated:

- *What makes the CoVE Water SA effective?*
- *Who are the key stakeholders and what is their current participation and collaboration with the platform?*

- *What should the CoVE Water SA offer to achieve the goals and needs of the stakeholders?*
- *What can the stakeholders offer to the CoVE Water SA?*
- *What can CoVE Water SA contribute to improve the network?*

1.3 Structure of the report

The report consists of eight chapters. Preceding the first chapter is the summary of the entire study. In the first chapter, the context and relevance of the study is described. Based on this, a main question and associated sub-questions are formulated. Following, a literature review is given in chapter 2, about the water networks and its laws in South Africa. The third chapter gives some general information about the CoVE Water SA to get a further understanding of the project itself and the current state. Chapter 4 describes the research method and approach. Next, a stakeholder analysis is conducted in chapter 5. Here, different models are used to understand the roles of the stakeholders and the relations between them. In chapter 6 the results of the study can be found. Finally, chapter 7 draws a conclusion and chapter 8 discusses limitations of the study.

2. Water network and water governance in South Africa

2.1 Water network

The governance of water networks in South Africa consists of a complex set of policies, regulations, and institutions, aimed at managing and providing water resources. Understanding the institutional and legislative context is crucial for addressing challenges related to water access and participatory governance. The major institutions and stakeholders within the water sector in South Africa are organised into different levels (Rodina et al., 2016). At national level, the Department of Water and Sanitation (DWS), before 2014 known as the Department of Water Affairs and Forestry (DWAF), is responsible for formulating policies and regulations, and it plays a vital role in the overall management of the country's water resources.

At regional level, multiple entities are active, including Catchment Management Agencies (CMAs) and Water Boards. CMAs ensure that water resources are managed effectively at catchment or regional level and actively involve local communities. South Africa is divided into 19 Water Management Areas (WMS), each with its own CMA. CMAs are delegated a wide range of responsibilities for water resource management within their respective catchment areas. The Minister of Water Affairs is responsible for the regulation of the CMAs (DWA, 2014). Within the CMAs, there are Catchment Management Forums (CMFs) and Catchment Management Committees, which foster community engagement within a water management area (Makaya et al., 2020). Water Boards are public water service providers, providing bulk services to Water Service Authorities (WSAs), regulated directly by DWS, and retail services, regulated by contract with the WSA (DWA, 2014). The Water Boards assist municipalities by managing, providing, and operating regional infrastructure for bulk water services.

At local level, Water Service Authorities (WSA), which are municipalities who are given responsibility for ensuring access to water services, are responsible for guaranteeing access to both water supply and sanitation services (DWS, n.d.). The WSAs are regulated by the Department of Cooperative Government and Traditional Affairs (DWA, 2014). Water Service Providers (WSPs) deliver water and sanitation services to consumers through contractual arrangements with the WSA. The role of a WSP can be fulfilled by a municipality, water board, community-based organisation, non-governmental organisation, private sector company or any other public or private entity (DWS, n.d.). Water User Associations (WUA) are cooperative organisations formed by individual water users who want to engage in water-related activities. The WUAs are specifically designed for the management of regional water resources and associated infrastructure. Their primary function is to ensure fair and reliable water supply to their members, such as farmers. The Minister of Water and Sanitation is responsible for the regulation of the WUAs (DWS, n.d.).

2.2 Water governance

All institutions related to Water Resource Management act based on different policies and regulations, such as the National Water Policy, the National Water Act (Act 26 of 1998) and the Water Services Act (Act 108 of 1997). These are transformative pieces of legislation aimed at rectifying past problems and promoting a better future. The purpose of the National Water Act is to protect and manage the nation's water resources, ensure access to basic human needs, foster fair access to water, address historical inequalities, support economic and social development and conserve aquatic ecosystems.

The profound political and social shifts in South Africa in the early 1990s exacerbated the gap between outdated policies and changing resource management needs. The 1956 Water Act's focus on the development of water resources and riparian rights was insufficient to adapt to the changing political, social, and economic landscape (Karodia & Weston, 2001). The recognition of ecological integrity and the role of watercourses in conserving resource quality required more integrated, dynamic, and flexible policies and legislation.

During the apartheid era, water supply followed a policy that segregated white, black, and coloured communities (Rodina et al., 2016). The Department of Bantu Administration and Development managed water supplies for black communities, under the control of DWA. With the advent of the new constitution and a democratic government in the mid-1990s, new regulatory frameworks for water were aimed at addressing past inequities and engaging with marginalised communities. The most important post-Apartheid legislation and water policies are (Rodina et al., 2016):

- The **1994 White Paper on Water Supply and Sanitation** tackles issues of equity in the allocation of water resources and the development of water supply.
- The **1996 Constitution of the Republic of South Africa** specifies that every individual has the right to have access to adequate food and water. In addition, the constitution guarantees the right to a safe and healthy environment, which must be preserved for the benefit of both present and coming generations.
- The **1997 White Paper on a National Water Policy** identifies water as a public good, as confirmed by the DWA in 2014. It describes three core principles for Water Resources Management: efficiency, sustainability, and equity. It contained new integrated policy positions for protection, development, utilisation control, management, and conservation of South Africa's water resources (Karodia & Weston, 2001).
- The **Water Services Act** established the Department of Water Affairs and Forestry (DWAF), which is now known as the Department of Water and Sanitation (DWS), as the regulator, Water Boards acting as bulk providers and municipalities as service providers, in line with the Water and Sanitation Project of 2011.
- Two key regulatory frameworks that operationalise the right to access free basic water as part of the Water Services Act are the **Guidelines for Compulsory National Standards and the Norms** & **Standards for Water Services Tariffs**, as determined by the DWAF in 2002.
- The **National Water Act** in South Africa, which replaces the previous Water Act of 1956, redefines water rights and introduces a new framework for monitoring and managing water resources, as outlined in the 2011 Water and Sanitation Project.

This legislation encourages the introduction of Integrated Water Resource Management (IWRM). The power of this kind of approach is that it enables the adaptability required to manage and regulate a dynamic world (Karodia & Weston, 2001).

- The **National Environmental Management Act** of 1998 establishes principles for cooperative environmental management and guides decision-making on environmental issues.
- The **2001 White Paper on Basic Household Sanitation** addresses service delivery backlogs in rural areas with low population density, preferring a demand-driven approach that empowers households to maintain and service their toilets independently, in contrast with the supply-driven approach to free basic water policy set out by the South African Local Government Association in 2008.
- The **2003 Strategic Framework for Water Services** introduced free basic water. In 2014, the city of Cape Town also added the following two conditions: a common tap/standpipe must be positioned within 200 metres of a household and a maximum of 25 households may share one tap.
- A government review determined that to guarantee financial feasibility, free basic water would be provided only to needy households, according to the DWA in 2014. In addition, the framework aims to reiterate municipal responsibility for providing water supply and sanitation services, prescribed by the Municipal Systems Act of 2000, to ensure the "progressive realisation" of the right to water.
- The **2008 Water Allocation Reform Strategy** seeks to redress the inequalities in water allocation of the past. The goal is that by 2024, 60% of water that can be allocated should be owned by black people, half of which should be owned by black women, as stated by the DWA in 2008.
- The **National Water Resource Strategy 2** of 2013 will ensure the long-term protection and conservation of water resources while contributing to the country's economic and social goals.

3. CoVE Water SA

This chapter explains more in depth what CoVE is about. It expresses how CoVE is set up, for whom CoVE is interesting, what its objectives are, what their focus points are at the moment and what the current state of the project is.

3. 1 CoVE Water & PoVE Water

The Centre of Vocational Excellence (CoVE) Water fosters Vocational Excellence by operating at regional and national levels, integrating Vocational Education closely within the regional innovation ecosystems related to the water sector. They collaborate with various entities, including water technology businesses, chambers of industry and commerce, tertiary education, research institutions, public authorities, companies etc. (PoVE Water, 2019). A CoVE serves as a connection to bring together schools, companies and governmental institutions in a specific region and sector, in this case water sector. Their primary objective is to develop a range of services and initiatives aimed at enhancing Vocational Education Training (VET) curricula and teaching and learning methods. In other words, CoVE established a network of partners delivering high-quality vocational skills to both young people and adults. Ultimately, their efforts aim to contribute to regional development and innovation (*European Commission*, n.d.).
Currently, CoVEs Water are operational in several countries, including The Netherlands, the Czech Republic, Latvia, Malta, and South Africa, where a recent launch has taken place.

There are several elements for success of a CoVE (*European Commission*, n.d.)

- Being integrated in frameworks of regional development, innovation, and smart specialisation
- Strong and long-lasting relations between stakeholders
- Integration of activities

Due to the several CoVEs Water operating in different countries, it is interesting to exchange knowledge and training with each other. To establish this, a Platform of Vocational Excellence (PoVE) Water is set up. PoVE Water introduces an EU dimension to Vocational Excellence within the water sector, promoting international collaboration among different CoVEs Water. Within the PoVE Water, each CoVE designates one representative responsible for fostering connections between the CoVEs. This process can be viewed as a bottom-up approach for achieving Vocational Excellence involving a wide array of local stakeholders. It empowers VET institutions to swiftly adjust their skills offerings to align with changing economic and social demands. This bottom-up approach is visualised in figure 1.

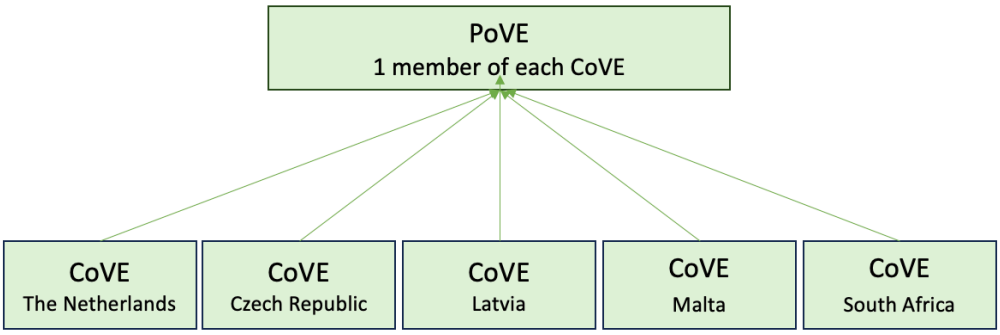

Figure 1: Visualisation bottom-up approach CoVE & PoVE

3.2 TVET schools

The CoVE Water focuses on VET education, a form of education primarily provided by TVET schools or VET schools in Europe. TVET schools represent a form of higher education distinct from universities, and these differences are detailed in table 1.

Beside enhancing VET education, CoVE Water also has the objective to involve the TVETs schools more into the water network, while these students can fill the workforce gap, which is currently notable in the water sector. Furthermore, new regulatory measures require that education organisations, including both universities and TVET schools, collaborate more closely with key stakeholders in their local setting, such as business and local government. To improve the responsiveness, TVET schools need to gain a better understanding of skills needs in their local setting and gather information about their partnerships and linkages needs with other education and training organisations, as well as employers, and so on (Kruss & Petersen, 2016). As a result, these schools will play a vital role in this project, and the CoVEs Water can offer support to help them improve their network and their skills.

Table 1: University vs. TVET College

University	*TVET College*
- stricter entry requirements for admission	- Only need grade 9 certificate to enter
- Degrees last between three to four years	- Degrees last from months to three years
- Wider range of degrees: Associates, Bachelor's or Master's	- More affordable than universities
- More fields available: Engineering, Medicine, Law and more	- Limited number of degrees
	- Practical training which can lead to a quicker job

3.3 Objectives CoVE Water SA

There are several objectives the CoVE Water SA focuses on. These focusses will be kept in mind during the analyses, so the recommendations will be aligned with these objectives.

Mobility
The department of Higher Education and Training's (DHET's) objective is to foster stronger partnerships between universities, TVET colleges, the private sector, and the government (Stellenbosch University, 2023). At the moment TVET schools have limited involvement in the water sector, and in the water sector there is a shortage of employees. To bridge this gap, it is promising to educate TVET students to become professionals in the water sector, necessitating greater engagement of TVETs within the water network and to reduce the shortage of employees in the water sector. In addition, both the TVETs and the South African water sector could benefit from more collaborations between TVETs and European schools. This international network is already in place among universities, and it would be advantageous to extend this collaboration to TVETs. The PoVE Water introduces a European dimension to TVET schools, facilitating more international connections for TVETs.

Focus on Vocational Excellence improvement
Currently, water related topics are not incorporated into the curricula of TVETs. The CoVE Water SA aims to address this gap and eventually ensure that the VET takes a prominent role in research and technological advancements in the water sector. This implies that current and future water sector professionals have the work attitude, knowledge, and competencies that the water industry demands (PoVE Water, 2019). To elevate the standard of VET, robust research is essential. Research serves as a critical metric to gauge the quality of VET, a parameter emphasised by the DHET. As DHET plays a pivotal role in establishing educational curricula, it is imperative that educational programs align with their criteria. To measure the VET is of high level, it needs to be aligned with the skills needed in the water sector. Besides high theoretical knowledge, experience and practical skills are in demand.

Stronger and more robust relation with labour market
The aim of the project is to integrate Vocational Excellence in the water sector, with the goal of ensuring the provision of high-quality skills and competencies that can lead to quality employment and careers. This aligns with the requirements of an innovative, inclusive, and sustainable economy (PoVE Water, 2019). Therefore, it is important to analyse potential collaborations that can provide access to the labour market. For example, setting up relations with municipalities and governmental departments. Ultimately, the CoVE Water SA project aims to establish a strong connection between TVET institutions and the labour market, thereby enhancing the relevance of VET to labour market demands and improving the employment prospects of graduates (Stellenbosch University, 2023).

Define funding opportunities
While the project is in its start-up phase, funding will play a key aspect. Without funding it will not be possible to set up training, events, and other activities. Therefore, it is important for the CoVE Water SA to seek where funding opportunities are lying and which stakeholders can provide them. These stakeholders will be important for the network.

3.4 Current focus points

Aligned with their objectives, CoVE Water SA main focus is setting up good VET and creating a strong network in the water sector. First of all, they believe VET education can enhance knowledge in the water sector and can contribute to solving the current challenges South Africa is facing and will face in the future. CoVE Water SA aspires to see VET education tailored to the water sector integrated into the curricula of schools, especially at TVETs, to educate and prepare students for careers as water professionals. Providing these educational programs is one of the key contributions CoVE Water SA aims to make.

In addition, they seek to establish a stronger and robust water network. They have identified gaps in the existing network, particularly regarding the involvement of TVETs. As a result, a primary focus will be to build a resilient network in which TVET schools maintain connections with the labour market, international institutions, and the broader South African water network. Promoting partnerships and linkages between TVET colleges and its stakeholders is crucial for the fundamental purpose of preparing students for the workforce or self-employment (Kruss & Petersen, 2017).

Creating these networks necessitates the active involvement of numerous stakeholders. The involvement of stakeholders within the water sector will add extreme value to the project. Partnerships and linkages are seen as mechanisms providing opportunities to enhance teaching and learning and improve graduate employment (Kruss & Petersen, 2017). These partnerships ensure the quality and standards of training expected by industry are met by the college, as the Chemical Operations project by Coastal KZN TVET also showed (CHIETA, n.d.). This project showed that the key to the success of any project is a clear vision, the formation of working partnership, based on common goals and willingness. As such, it is imperative to identify and sustain robust partnerships, identify missing linkages, and address weak connections to bolster the effectiveness of these networks.

3.5 Current situation

Few months ago, the CoVE Water SA project was launched. However, it was launched before the necessary preliminary groundwork had been completed. In other words, the network had not been created yet. Consequently, many potential partners remain relatively unaware of the project, and efforts are ongoing to engage stakeholders and bring them on board. Beside creating a network of participating stakeholders, they also lack funding. In addition to creating a network of participating stakeholders to advance VET in the water sector, there is a concurrent search for funding partners. Although conversations are already underway, there are numerous other key stakeholders who could contribute to the project.

The focus of CoVE Water SA is very momentum focussed, involving effective planning, clear communication with stakeholders, setting achievable milestones, and ensuring that every stakeholder is aligned and committed to the project. So, their focus will be building a strong network and finding funding. These momentums are essential for the project's successful executions and eventual completion.

4. Method

This chapter outlines the research methodology and explains the approaches used to address the research questions. The research is focused on gaining in-depth insights into the CoVE Water SA initiative, identifying key stakeholders and their expectations and involvement in the platform. Both qualitative and quantitative methods were applied to gain an understanding of the stakeholder network and their needs. The research approach encompasses a stakeholder analysis, data collection, interview analysis, Power Interest grids, and a Social Network Analysis.

4.1 Stakeholder analysis

The process of identifying stakeholders was facilitated with the guidance of our supervisors. They provided numerous relevant stakeholders and suggested interviewing several specific key stakeholders. Ultimately, twelve stakeholders were selected for the interviews. Care was taken to ensure that the chosen stakeholders constituted a diverse group, encompassing various types of stakeholders, including governmental entities, research institutions, TVET colleges, universities, and EU partners.

To further investigate the stakeholders, the stakeholder network scan approach from Cunningham and Hermans (2018) is applied, including several stakeholder analyses such as the Issue Tree, Instrumental and Normative Perspective, Dedicated and Non-Dedicated stakeholders and a Formal Chart. Utilising these diverse approaches, a comprehensive understanding of the stakeholders, their perspectives, and their involvement in the CoVE Water SA initiative can be obtained. This analysis aids in distinguishing the stakeholders into various sub-groups and plays a pivotal role in structuring the interviews and tailoring the questions to the specific subgroups within the stakeholder network.

4.2 Data collection

Considering the relevance and active involvement of the stakeholders in the CoVE Water SA initiative, twelve stakeholders were selected from a broader range of stakeholders. Based on the stakeholder analysis, the twelve interviewees were thoughtfully categorised into four distinct subgroups. This categorization aimed to enhance the relevance and specificity of the interview questions for each subgroup. The four subgroups are as follows:

Education

- Vhembe TVET College
- Capricorn TVET College
- University of Cape Town (Future Water Institute)
- University of Western Cape (Institute for Water Studies)

Government

- Department of Water and Sanitation
- Drakenstein Municipality
- EWSeta
- Council of Scientific Industrial Research

- Breede Gouritz Catchment Management

Private Sector
- Hanse Parlament

CoVE Water Europe
- Katapult
- Mendelu University

The data collection process comprised structured interviews with each participant, each with a distinct set of questions customised to their respective sub-group. These questions were designed to explore the specific roles and contributions of each sub-group within the framework of the CoVE Water SA initiative. Additionally, more general questions were included to explore the challenges faced by these stakeholders and South Africa as a whole in the field of Water Resource Management. A list of interview questions for each subgroup can be found in Appendix B. As the interview processed, it became apparent that adapting the questions in response to evolving insights and participant responses was of great importance.

Throughout the data collection process, ethical standards were strictly adhered. Each participant was required to sign a consent form that outlined assurances of anonymity, confidentiality, and their approval regarding auto recording of the interview. Eventually, all participants agreed to record the interview, and transcripts were made of these recordings to ensure the accuracy and completeness of data.

4.3 Thematic analysis of interview transcripts

The conducted interviews are analysed using thematic analysis, which involves identifying recurring themes within the data. These themes are derived from the prevalent topics observed during the analysis and are thus considered important by the stakeholders. Through these themes, it becomes easier to make recommendations and extract the most important and valuable quotes from the interviews.

Based on the established themes, two tables are created. The first table encompasses quotes addressing what actions CoVE should undertake or where it can provide assistance, while the second table contains quotes regarding what stakeholders can contribute to the platform. This approach facilitates the answering of the two sub questions: '*What should the CoVE Water SA offer to achieve the goals and needs of the stakeholders?'* and '*What can the stakeholders offer to the CoVE Water SA?'*

All quotes within these tables are categorised by theme. To prevent excessive length of the tables and facilitate the identification of key points, the quotes are often presented in a more generalised form, deviating from the exact words of stakeholders. When several participants expressed almost identical quotes, these statements are consolidated into a single, overarching quote. Within each theme, sub themes are created to enhance the clarity of the tables and quotes. Each sub-theme received a title that reflects the combined quotes. It is important to note that certain statements recurred more frequently than others, but this

doesn’t necessarily imply that the quote is more important. The variation in quote frequency is attributed to the specific interview questions posed to the participants, which may not be the same.

4.4 Power-Interest Grids

To further explore the sub question *"What can the stakeholders offer to the CoVE Water SA?"*, three distinct Power-Interest Grids (PI Grids) have been established. These PI Grids show what stakeholders can contribute to the CoVE Water SA and to what extent. The PI Grids are divided into three categories: knowledge, collaboration, and power, all of which are important elements for enhancing the platform.

Based on the conducted interviews and a literature review, the level of contribution to each of the three aspect is evaluated for all stakeholders. The assessment of power of each stakeholder is based on criteria such as financial resources, legal powers, political influence, and access to resources. Knowledge assessment is determined by the stakeholder's understanding of the gaps and issues in the water sector, while collaboration assessment is based on their involvement in existing collaborations, partnerships, and networks within the water sector. Furthermore, the stakeholders' level of interest in the CoVE Water SA is determined. This level of interest remains constant across the three PI Grids. Using the contribution to power, knowledge, and collaboration, as well as the level of interest, the PI Grid are constructed. These grids position the level of power, knowledge or collaboration on the y-axis and the level of interest in the CoVE Water SA on the x-axis. Stakeholders are then placed within this x-y grid based on their ratio of interest and power, knowledge, or power. The grid is divided into four spaces, marked by different colours, indicating different levels of power, knowledge or collaboration and their corresponding level of interest. Additionally, based on the stakeholder's position within the PI grids, a table of level per aspect is created. This table categorises which stakeholders score high, medium, or low on certain aspects, and these categorisations are determined by their position within the PI grids.

4.5 Social Network Analysis

The choice of Social Network Analysis (SNA) was prompted by the need to gain insight into the following sub-question, *"Who are the key stakeholders and what is their current participation and cooperation with the platform?"* The purpose of SNA is to analyse and understand social relationships within the network, identify key players, detect information flows, identify components of network dynamics, and improve decision-making. Two programs are used to conduct the SNA, Gephi and Microsoft Excel. Gephi is an open-source software tool used for the analysis and visualisation of social networks. Excel is used to collect and structure the necessary data.

Initially, a social network is built for all key stakeholders who were interviewed, to assess the strength of the relationships between these stakeholders and CoVE Water SA. To determine this strength, the results of PI Grids were used. The PI Grids provide insight into what each stakeholder can contribute to the platform. The more aspects a stakeholder can contribute, the stronger the relationship will be. In this way, it is possible to assess with which

stakeholders CoVE Water SA can work effectively, as these stakeholders have much to offer. It can also be determined which stakeholders need more support to increase their contributions to the platform.

Beyond the social network analysis involving key stakeholders to assess their potential contributions to the platform, it is also essential to construct a social network that encompasses all the significant stakeholders involved in the (water) network. Since the selection of these stakeholders is a crucial step and forms the foundation of the analysis, extensive research was conducted based on information from interviews and literature. Using this information, a careful selection of relevant stakeholders was made. The decision to include a stakeholder depended on whether they possessed any knowledge or connections within the existing network and mainly focussed on the water sector.

After selecting the stakeholders, data was collected, indicating whether stakeholders are linked to each other, and if so, what the strength of these connections is. These connections are categorised into four types, determined based on common practices and literature. These categories include Networking (weighted as 2), Cooperation (weighted as 4), Coordination (weighted as 6), and Full Collaboration (weighted as 8). The strength of each connection was determined through interviews and literature review. It is decided to increase the weights by 2 when the connection is stronger, to make the contrast between the different weights more visible.

To carefully organise and structure the collected data, a comprehensive Excel file was compiled. This file contained all correlations between stakeholders with their respective weights, so that the information was systematically organised. After the compilation of the Excel file, the data was entered into Gephi. Within Gephi, a detailed social network was constructed. This network visualises the relationships between stakeholders. Essential data related to the network, called centrality data, were systematically tabulated and stored for further analysis.

Within the context of SNA, identifying the most central stakeholders plays a significant role. Centrality concepts, including degree, closeness, betweenness, and weighted degree, provide a structured framework for understanding the relative influence and position of stakeholders within the network (Hermans et al., 2018). During the analysis, specific attention is given to both the highest and lowest values of these centrality measures, as they can provide in-depth insights into the relationships among various stakeholders and their connections with CoVE Water SA. This analysis directly pertains to the sub-question within the research. Furthermore, emphasis is placed on three specific stakeholders: CoVE Water SA, TVET institutions, and schools (primary and secondary) in South Africa. This focus is inspired by the need for the CoVE Water SA to comprehend their position within the network and the strength of their relationships with other stakeholders. Additionally, TVETs and schools are thoroughly examined as it is a core mission of CoVE Water SA to involve these parties more closely in the network. Therefore, it is crucial to determine the degree of centrality of these stakeholders within the network and to identify existing strong connections as well as those that have the potential for development.

In addition to centrality analysis, attention has been given to the identification of clusters within the social network diagram. Discovering these clusters is valuable for recognizing groups of stakeholders that exhibit strong relationships among themselves. This also provides valuable insights into the opportunities for more effective integration of these clusters into the CoVE Water SA network. Through this analysis, it can be determined how these clusters are internally connected and which stakeholders influence collaboration and cooperation strategies within these clusters.

Besides identifying network clusters, a pivotal component of the SNA involved the categorisation of stakeholders based on specific characteristics, specifically, the sectors within which these stakeholders operate. The sectors employed for this classification include:

- Government
- Education
- Research and Knowledge
- Agencies
- NGOs (Non-Governmental Organisations)
- Network Organizations
- Businesses
- Local Entities
- Water Organizations
- Energy Organizations

By utilising these sector-specific attributes, an investigation was conducted to discern the presence of 'bridges' and 'brokers' within the social network, following the structural approach outlined by Gould and Fernandez (1989, 1994). The identification of bridges and brokers hinged on the structural distribution of these sectors within the network. Uncovering such stakeholders served to provide valuable insights into the processes of stakeholder engagement within the network and the roles they assumed. These insights, in turn, held the potential to furnish valuable information and recommendations for CoVE Water SA.

5 Stakeholder Analysis

In advance of conducting the interviews, the selected stakeholders are further investigated through several methods, as explained in section 4.1. Utilising these diverse approaches, a comprehensive understanding of the stakeholders, their perspectives, and their involvement in the CoVE Water SA initiative is obtained.

5.1 Stakeholders

The stakeholders that are involved in the interviews are listed in Table 2. A more in-depth table of the stakeholders, including the objectives, perceptions, resources, and collaborations, is listed in Appendix A.1.

Table 2: Stakeholder list

Stakeholder	**Description**
CoVE Water South Africa	A platform acting within the water sector to provide knowledge and skills within this sector.
University of Cape Town (Future Water Institute)	A research institute that addresses issues of water scarcity in South Africa.
University of Western Cape (Institute for water studies)	A research institute to promote research, postgraduate training and outreach on water related issues.
Vhembe TVET College	TVET colleges fall under the department of higher education and training and focus on practical skills.
Capricorn TVET College	TVET colleges fall under the department of higher education and training and focus on practical skills.
Department of Water and Sanitation (DWS)	DWS is responsible for South Africa's water resources. They have the responsibility for the formulation and implementation of policy governing in the water sector.
Drakenstein municipality	Local municipality located in the Cape Winelands District Municipality, in the Western Cape province of South Africa.
Hanse Parlament	An association that promotes and consults small and medium-sized companies.
Katapult	A platform, located in the Netherlands, that supports public-private partnerships with tools and guidance that will benefit students, educational institutions, industry, and society.

Mendelu University	Mendelu is a public institution in the Tsjech Republic, which is connected to the CoVE in the Czech Republic.
Council for Scientific Industrial Research	A leading scientific and technology research organisation. It is an entity of the Department of Science and Innovation.
Energy Water Sector Education Training Authority	A skill development authority serving the energy and water sectors.
Breede Gouritz Catchment Management (Catchment Agency)	A Catchment Agency is a statutory body established in terms of the National Water Act to manage water resources at catchment or regional level. The Breede Gouritz Catchment Management is responsible for the area of the Gourtiz River and its major tributaries and smaller rivers in the area.

5.2 Stakeholder Analyses

The issue tree, which can be seen in Appendix A.2, illustrates what CoVE Water SA's main goal is and with which sub-goals and means they will be able to achieve it. The main goal is to attract as many people as possible to the water sector. This can be achieved through better establishment of partnerships, improving learning materials and increasing interest and awareness.

In Appendix A.3, the Instrumental normative review is presented, which shows that the key stakeholders, who will be interviewed, are divided into two groups. One group, which is called the instrumental group, can actively change the situation, and the other group, the normative group, is likely to be influenced by the actions of the instrumental group. Furthermore, in Appendix A.4, the Dedicated and Non-dedicated stakeholder analysis can be found. The conclusion can be drawn that all key stakeholders are supportive stakeholders, and their objectives align with the objective of the CoVE Water SA. However, some stakeholders are more dedicated than others. This can be further analysed during the interviews.

Lastly, the Formal chart can be seen in Appendix A.5. This chart visualises that the key stakeholders already exchange resources. This indicates that they already have connections within the water sector network. This analysis can help to set up the network with the Social Network Analysis.

6. Results

In this study, several methods were used to analyse the conducted interviews. Firstly, a thematic analysis was applied to the interviews. Based on these results, several PI grids were created in order to see power and knowledge relations. Finally, a Social Network Analysis was conducted to understand the network of CoVE Water SA more clearly and to deduce possible clusters.

6.1 Interviews results

6.1.1 Established themes

Based on the collected data from the interviews, eight themes have been established in order to structure the data and to be able to draw conclusions and recommendations. The themes are as follows:

Raising Awareness
South Africa faces the challenge that there is little awareness of Water Resource Management, often resulting in a lack of interest in studying and working in the water sector. The CoVE Water SA can contribute to raising awareness by organising activities.

Skills gap in the water sector
Graduated students may lack practical skills required by employers in the water sector. There are a lot of possibilities to bridge this skills gap, and CoVE Water SA can play a role in this.

International collaborations
International collaborations can be beneficial for students, lecturers, and employees. One can learn a lot from the knowledge and expertise of foreign countries.

Labour shortage in the water sector
The water sector is not attractive for young people to work in. The sector is very conservative making it difficult for youngsters to bring in their innovative ideas. In addition, a lot of older people who work in the sector now, will leave soon.

Improving education material
It is essential to align the curricula of schools to the needs of companies and the government, to ensure students acquire the right skills for the workspace. Practical education, in addition to theoretical education, is crucial to prepare students for their future careers.

Possible failures of the CoVE Water SA
It could happen that CoVE Water SA doesn’t achieve its goals or that it doesn't work properly. Next to that, partnerships between stakeholders might fail, for example because they don’t see the value of the partnership anymore. These possible failures can aid CoVE Water SA in preventing any shortcomings of the platform.

Desired collaborations
When upscaling CoVE Water SA, the inclusion of more partners can facilitate a broader and more diverse range of partnerships.

Success factors of the CoVE Water SA
The platform provides a space for stakeholders to collaborate and plays a vital role in facilitating these partnerships. In addition to the mentioned themes, CoVE Water SA can assist in various ways to ensure the platform's optimal functionality.

6.1.2 Conclusions based on the established themes.

The main takeaway from the interviews is understanding what the CoVE Water SA can offer to achieve the goals and needs of the stakeholders, as well as what the stakeholders can contribute to the platform in return. To address this, important quotes from the interviews are categorised according to the defined themes, as presented in Table C.1.1 and C.1.2 in Appendix C.1. These quotes form the basis for drawing conclusions within each theme. However, it should be noted that the stakeholders may potentially offer more than what was mentioned in the interviews, as these interviews did not delve deeply into this aspect. Additionally, it is worth mentioning that some of the defined themes lack quotes related to the contribution of stakeholder concerning that specific theme, as it may not be applicable. Finally, schematic representations of the themes and stakeholders are shown. The stakeholders are represented by ovals and the themes by the blue rectangular. When a stakeholder is placed under a particular theme, it indicates that the stakeholder has made a statement regarding this theme. However, it should be noted that themes containing more statements of stakeholders, are not necessarily more important than other themes.

6.1.2.1 What can the CoVE Water SA offer to the stakeholders

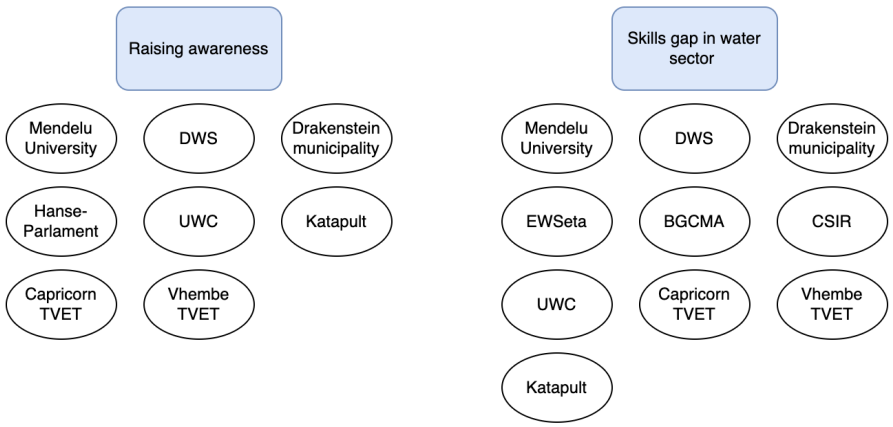

Figure 2: Thematic overview of raising awareness and skills gap in the water sector.

Raising Awareness
Many stakeholders have mentioned the potential of organising activities to generate greater awareness and interest in the water sector. These activities encompass organising hackathons, water weeks, community projects, roadshows, workshops and campaigns. However, you should only organise these activities when there is a genuine need for it.

Moreover, there are some logistical challenges when arranging such face-to-face activities, like obtaining permission for off-hours visits and organising transportation.

In the context of raising awareness, it is also important to promote Water Resource Management already in primary and secondary schools. In this way, children are introduced to the sector at an early age. In fact, the fundamental issue contributing to the lack of interest in water-related studies is the declining number of children choosing science subjects at school. Furthermore, ensuring that more TVET colleges offer courses related to water resource management is essential. Additionally, it is important to show students the various opportunities available in the water sector after their studies, as this may boost their interest.

Skills gap in the water sector

A problem that many companies in the water industry face is that students who have just graduated are often not ready for the working world. Graduates often lack job experience when they start working. In addition, a skills gap can be seen between the theoretical knowledge they have learnt in university and the practical skills they require in workplaces. CoVE Water SA, however, can help to bridge this experience gap. Besides this skills gap, there are also skills gaps related to soft skills, the ability to adapt to the work environment and the ability to solve problems and think critically.

A possible solution to better prepare graduates for the working world, is to extend the courses by one year to provide students with more guidance and strength. This can create an additional bridge between the university and the working world. Another option is to offer subjects related to general work readiness. The reason why students have a skills gap with the working world and are therefore not yet adequately prepared for it may be because schools and universities are still working with outdated learning tools and methods, combined with the lack of adaptation to current technologies.

However, the work environment also affects the utilisation of the skills of students. Even when well-educated and skilled professionals enter the workforce, their ability to make a meaningful contribution depends on the overall work environment. Multiple factors are involved, such as the culture of the organisation, level of support and political factors. As a result, skilled people may choose to seek opportunities abroad because of their frustrations and desire for a more conducive work environment.

Finally, it is worth noting that there is a high rate of ageing in the water sector. The sector has many elderly people who are retiring and are not adequately passing on their skills to the younger generation. This results in a lack of well-trained young people in the water sector. The challenge is to ensure that the skills that are being taught are retained within these workplaces. It is therefore important to not only look at the gap of skills among students but also at the possible lack of skills of those who are already working in the water sector.

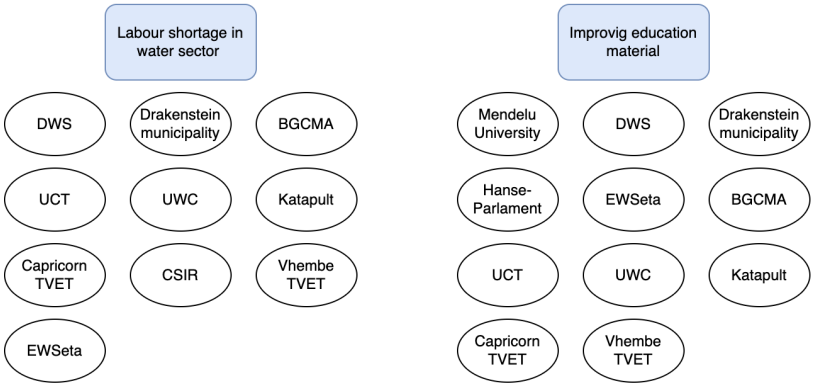

Figure 3: Thematic overview of labour shortage and improving education material.

Labour shortage in the water sector

Various stakeholders indicated that there is a shortage of people in the water sector. For newly graduated students, working in the water sector is not attractive. This is because the water sector is very conservative and offers low salaries. Furthermore, students do not find the government attractive as they often see the government work mainly as a lot of paperwork and being bogged down in excessive red tape. Moreover, students may not be fully aware of the different disciplines and roles within the sector as the government does not effectively promote its activities.

There is also a high level of failure and insecurity because of the poor investment in infrastructure. In fact, the government used to employ people, but due to finances, they cannot employ many people anymore. This then causes graduate unemployment to be very high and it is advised to many students to start their own businesses. This is exactly why it is important to get more financial support and to encourage companies to sponsor students to make the sector more attractive. This is the reason why a great deal of talent drain is now taking place in the sector. Engineers tend to leave the profession or the country because of the low salary and the conservative sector. As a result, it has become difficult to replace people who retire.

It may be recommended to increase the diversity of employees to counter the shortages of labour in the water sector. For example, focus on attracting lateral entrants and offer broader education. This will allow students to choose their specialisation later which makes students more widely employable as employees.

Improving education material

The CoVE Water SA plays a significant role in supporting its partners in enhancing education materials. The platform's assistance extends to the improvement of curricula at universities and colleges. It is important to include more water-related topics, integrate the needs of industries, and align the needs of TVET colleges and universities. Alongside maintaining an up-to-date curriculum, it is also necessary to ensure that lecturers are well-equipped to deliver high-quality education. This can be achieved by continually providing them with training and development. Moreover, it is crucial to better prepare students for the workforce and reduce the skills gap in the water sector. This can be achieved through changes in education, such as stimulating internships at companies or governmental

institutions, offering courses about general work readiness or even extending the curriculum by a year, during which students receive mentoring to strengthen their skills and get ready for the workforce. Additionally, it is important to make the education more practical rather than purely theoretical, which can also help with bridging the skills gap with the industry.

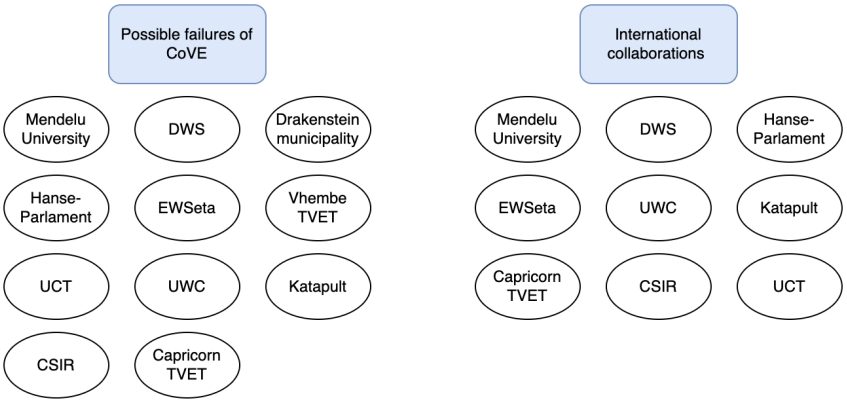

Figure 4: Thematic overview of possible failures and international collaborations

Possible failures of the CoVE Water SA

It might happen that the platform doesn't function properly or fails to achieve its objectives. Multiple stakeholders can contribute to potential failures of the platform, and it is crucial to keep an eye on it. Firstly, involving all desired stakeholders can be challenging, as some may not immediately recognise the value of their participation. It is essential to clarify to them the benefits of the platform. For example, companies gain access to new talent, students can consider involved companies as potential future employers, and stakeholders acquire access to valuable knowledge. It can also be challenging because stakeholders are often preoccupied with their own agendas and may lack the time to fully engage with the platform. Moreover, partnerships between stakeholders could falter due to various factors, including personal aspects, bureaucratic obstacles or differing mindsets. It could also occur that stakeholders no longer see the added value of the partnership anymore and consequently lose interest.

To ensure the platform and collaborations succeed, it is necessary that every stakeholder contributes. The platform should not depend solely on a few individuals; it must be capable of continuing even if key figures step aside. Moreover, all stakeholders in a partnership need to invest, whether in the form of financial contributions or other resources, to ensure everyone's commitment. Furthermore, smooth communication between stakeholders is essential. All partners must understand the common area of interest, set common goals and refrain from pursuing their own separate agendas. Water scientists often struggle to convey their message effectively to the public and private sector and this is worsened by the communication gap between generational perspectives. Bridging these gaps is essential to foster effective and relevant collaborations. Next to that, strong leadership is needed for the collaboration to function effectively.

In addition to these challenges, there are broader issues, including lack of political support, insufficient funding, a deficit in trust and limited international relations. Furthermore, it is important that stakeholders consider CoVE Water SA not as a mere project, but as

something that will endure and persist. Additionally, both the platform and its stakeholders must be cautious of setting unrealistic expectations for their goals.

International collaborations
International collaborations are important for a platform such as CoVE Water SA. Collaborations with other international stakeholders such as universities and private companies allow an exchange of knowledge, ideas, and issues in order to learn from each other. These exchanges can take place among students, teachers and working people in the water sector. Furthermore, special training materials can be developed on the platform that can then be utilised by other countries as well. Finally, international collaborations makes it easier to attend international workshops, conferences and public events.

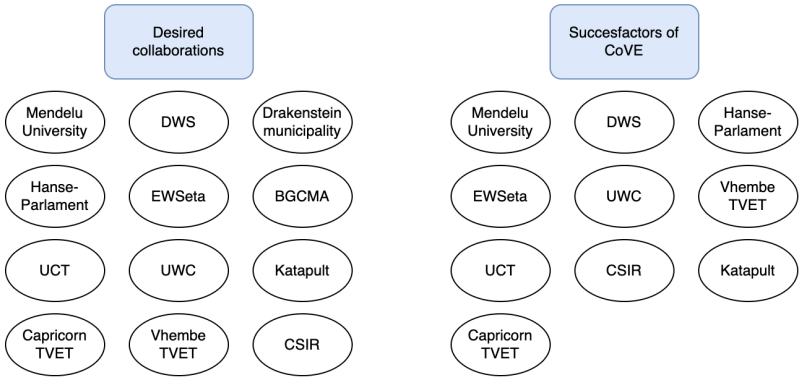

Figure 5: Thematic overview of desired collaborations and success factors.

Desired collaborations
To further enhance the effectiveness and reach of the CoVE Water SA, it is imperative to foster broad and diverse collaborations. This includes the involvement of primary and secondary schools, local communities, farmers, private entrepreneurs, industries that incorporate water in their production processes, such as mining companies, and various stakeholders from sectors beyond the water industry. Furthermore, it is essential to cooperate more with the government, municipalities, and educational institutions. Moreover, it would be advantageous to establish more regional collaborations to create a regional network. It may not be as valuable if a TVET college from one province collaborates with a waterboard from another province. Instead, it is preferable to seek partners nearby, allowing for strong regional connections. In addition, actively involving the younger generation in conferences and other activities is essential.

Success factors of the CoVE Water SA
A platform like CoVE Water SA has a lot to offer its stakeholders. Besides the aspects mentioned above, it can provide many more: it can provide opportunities for students, such as recruitment through the platform, reaching out to TVET students and creating opportunities for students to learn from real-world problems. In addition, the platform also serves as a place to collaborate and bring together people related to the same topic, making contacts with stakeholders easier. Therefore, it is important to create moments where interaction can take place through meetings, workshops, or site visits. This can positively

affect the decision-making process. So, ensure that concrete activities actually take place. Simply start working. The moment success occurs, others will join in.

In addition, the platform can also ensure that there is effective collaborative communication. However, it is important here that the dialogue is kept open, there is highly interactive and participative involvement, and everyone's intentions and goals of the collaboration are clear. Furthermore, people need to understand each other in the partnership because people prefer working with someone they know, which encourages honest and open discussions.

The platform has a system-wide understanding. It has a view of the whole system, so it can clearly see where all stakeholders fit in. In this regard, it is important for the platform to be the glue in the space. This ensures that the strengths of all stakeholders are well leveraged. As a result, the platform can serve as a channel to direct resources in the way that is needed, in order to achieve more with the resources that are there. In doing so, all stakeholders are coordinated with each other, reducing duplication of effort. For this reason, the platform can be used effectively for preserving developed skills, as long as there is proper intellectual property protection. Moreover, it is important to think about what will make the platform sustainable. Taking risks into account is essential to differentiate the organisation from others and ensure its sustainability.

6.1.2.2 What can stakeholders offer to CoVE Water SA

Figure 6: Thematic overview of raising awareness and skills gap in the water sector.

Raising awareness
As mentioned before, organising activities can generate greater awareness and interest in the water sector. Some stakeholders mentioned activities they already organise; Both UCT and DWS organise educational visits to the Water Hub in Franschhoek to illustrate the full scope of the water resource management and to make the education more practical. UCT also organises symposia to promote graduation projects in the water sector and to encourage students to work in the water industry. Furthermore, DWS arranges a competition among students in the water sector to present new ideas and projects. The goal of the competition is to win the bursary from the department and to eventually work there after they finish their studies, during which they will receive training. When there is low interest in the competition, the department will go to universities and schools to pitch the competition. Lastly, the Capricorn TVET college mentioned that their marketing department within the college should play a vital role in raising awareness, together with the CoVE Water SA platform.

It was also emphasised that it is crucial to expose students to the numerous opportunities within the water sector after completing their studies, as this can significantly enhance their interest. EWSeta offers various initiatives to raise students' awareness of potential career paths. This includes career guidance facilitated by a career opportunities booklet that shows various water and energy-related careers. Life orientation teachers play a vital role in advising learners about career options and providing them with insights into the various careers available within the sector. Additionally, students benefit from practical exposure through interaction with small-scale models of technologies or the opportunity to witness real-world applications, encouraging professionals in the water sector to visit schools. Professionals in the water sector are encouraged to share their personal experiences and explain why their work is intriguing. Lastly, EWSeta provides information through a careers portal on their website, allowing learners to conduct in-depth research on various careers. These resources collectively serve to inform and inspire students about the possibilities in the water sector.

Skills gap in the water sector

To better prepare students for the job market, different stakeholders can offer inputs. DWS, for example, can offer training to give students more work experience, which is often a requirement for the industry. BGCMA and EWSeta can additionally offer internships to bridge the gap between education and labour market preparation.

EWSeta also has other possibilities to offer in this regard. They are committed to producing a skilled workforce for the water sector and therefore work directly with universities and TVET schools. They assess the specific skill needs of the water sector by conducting extensive industrial research. With this, they can bridge the skills gap in the water sector. However, the sector needs to understand that graduates may not be fully job-ready when they enter the labour market. EWSeta encourages a change in mindset and a recognition that a certain level of skill related to the world of work is necessary.

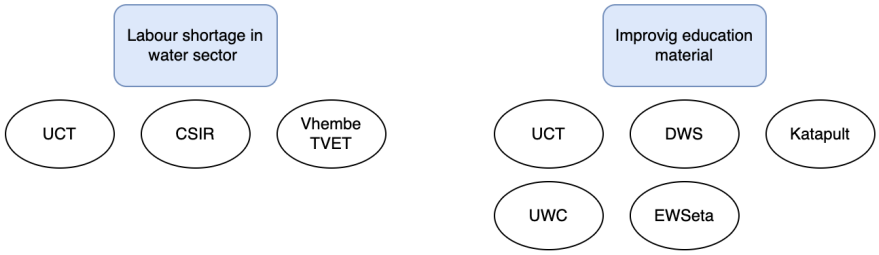

Figure 7: Thematic overview of labour shortage and improving education material.

Labour shortage in the water sector

UCT and CSIR support students with their idea of setting up their own business, to ensure that less graduates leave the water sector because it is considered too conservative. In addition, Vhembe TVET offers vocational qualifications to people who are currently unemployed so that they can get started in the water sector.

Improving education material

EWSeta conducts research to assess the demand for skills in the energy and water industries. This may lead to accrediting the curricula and qualifications. If there's a need for

specific skills, EWSeta assembles a group of expert practitioners, who are responsible for crafting curriculum and accreditation qualifications or programs. They facilitate and guide this process. In some cases, certain skills are best taught through short courses, which don't require formal accreditation. EWSeta seeks out capable providers to deliver these short courses. Furthermore, EWSeta offers training programs to help people obtain the qualifications they deserve, when they have spent years working but lack formal qualifications. EWSeta also assists professionally trained individuals in refreshing their skills to keep up with emerging technologies. Lastly, they work with private institutions that provide training outside the realm of TVETs. In line with its commitment to assessing skills demand in the energy and water industries, EWSeta underscores the advantage of conducting curriculum development through the platform, given the presence of the industry, TVET colleges, and universities. This approach enables EWSeta to ensure that curricula and qualifications align with the evolving needs of the sector.

In addition to accrediting the curricula and qualifications, it is important to connect the education with real-world practice. One approach to achieving this is through educational site visits, such as those to the Water Hub in Franschhoek. Both UCT and DWS are already organising site visits to the Water Hub, offering students the opportunity to explore diverse perspectives on water management. Another approach is the organisation of events to bring the private sector and government officials into the academic environment, which is already implemented by UWC. Furthermore, regarding the promotion of water sector career paths, UCT offers graduation projects within the water sector, aiming to inspire students to pursue careers in this field and UWC provides a unique master in integrated water resource management.

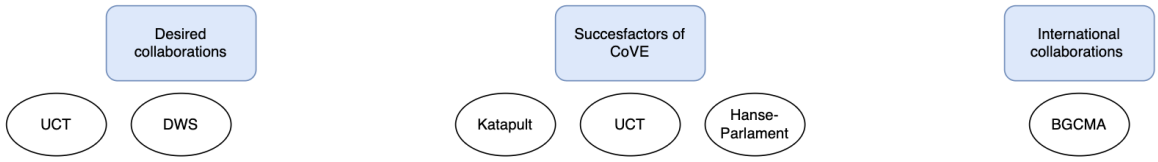

Figure 8: Thematic overview of desired and international collaborations, and success factors.

Desired collaborations
DWS can provide NGOs with the necessary materials and guidance that they can use to educate and train people. This can be valuable in reducing existing skills gaps and creating more awareness for the water sector. In addition, the UCT has a collaboration with the Water Hub in Franschhoek, which is an opportunity for students to do site visits, learning them more about what the water sector entails and what kind of different job opportunities are available.

Success factors of CoVE Water SA
Several stakeholders mentioned skills that could contribute to the success of CoVE Water SA. Hanse-Parlament, for instance, holds a big project meeting twice a year with all the different partners, in order to see what kind of problems they are facing. UCT is an expert when it comes to leading partnerships, which can be very beneficial for the platform. Moreover, Katapult can also be helpful in this regard. They have great knowledge about obtaining partnerships between public and private organisations.

International collaborations
BGCMA is already engaged in having international collaborations. They cooperate with other CMAs within the country and in foreign countries. This makes it possible to exchange knowledge in order to better understand each other's activities and work.

6.2 Power Interest Grids

6.2.1 Knowledge, Power and Collaboration Grids

The three PI Grids "Knowledge," "Power," and "Cooperation," offer insight into how all stakeholders contribute to the CoVE Water SA platform. In Appendix D, the PI Grids can be found, accompanied with an explanation of all determined positions of the stakeholders. A brief description of each dimension is provided below:

Knowledge PI Grid
This PI Grid reveals which stakeholders possess a deep understanding of the problem and the gaps within the water sectot, and therefore can contribute to generating solutions. These stakeholders know where the problem lies and comprehend its complexity. A high score in this grid indicates that the stakeholder is well-informed about the situation and can address where the knowledge gap lies. With this knowledge they can actively participate in finding solutions to the problem.

Power PI Grid
This grid illustrates which stakeholders have the necessary resources and influence to bring effective changes. A high score in this grid indicates that stakeholders can mobilise funding, policy decisions, or other resources to address the problem.

Collaboration PI Grid
This PI Grid shows which stakeholders have an extensive network to address the problem. Stakeholders who score high on this grid have strong collaboration skills and tend to involve others in finding solutions. As a result, they can also be the mediators of knowledge transfer between other stakeholders.

6.2.2 Combined PI Grids

The position of stakeholders within the PI Grids can be categorised into low, medium and high, based on their level of knowledge, power and collaboration. In the PI Grid, the levels are indicated with the colours yellow, orange, and light and dark green. The yellow and orange squares below the dotted line represent the "low" status of the stakeholders, indicating below-average performance. "Medium" indicates that the stakeholders are slightly average, suggesting that they are in any box between the two dotted lines. The term "high" indicates that the stakeholders are above the corresponding dotted line in the green squares. The dotted lines are placed so that there is equal representation of the low, medium and high categories everywhere. In table 3, an overview of the position of stakeholders for each aspect can be seen.

Table 3: Position of stakeholders in PI Grids

	Knowledge	Power	Collaboration
CoVE (SA)	Medium	Low	Medium
DWS	High	High	High
EWSeta	High	High	High
Mendelu University / Katapult	High	Medium	High
BGCMA	High	High	High
UWC / UCT	High	Medium	High
CSIR	Medium	Medium	Medium
Drakenstein Municipality	Medium	Low	Low
Capricorn / Vhembe TVET	Medium	Low	Low
Hanse Parlament	Low	Medium	High

Comparing these three grids assists in identifying key players and cultivating strategic partnerships. It is important to note that achieving a high score on one of the aspects does not necessarily mean that the individual can directly provide the resource to the platform. Collaborations may be necessary, and this is where CoVE Water SA can provide further insight.

When stakeholders possess substantial knowledge but lack the means to implement it, they can greatly benefit from working together with those who can. In this context, it means that organisations or individuals with the financial or organisational means to address a problem can form partnerships with stakeholders who are aware of the problem but lack the means to do so. Effective solutions can be generated by combining their knowledge with the strength or resources of others. An example is Katapult and Mendelu University. These organisations score high on knowledge but only average on power. For them, it is crucial to collaborate with organisations and companies that have significant power and financial resources. This enables them to effectively put their findings into practice. The same goes for universities and TVETs; they can provide significant knowledge and think in solution directions, but do not always have sufficient power or financial resources to apply this knowledge effectively. Drakenstein municipality also faces this dilemma, as they do not always have the leverage to effectively implement their knowledge because they are dependent on higher government agencies. CoVE Water SA is in a similar position, where they have considerable knowledge about problems and possible solution directions, but do not always have the necessary power or financial resources to implement these findings. Therefore, it is critical that they continue to work with partners who do have this power and financial resources. The table shows that DWS, BGCMA and EWSeta score highly in terms of power. This can make them ideal partners for stakeholders in need of influence and financial resources to effectively implement their initiatives.

These examples emphasise the importance of collaboration, as it is often a crucial component for stakeholders to combine their knowledge with the necessary power and resources to address complex issues effectively. CoVE Water SA can be used by

stakeholders who have limitations in particular areas, in order to make up for these shortfalls. Furthermore, CoVE Water SA can match stakeholders with similar goals and needs. This can be done based on their respective strengths and weaknesses, enabling them to complement each other and work together effectively. Maintaining relationships with stakeholders who already have large networks is also essential for CoVE Water SA. CoVE Water SA can grow its own network and gain from these already-existing ones. In places where CoVE Water SA might be deficient, these new networks offer access to other resources and crucial stakeholders. Effective partnerships are a means for CoVE Water SA to increase its impact. Interviews have shown that this potential is acknowledged as a valuable function even though it has not yet been fully realised.

6.3 Social Network Analysis

Social Network Analysis (SNA) focuses on the relationships between stakeholders. The goal of SNA is to analyse and understand social relations within the network, identifying key players, detecting information flows, assessing the dynamic of the network and improving decision-making. SNA helps to evaluate collaboration, define potential collaborations, and enhance network resilience (Hermans et al., 2018). The networks are depicted as graphs with stakeholders as nodes and relations as connections among nodes. While a focus of CoVE Water SA is creating a strong network, a SNA is conducted to analyse the current network and to define where gaps are to improve the network.

The results of this analysis can make several contributions to CoVE Water SA's objectives. First of all, it pertains to the aspect of mobility, involving the enhancement of South Africa's water sector network and the establishment of connections with European parties. Beyond expanding the international network, CoVE Water SA aims to incorporate TVETs into the network, recognizing their potential value to the water sector. A third goal of CoVE Water SA is to identify potential funding sources within the network. While the project is in its early phases, funding is a critical consideration for launching the project effectively. Lastly, CoVE Water SA seeks to strengthen its ties with the labour market, particularly with government departments and municipalities, where prospective water-related students can find employment opportunities. To create more interest among the students in the water sector, it is important to show them where they can work and what contributions they can make.

CoVE Water SA relies on the participation of various stakeholders for the establishment and sustained management of the project. Therefore, building a robust network is of paramount importance. However, other stakeholders must be willing to contribute to the network in order for it to be strong. Therefore, it is necessary to address the needs and interests of the other stakeholders and to respond accordingly to enhance their readiness for collaboration. Identifying these needs and interests is achieved through interviews with key stakeholders, seep chapter 6.1. These needs and interests emerged from interviews are categorised into themes and SNA can assist in identifying insights to address these themes.

First, increasing awareness in the water sector is a significant concern for certain stakeholders. To accomplish this, establishing an extensive network is vital. Therefore, SNA can help to highlight the key stakeholders with a broad network. Having these stakeholders on board makes it easier to facilitate a broad network. Secondly, other stakeholders also

emphasise the importance of international collaborations. SNA can provide insight into the possibilities of connecting with parties in Europe. Thirdly, there is a need for a larger workforce in the water sector. SNA can help foster stronger relations with the labour market, allowing stakeholders to offer employment opportunities. The final theme is about the desire for more collaborations and a healthier, more effective network. SNA can identify gaps and areas for improvement within the network, including the identification of current bottlenecks that hinder collaboration.

In this chapter different analysing techniques of SNA will be used. First, the results of the PI grids, section 6.2, will be visualised with a network. This amplifies what CoVE Water SA can obtain from these stakeholders. Following the entire network will be explained and analysed, using the centrality scores, defining clusters, and defining brokerages. The section will be concluded with some recommendations to CoVE Water SA.

6.3.1 Social Network based on results PI Grids

The PI grid's findings in table 3 provide insightful information. The table 3 provides a thorough framework for evaluating the level of involvement of all significant stakeholders in CoVE Water SA. In order to provide a visual representation of the PI grid results, a social network diagram was subsequently built based on these discoveries. The relationships between important stakeholders and the CoVe Water SA platform can be clearly defined by defining the connections within the social network. This allows us to ascertain what and how much these important stakeholders can contribute to the platform. These contributions are divided into the following groups.

Table 4: Legend social network Key stakeholders

Blue	Knowledge (1)
Green	Collaboration (1)
Orange	Collaboration and Knowledge (2)
Roze	Collaboration, Knowledge and Power (3)

The stakeholders are first divided into these different categories based on how they contribute to CoVE Water SA. These are broken down into four different groups. As shown in the legend, each of these four categories is represented by a different colour. Furthermore, the strength of the connections is denoted by a weight, which varies between the values 1, 2, and 3. In this context, a weight of 1 means they have the fewest dimensions to offer to CoVE Water SA, while a weight of 3 means they have the most to offer to CoVE Water SA. This distinction is made with the rationale that if a stakeholder can only offer knowledge to the platform, this is less impactful than when a stakeholder can provide knowledge and collaboration or even collaboration, knowledge, and power. The stakeholders are categorised as follows. The abbreviations for these stakeholders can be found in Appendix D.

Capricorn, Vhembe and Drakenstein municipality
These stakeholders mainly offer knowledge to the platform. They have a deep

understanding of the problem and show a willingness to tackle the problem in cooperation with other stakeholders. However, they do need other stakeholders to add the knowledge to the platform making them less strong sources for CoVE Water SA. This association is indicated by the colour blue.

CSIR
In all areas of the PI grid, they consistently score at a moderate level. However, their main contribution to the platform is in the area of knowledge. As a research organisation, they have an extensive reservoir of expertise, which puts them in a favourable position to address the problem effectively. This gives also the link the colour blue

UCT, UWC, Katapult and Mendelu University
Their engagement with the stakeholder is mainly facilitated by the knowledge they can offer to the platform, which is also evaluated in the context of PI grids. Moreover, their extensive partnerships with various stakeholders have the potential to significantly expand the network. This makes the link orange between the CoVe Water SA platform and these stakeholders.

Hanse Parlament
Hanse Parlament enriches the platform primarily through its strong collaborative links. By using their extensive network, they have the capacity to involve numerous stakeholders within the network, which will significantly benefit the overall network. This contribution is indicated by the colour green.

DWS, Ewsate, and BGCMA
They represent influential key stakeholders, contributing comprehensively to the CoVe Water SA platform across all three dimensions, including collaboration, knowledge, and power. This integral support is represented by the colour pink.

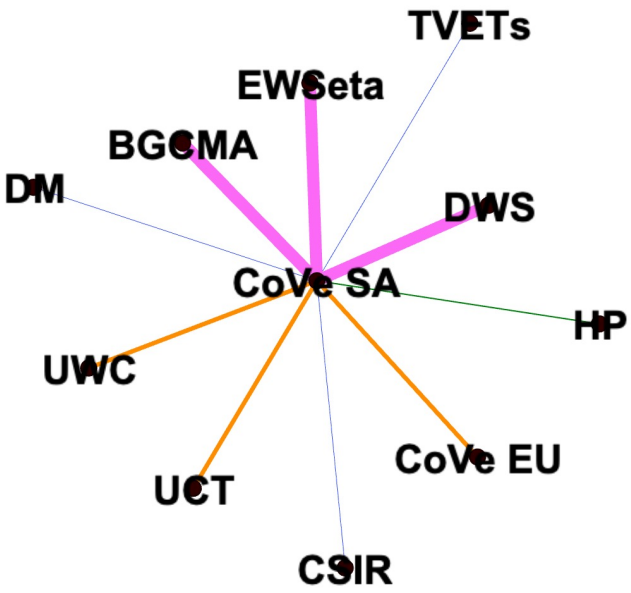

Figure 9: social network key stakeholders

In the social network it can be seen that the stakeholders HP, CSIR, DM and the TVETs have the thinnest connections. Looking back at table 4 this is also true because these connections were the weakest. In addition, BGCMA, EWSeta and DWS have the strongest connections to CoVE Water SA. This is because they provide the most dimensions to CoVE Water SA. These findings are reflected from the table 3 the results of the PI grids.

6.3.2 Network

6.3.2.1 Relations & Weights

The relations among the different stakeholders are collaborations, making the relations undirected. In addition are all the relationships between the stakeholders weighted. This weight explains the degree of collaboration between the stakeholders. The higher the weight, the better the relationship between the stakeholders is. The weights are based on four levels of collaboration (Frey et al., 2006), see table 5.

Table 5: Different types of collaboration and their assigned weights

Weight	**Collaboration type**
2	Networking
4	Cooperation
6	Coordination
8	Full Collaboration

Networking
This type of collaboration is based on sharing information for mutual benefit, but no agreements are reached between the stakeholders. The collaboration is flexible, mostly informal and no to minimal decision-making at stake.

Cooperation
Cooperation is a more structured form of collaboration. The stakeholders support one another's activities, but there is no formal agreement in place. Support can be in the form of co-sponsoring, exchanging resources and attending one another's activities and events. The way of communication is in a more formal way, however decision-making together is still limited while the stakeholders are mostly independent of each other.

Coordination
A formal collaboration involving shared decision-making is called a coordination collaboration. Stakeholders are engaged in mutual projects and initiatives. Because the stakeholders are collaborating, they communicate more frequently and are more interdependent.

Full collaboration
Full collaboration is the most intensive form of collaboration, where a formal agreement between the stakeholders is at stake. The stakeholders become interdependent as a result. In full collaboration the stakeholders belong to one system, resulting in a shared sense of

responsibility for the project and a need to collaborate to achieve a shared vision. The stakeholders belong to one system.

Assigning relations and weights

To define the current relation between the stakeholders, information from the interviews and sources, found on the internet, are used. In the appendix (Appendix E) an overview is given of these used sources to define these relations. A global explanation of the given relations and weight is given below. Due to too many relations, only the important relations are mentioned.

Governmental stakeholders (Departments, agencies, and other governmental institutions)
There are several departments and its associated government agencies in the network. The assumption is made that the relation between these departments and agencies is a type of the highest collaboration, *full collaboration*. They are dependent on each other and work together towards a common goal. The agencies provide information to the departments and are formally connected to each other. However, based on the interview with the Department of Water and Sanitation, the relation between the different departments is not that strong. There is much room for improvement and therefore the decision is made to assign a lower weight to these relations.

The major institutions and stakeholders within the water sector in South Africa are divided into different levels: National Level, Regional Level, Local Level, International Level, NGOs and Research Institutions (Rodina et al., 2016). Within these levels different stakeholders are involved and collaborate. These levels are used to define the relations between stakeholders. When stakeholders are located at the same level, there will be a relations. However, the weight of these relations are mainly based on the results of the interview.

In addition to the levels, there are multiple arrangements made in the water management system in South Africa (Weaver et al., 2017). These arrangements are used to define the relations with the stakeholders. For example the DWS has a relation with the CMA, Water Boards and Water Service authorities. However, there is no relation between the DWS and the Water User Association. This contact is done by the CMA. The same for the municipalities. The collaboration with them is done by the authorities and not by the DWS. Based on the interview the weight of these relations are assigned. The relation between CMA and the Water User Association is very good, according to the interview, and therefore assigned with a higher weight.

Education stakeholders (TVETs, schools and universities)
An important goal of the CoVE Water SA is to create a better network for the different education institutions. At the moment not all relations are as strong and sometimes there is no relation at all (interview). First of all, there is a difference between the different universities. CTU and Stellenbosch University are examples of universities that have a good relation with schools and European Universities. However, other universities, for example UWC, have less strong relations. This can be explained while the UWC is an Historical Disadvantaged Institution (HDI). These universities have a disadvantage while they were established as non-white universities. Therefore they lack adequate access to financial products or services. This results in a less strong relation in the network. Secondly, based on

the interviews the assumption is made that the relations of TVETs schools in the network is weak and that it needs to be improved. Therefore there are less relations with TVETs visible in the network. Lastly, according to the interviews there is a need to improve the participation of the schools in the network. There are some relations between universities and schools (interview), however there is room for improvement.

CoVE Water SA
Based on interviews and given the information provided by the CoVE Water SA, the relations with stakeholders are defined. The relations in the network express the current relations. While the project is still in its early phases, the relations are not as strong as wanted. This results in a lower weight, however the first step to set up these relations is already made and according to the interviewed stakeholders they are all willing to collaborate with the CoVE Water SA.

International
Another theme and goal is to improve relations with Europe and International (other countries in Africa). The relations with EU and other countries in Africa that are in the network are based on interviews (interview with CMA, CoVE EU and Universities). The other stakeholders did not manage any noteworthy relations.

Research
Research plays a significant part in the Water Sector and the Water Management System. Most stakeholders have a relation with a research institution, to obtain more information about issues. They need this information to set up new activities and projects. Therefore research institutions have many relations in the network. The strength of these relations are however not as strong as others while it is more a collaboration of exchanging resources.

6.3.2.1.1 Network & Outcomes

With the defined weights of the relations, see section above, a network is created which is visualised in figure 10. The stakeholders involved in the network are chosen according to information retrieved from interviews and literature review.

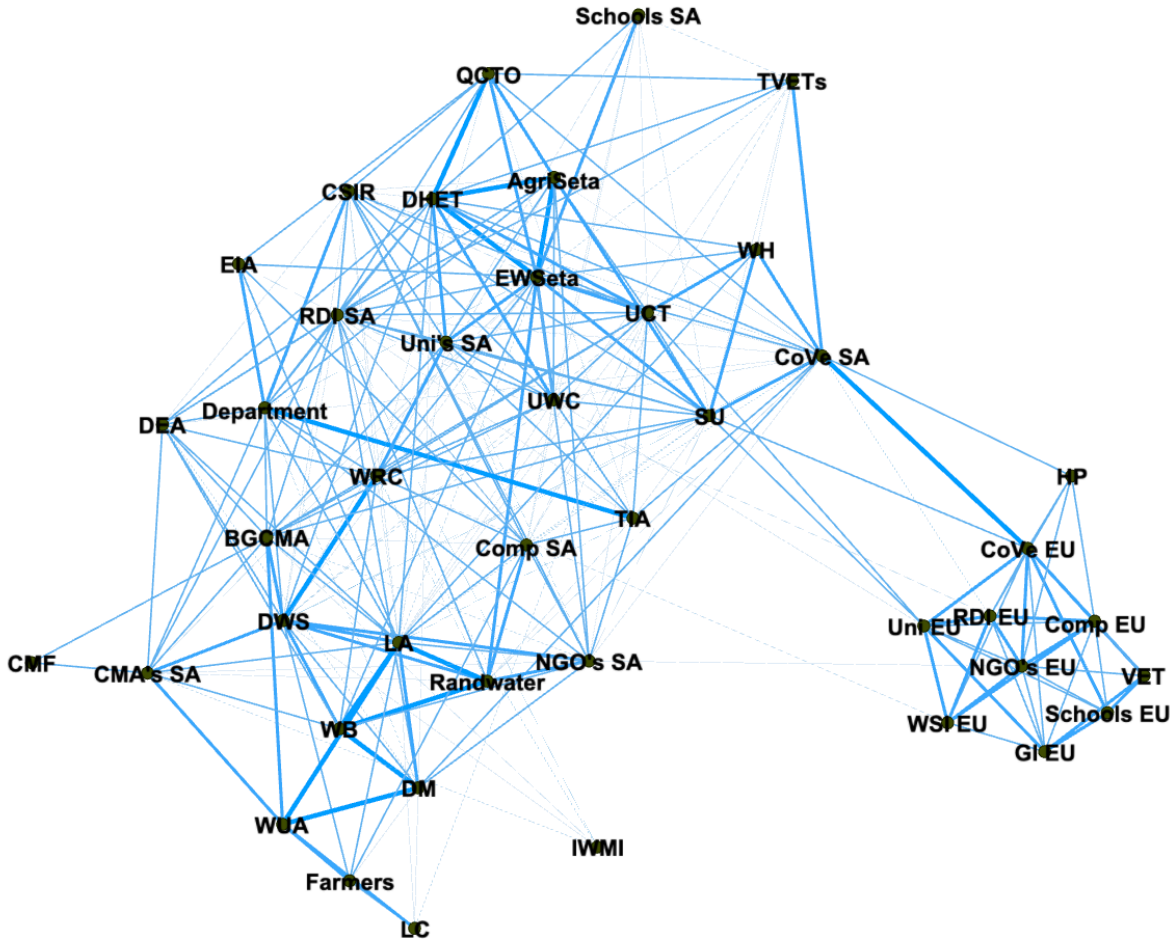

Figure 10: Social network analysis

The results of the network can be found in the appendix. The network consists of 43 stakeholders with 269 undirected relations. The total potential relations in this network would be (43 * (43-1))/2 = 903. The network's density, which represents the existing relations relative to the total possible connections if all stakeholders were linked, is 0.284. This density suggests that the network is not particularly dense, leaving ample room for additional relations and opportunities to bring stakeholders closer together, indicating potential for network improvement.

6.3.2.1 Results

The findings of the SNA will be examined in this section, paying particular attention to concepts of centrality, network clusters, and the brokerages that can be obtained from the network.

6.3.2.1.2 Centrality Conceptions

The outcomes of the Social Network Analysis, using various methods, will be described in this section. First, Walsh's (1994) Three Conceptions of Centrality is used. These three notions include:

Degree Centrality, is based on the number of direct connections an stakeholder has with other stakeholders in the network. It signifies the degree of independence of a given

stakeholder. Stakeholders with high degree centrality can communicate directly with other stakeholders, minimising the need for intermediaries.
Closeness Centrality, denotes the average distance or number of steps required for a stakeholder to reach another stakeholder within the network. stakeholders with high closeness centrality have positions that offer easy access to numerous other stakeholders.
Betweenness Centrality, measures the extent to which an stakeholder serves as a bridge for the shortest paths between any two stakeholders in the network. It reflects the stakeholder's capacity to mediate communication and resource exchange among various stakeholders. Betweenness centrality indicates the power of central stakeholders in controlling communication and resource flow.

By using these conceptions, stakeholders that stand out in the network can be determined. This enables us to recognise those with significant influence or power in the network and to better understand the connections between the stakeholders. Additionally, it aids in identifying stakeholders whose limited or peripheral roles within the network may call for greater involvement.

6.3.2.1.1 Problem owner, TVETs and schools

First, the centrality aspects of three key stakeholders will be addressed: CoVE Water SA, TVETs, and the schools in South Africa. These stakeholders are of great importance within the network. CoVE Water SA, the owner of the problem, is crucial to examine because understanding its current role within the network and identifying possible improvements can facilitate the expansion of the network and the achievement of its ultimate goals mentioned earlier. In addition, the TVETs and primary/secondary schools in SA play a vital role. The themes and CoVE Water SA's goals identified, showed that it is essential to address and narrow the gap between different stakeholders, including TVET students, which ultimately contributes to increased awareness. The same is true for schools in South Africa.

CoVE Water SA
CoVE Water SA, the problem's owner, centrality aspects are shown in the table 6 below.

Table 6: Centrality aspects CoVE Water SA

Stakeholder	***Degree***	***Weighted Degree***	***Closeness Centrality***	***Betweenness Centrality***
CoVE Water SA	**21**	**72**	**0.66**	**95.36**

After looking over the tables in this section and the appendix E, it is clear that CoVE Water SA ranks moderately to highly across a number of categories. This implies that they are important players in the social network diagram. CoVE Water SA ranks fifth among all stakeholders when considering degree centrality, demonstrating that they have a large number of direct connections in the network. However, it should be noted that not all of the stakeholders they want to work with are yet connected, so there is still room for improvement. Having no connection with the catchment agencies is one instance of this. The quality of these connections is just as important as their quantity. The network and collaborations will be more robust the more links there are between the CoVE Water SA platform and the involved stakeholders. The weighted degree, which assesses the strength

of the connections CoVE Water SA currently has with all directly connected stakeholders, serves as a proxy for connection strength. A score of 72 indicates that there is room for improvement and that not all connections are as strong as they could be. Strong connections are necessary for effective resource exchange and information sharing to speed up processes. A stronger connection between CoVE Water SA and the universities outside of Stellenbosch, for instance, could speed up knowledge exchange.
It is also possible to evaluate how close CoVE Water SA is to other stakeholders. It can be deduced from the table in the appendix E that CoVE Water SA ranks third in this category, which is remarkably high. As a result of its close ties to numerous stakeholders and high degree centrality, CoVE Water SA is implied to play a crucial role in the network. Additionally, CoVE Water SA ranks first in betweenness centrality with a very high score. This suggests that CoVE Water SA serves as a major conduit for communication.

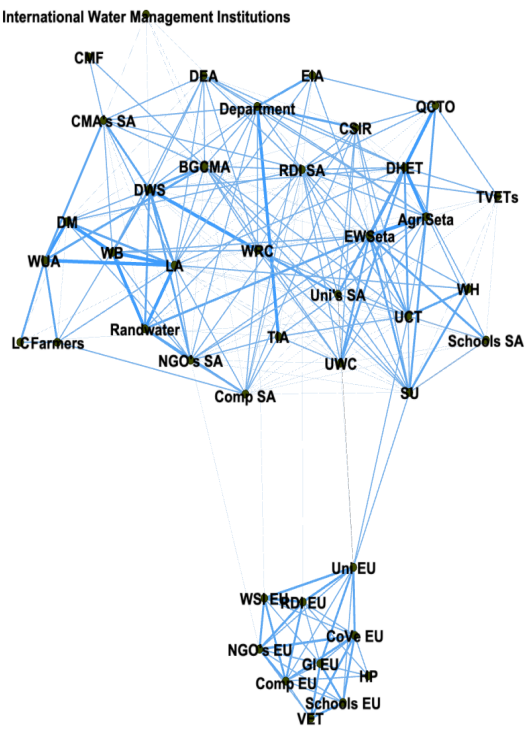

Figure 11: Social network analysis without CoVE Water SA
The social network diagram above, figure 11, shows the network without CoVE Water SA. In the absence of CoVE Water SA's mediating role, the European network primarily relies on university connections, which are not as tightly interlinked as those facilitated by the CoVE Water SA platform. One of the aforementioned themes is improving the global network, which CoVE Water SA must focus on in order to continue to improve. In the absence of CoVE Water SA, there are a lot more stakeholders who are poorly or not connected to one another. These are just a few instances of the crucial role that the CoVE Water SA network has played as a mediator, serving as the link between various stakeholders. These frailer links show the necessity of the platform, which was emphasised throughout the interviews. This demonstrates CoVE's crucial function and substantial control over relationships between various stakeholders.

TVET's
Additionally, the TVETs are being further emphasised. Below in table 7 are listed the centralities of the TVETs.

Table 7: Centrality aspects TVETS

Stakeholder	***Degree***	***Weighted Degree***	***Closeness Centrality***	***Betweenness Centrality***
TVETs	**10**	**30**	**0.53**	**3.03**

The TVETs' low degree, which places them 10th from the bottom in terms of centralities, indicates that they have few direct connections. Although their closeness centrality is average, it might indicate that they are located relatively in the middle of the network. This is not the case, though, as the TVETs' connections are very shaky. Their low weighted degree, which is noticeably 0.53 and emphasises their lack of centrality, makes this clear. This is also shown in figure 12, where TVETs are shown on the right without taking on a central position and are distinguished by their sparse connections. What is also clear is the low betweenness score. There aren't many connections made through TVETs.
The TVETs' stronger ties to CoVE Water SA as compared to their other affiliations are an intriguing finding. This strong connection results from CoVE Water SA's primary focus on raising TVETs' awareness of and familiarity with the water sector. It becomes clear that CoVE Water SA is important within this network, promoting more connections between the TVETs and other stakeholders.

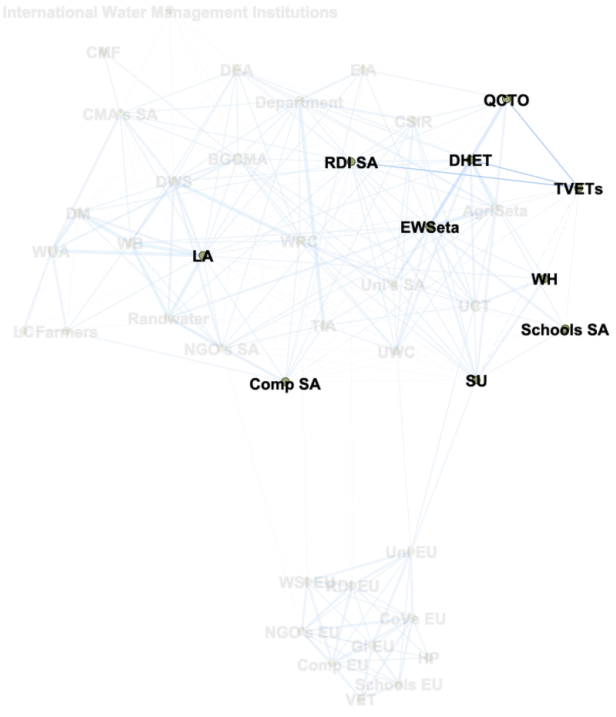

Figure 12: Centrality TVET's without CoVE Water SA

It is clear from the above figure that without CoVE Water SA's intervention, the TVETs have very few and low connections or none at all. CoVE Water SA can enable indirect connections with many more stakeholders by acting as a mediator for the TVETs. CoVE's high degree, closeness, and betweenness centrality, which allows them to connect with

many stakeholders, is to blame for this. In interviews, the advantages of this for TVETs were emphasised. For instance, the DWS interview revealed that there is a strong desire to forge closer ties between TVETs and universities. It is thought that these two industries can learn a lot from one another. Universities can gain practical knowledge, while TVETs can learn more about the water sector. Interviews with universities and TVETs revealed their shared interest in fostering these ties as well. This offers CoVE Water SA the chance to encourage development, which could pave the way for the creation of a strong educational network.

Schools SA

Examining the function of schools is crucial in order to strengthen educational connections. Therefore, the importance of schools in South Africa will be reviewed once more. The centrality scores of schools in South Africa are outlined in the table below.

Table 8: Centrality aspects Schools SA

Stakeholder	***Degree***	***Weighted Degree***	***Closeness Centrality***	***Betweenness Centrality***
Schools SA	**9**	**28**	**0.49**	**0.69**

It is clear that Schools SA is eighth from the bottom when looking at the degree centrality of schools there and comparing it to the list in the appendix E. This suggests that there aren't many direct connections between schools within the network. Their overall centrality, which shows that they do not occupy a central position in the network, also demonstrates this modest degree of centrality. Additionally, the weighted degrees have a score of 28, which is noticeably low and indicates the dearth of strong connections. They also have a very low betweenness centrality, which is noteworthy. This is explained by their position in the periphery of the network, which limits the connections that pass through the schools. Contrary to TVETs, which have direct connections with CoVE Water SA, schools may miss the chance to access the knowledge and resources available through strong connections with TVET institutions and some universities. A connection with CoVE Water SA would have allowed schools to explore collaboration and educational initiatives, deepen their understanding of the water sector, and take advantage of other opportunities that CoVE Water SA could have otherwise provided. This circumstance also draws attention to a potential area where CoVE Water SA could improve the education network.

Degree Centrality

As was already mentioned, Degree Centrality is determined by how many connections an stakeholder has with other network stakeholders directly. The highest and lowest values of this centrality measure for the various stakeholders are briefly explained below.

Highest Degree centrality

The four stakeholders with the highest degree of centrality are shown in the table 9 below. The sections that follow will delve into more detail about the causes of this high degree centrality and what it means for these stakeholders and possibly other stakeholders in the network.

Table 9: stakeholders with highest degree centrality

Stakeholder	***Degree***	***Weighted Degree***	***Closeness Centrality***	***Betweenness Centrality***
LA	25	96	0.65	66.59
RDI SA	24	82	0.68	71.72
EWSeta	22	98	0.64	29.83
DWS	21	82	0.63	28.73

LA (local Authorities) (25)
Due to the high degree centrality of the Local Authorities (LAs), it signifies that these stakeholders have numerous direct connections within the social network, even more than any other stakeholder. This high degree can be explained by the fact that Local Authorities are closely intertwined with the government institutions above and below them. They maintain these connections primarily to act as intermediaries between local communities and higher-level government bodies. Their role involves implementing government policies and regulations at the local level, which requires regular communication and collaboration with government departments at regional or national levels for approvals, resource allocation, and policy implementation coordination. The robust involvement of LA with other stakeholders can be attributed to their role as local governing bodies responsible for managing municipal affairs. As representatives of the government at the local level, they regularly interact with a wide array of stakeholders within their communities. They are tasked with both upholding government regulations and facilitating the needs and requests of businesses, educational institutions, and NGOs within their jurisdictions. This naturally fosters engagement and connectivity between Local Authorities and these stakeholders, contributing to their high degree centrality in the social network.
The connection between the LA and CoVE Water SA is currently not developed to their full potential, particularly because CoVE Water SA depends on particular government agencies like the DWS and DHET. Therefore, in order to provide the Local Authorities with the necessary labour force, it is imperative that CoVE Water SA forge strong local ties with them. Given that the average free hand is for the LAs. In this case, adherence to the recommendations is necessary.

RDI SA (24)
High degree centrality in the network is also attained by South African Research and Development Institutions, or RDIs SA. This can be attributed to their extensive knowledge of the problem at hand and their ability to consider a variety of options for potential solutions. They provide useful insights to businesses, governments, educational institutions, and other sectors in addition to the CoVE. Their many connections within the network are a result of these stakeholders. Further enhancing their degree of centrality is the fact that they are research institutions, which implies a vast network of partnerships and collaborations with various stakeholders.

EWSeta en DWS (22, 21)
Higher level government agencies like DWS and EWSeta show a notable degree of degree centrality. Even though this may not be as central as the Local Authorities, it is still important

to keep close ties with them. These government organisations' significant influence over laws that impact numerous stakeholders and their financial resources can be credited for their high level of centrality. The PI grids table 3, which exhibit their considerable power, potential for collaboration, and knowledge, further reflect this. Therefore, it makes sense for CoVE to already make an effort to keep a close relationship with them.

Lowest Degree centrality

The table 10 below displays the two stakeholders with the lowest level of centrality. Which means that you have few direct links and are not centrally located in the network. In this section, the reasons behind this low degree centrality and what it means for these stakeholders will be discussed, as well as potentially other stakeholders in the network.

Table 10: stakeholders with lowest degree centrality

Stakeholder	***Degree***	***Weighted Degree***	***Closeness Centrality***	***Betweenness Centrality***
LC	5	16	0.46	1.25
IWMI	5	10	0.46	0.18

LC (5)

The Local Community's low degree of centrality can be attributed to their lack of knowledge and interest in South Africa's water network. Next to that, they are also little engaged by other stakeholders. Their low level of participation results in their few connections and peripheral role within the network, which leaves them ignorant and uninformed. Another possible reason for the low degree centrality of the Local Community may be related to limitations in their resources and capabilities. Small-scale local communities may not have the resources or capacity to actively participate in broader networks within the water domain, as larger organisations or government entities can. In order to increase their engagement and give them more influence over the issues, it is therefore preferable to actively involve these stakeholders in the platform. This is a crucial objective for the CoVE Water SA platform and calls for more work.

IWMI (5)

The International Water Management Institutions in other African countries also possess a low degree of centrality. This is explained by the fact that there are few connections between them and the stakeholders in South Africa. This may be due to a variety of stakeholders, such as geographic distance, language barriers, or shifts in operational focus. It is important to get to know these stakeholders better on the network and to address any obstacles to their trustworthiness.

Low degree centrality could also be a result of the particular function that these institutions serve. They might not be mainly focused on the South African context, but rather on a regional or continental scale. They consequently inherently have fewer connections and direct interactions within the local network. It is essential to emphasise the benefits of their participation in South African water management and figure out how to collaborate more successfully with them. This is something that the CoVE Water SA can help with.

This is intriguing because a lack of awareness and knowledge in the water sector is a problem that many African regions face similarly. One potential benefit that could save a lot

of time and effort is the similarity between solutions and implementations. (Personal communication)

Weighted Degree Centrality

Diving deeper into the weighted degrees in addition to the degrees discussed above is necessary. These, as previously stated, represent the degree of collaboration within these particular connections. The table below, table 11, lists the top 4 stakeholders according to their performance.

Table 11: stakeholders with highest weighted degree

Stakeholder	***Degree***	***Weighted Degree***	***Closeness Centrality***	***Betweenness Centrality***
EWSeta	22	98	0.64	29.83
LA	25	96	0.65	66.59
DWS	21	82	0.63	28.73
DHET	17	82	0.58	11.70

The stakeholders EWSeta, LA, DWS, and DHET have the highest weighted degrees. The fact that they are all government agencies helps to explain this. These strong ties are mostly the result of the affiliations between agencies and government organisations that are under the purview of a particular ministry, as was indicated in the chapter on weights. EWSeta is covered by the DHET in this instance, which entails formal agreements that reinforce the relationship. These departments also include Local Authorities (LAs), which explains why their weighted degrees are so high. Their cooperation on common goals and interests in the water sector may be the cause of the positive relationships that exist between these government agencies and departments. This entails encouraging policy creation, education, and supplying clean water. Their shared dedication to these goals fortifies their bonds and may result in official agreements and collaboration to accomplish these goals. Strong connections exist between the departments DWS and DHET as well, albeit slightly less so. According to interviews, collaboration between departments is not always successful, due to busy and contradicting agendas.

Closeness Centrality

As mentioned above, closeness centrality indicates whether the stakeholders have a central position in the network or not. Stakeholders with a high closeness are relevant for the network, while they can collaborate with many stakeholders easily. In table 12 the stakeholders with a high closeness are shown.

Table 12: Top Closeness centrality scores

Stakeholder	***Degree***	***Weighted Degree***	***Closeness Centrality***	***Betweenness Centrality***
RDI SA	24	82	0.68	71.72
SU	20	74	0.66	50.23

LA	25	96	0.65	66.59
UCT	20	72	0.65	38.86

RDI SA (0.68)
Lots of research is needed in the Water Sector while there are many issues and a knowledge gap. Therefore, the RDI SA has a relation with many stakeholders, to provide them with knowledge. This results in a central position. It is important that they take a central position in the network to produce new knowledge, which serves as a valuable resource for other stakeholders, but also because of their expertise. Their expertise and specialisation make them valuable resources.

SU (0.66)
The central position of University Stellenbosch is due to CoVE Water SA being located at this university and supported. This gives them also a strong relation with CoVE Water SA and CoVE Water SA related partners. Besides, the university does already have collaboration with universities in the EU, making them also connected to these stakeholders. Universities need to play an important role in the network, while they can improve EU relations by exchanges, provide new knowledge, and train students to work in the water Sector. Besides, universities are collaborative with companies. This can be an opening to get more involved in the labour market for job opportunities. So, it is for the CoVE Water SA beneficial that the SU has already a central position and this position can be an example for other universities.

LA (0.65)
As previously noted, Local Authorities (LAs) wield considerable influence within the network based on their high degree. In addition to their numerous connections with various stakeholders, their relationships with others are exceptionally close. This closeness facilitates their ability to swiftly establish connections with other stakeholders. The prominent position occupied by LAs highlights their active involvement in network activities. Consequently, this highlights that collaboration need not exclusively occur at higher government levels. The inclusion of local authorities within the network is important, given that their streamlined connections can greatly enhance the efficiency of collaborative efforts.For instance, based on an interview with the BGCMA, it becomes evident that gaining the trust of local authorities holds significant value. Their substantial investment in nurturing these relationships has already yielded rewards. The BGCMA characterises their collaboration with local authorities as highly effective. A common misstep lies in that local entities are insufficiently engaged, resulting in a lack of attention to their concerns and needs. This, in turn, hampers collaboration efforts and the resolution of issues, making it more challenging to establish and execute activities.

UCT (0.65)
The UCT holds a central position in the network, due to its high closeness centrality. Given the network's focus on increasing awareness and interest in the water sector, the active involvement of universities like UCT is of paramount importance. They play a pivotal role in acquiring new knowledge. But as indicated by their closeness score, they also maintain a broad network themselves, characterised by close ties to governmental organisations, other

educational institutions, as well as European universities through collaborations with EU institutions.

Specifically, UCT occupies a prominent role within this network, while it already shifted its focus towards initiatives that prioritise practical education, as indicated in the interview. For instance, UCT is currently engaged in collaborations with the Water Hub, a significant component of the CoVE Water SA project. Furthermore, universities such as UCT have strong connections with companies, a valuable link that can be leveraged for exploring funding opportunities and, naturally, potential job prospects for their students. Consequently, their presence in the network is of great significance, given the multitude of resources and opportunities they can offer. It's worth noting that, despite its central role, UCT scores lower than SU in engagement with CoVE Water SA, with SA demonstrating a higher level of involvement in this initiative than UCT.

Betweenness Centrality

As described in section 5.3.2.1.2, *Betweenness Centrality* indicates the extent to which an stakeholder is centred to mediate contact between stakeholders. Stakeholders with a high betweenness score wield substantial influence in regulating communication and interactions among stakeholders. These stakeholders hold particular significance as they have the capacity to control the flow of collaboration, easily shape decisions, and impact the network's overall efficiency and dynamics. Recognizing high-betweenness stakeholders is vital as it provides insight into potential network bottlenecks and identifies the important stakeholders in fostering new collaborations.

Table 13 highlights the Betweenness Centrality scores for LA. This emphasis on LAs is warranted because, in addition to CoVE, as previously discussed, they play a crucial role within the network. While current collaborations may not be as robust, there exists untapped potential for enhancing their involvement.

Table 13: Centrality scores LA

Stakeholder	***Degree***	***Weighted Degree***	***Closeness Centrality***	***Betweennes s Centrality***
LA	25	96	0.65	66.59

LA (66.59)
The high betweenness score of LA underscores their role as mediators within the network They are often involved with the communication between stakeholders. They frequently facilitate communication among stakeholders, making a relationship with LAs essential for various parties. This connection opens doors for establishing new ties with other stakeholders. As such, fostering a strong relationship with LAs is imperative. Without a robust rapport, LAs can become bottlenecks in the network, impeding the efficient flow of information.

This inefficiency can, in turn, hinder the successful initiation of projects and collaborations. It's worth noting that LAs bear multiple responsibilities and are likely central figures in

networks beyond the water-focused context. This multifaceted involvement could potentially slow down collaborations. Consequently, relying solely on LAs for partnerships poses a risk.

Lastly, this score highlights the significance of local-level engagement in forming collaborations and driving changes within the water sector. Therefore, it's crucial to involve them in the network

6.3.2.1.3 Clusters

There is a distinct cluster of stakeholders connected to the EU in the social network (figure 13). The existence of this cluster is consistent with the findings from the interviews with Mandelu and Katapult, where it was stated that the European network was strong and already in place. The connections with CoVE EU are all strong, as shown by the thicker lines in the figure below, which further demonstrates this. Additionally, it is clear that CoVE EU is linked to almost all of the stakeholders in this European network. As a result, CoVE Water SA can learn a lot from this example.

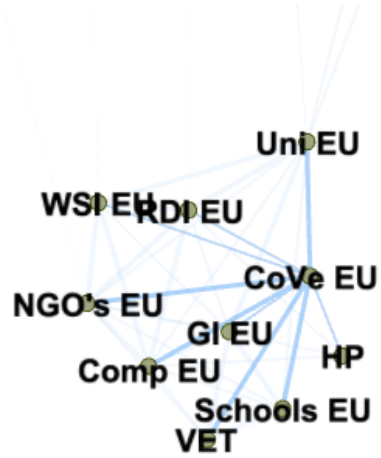

Figure 13: CoVE EU netwerk

Considering SA's goal of establishing more international connections, it is also clear from the figure 14 below (left) that the connections primarily pass through the CoVEs, which act as helpful mediators between the EU and SA. When looking at figure 15 (right), it is clear that the connections with foreign entities are significantly weaker, relying solely on universities, without the CoVEs acting as mediators. Unfortunately, each of these universities lacks a high level of centrality and proximity, which limits their ability to effectively tackle the problem of fostering global awareness, collaboration, and knowledge growth. It is obvious that the CoVE Water SA platform can offer a way to establish stronger connections with Europe as a result. The recommendations in this chapter will go over how they can do this.

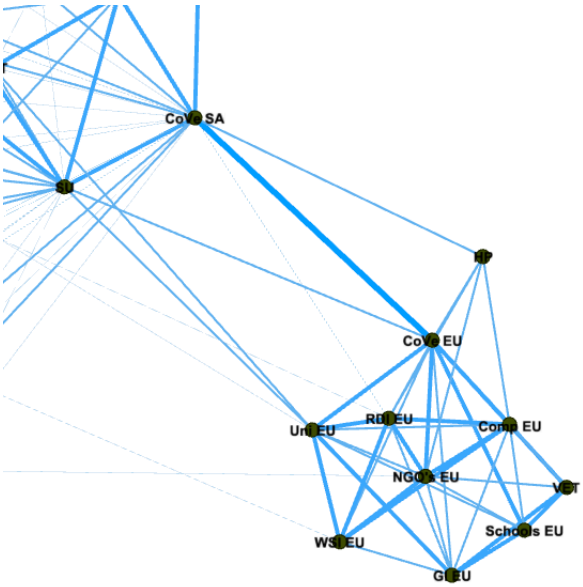

Figure 14: Cluster with CoVE Water SA

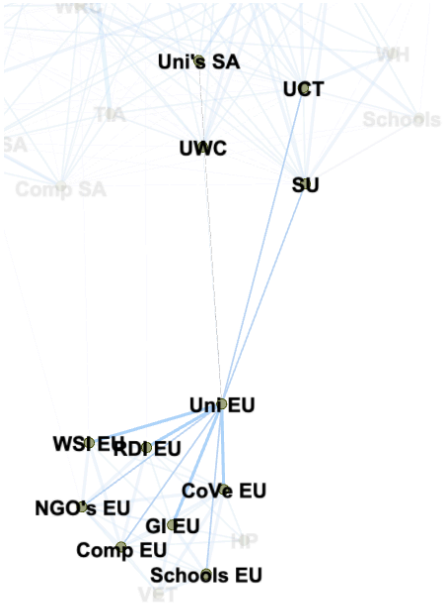

Figure 15: Cluster without CoVE Water SA

6.3.2.1.4 *Brokerage*

Brokerage is the process of connecting stakeholders in systems of social, economic, or political relations in order to facilitate access to valued resources. The crucial characteristics of brokers are that they bridge a gap in social structure and they help goods, information, opportunities or knowledge flow across that gap. So, brokerage is the process of linking otherwise unconnected stakeholders (Gould & Fernandez 1989, 1994). The types of brokerages are *Liaison, Itinerant, Coordinator, Gatekeeper and Representative.* An overview and more in depth description of these brokerages are defined in appendix E.4 In a brokerage analysis, the potential for bias or the emergence of cohesion around a broker will also be examined. A biassed broker may develop when the broker has stronger and more connections with one group compared to another. Cohesion can manifest when the groups connected to the broker develop numerous relations within their group, potentially forming a unified front against the broker or the other group.

Analysis

To analyse the type of brokerages in the network, the stakeholders are grouped based on their group type. The group type is based on the nature of the entity, functions and influence within a particular system of the stakeholders. In table 14 the group types are defined with a short description and the percentage of this group in the network.

Table 14: Overview of different group types in network

Group Type	Description	Percentage	Stakeholders	Colour
Government	Government groups play a central role in governance and	34.88%	DWS, EWSeta, BGCMA, DM, Randwater, Department,	Purple

	have the authority to implement policies, regulations and public services.		CMA's SA, DHET, DEA, CMF, AgriSeta, LA, WB, GI EU,IWMI	
Education	Education groups are institutions and organisations primarily dedicated to developing knowledge and skills and focus on educational outcomes and developments.	20.93%	UWC, UCT, TVETs, Uni's SA, SU, VET, Uni EU, Schools EU, Schools SA	Green
Research and Knowledge	These institutions are centres of expertise focused on generating, preserving, and disseminating information, fostering innovation and contributing to the advancement of human understanding.	11.63%	CSIR, RDI SA, WRC, WH, RDI EU	Light Blue
Agencies	*Agencies groups are a subset of government groups, they are responsible for specific functions. They often have a specialised expertise and authority within their designated areas.*	6.98%	TIA, QCTO, WUA	Yellow
NGO	This group are Non-	6.98%	HP, NGO's SA, NGOs EU	Orange

	governmental organisations with a non-profit purpose and are socially oriented.			
Network Organisation	These groups focuses on creating networks to achieve shared goals and share knowledge	4.65%	CoVE Water SA, CoVE Eu	Pink
Business	Business are organisations with the primary goal of generating revenue and profits by providing goods or services to customers	4.65%	Comp EU, Comp SA	Dark Blue
Locals	Residents of a specific area	4.65%	Farmers, LC	Light Pink
Water Organisations	These organisations have their expertise and focus in the water sector.	2.33%	WSI EU	Gray
Energy Organisation	These organisations have their expertise and focus in the energy sector.	2.3%%	EIA	Red

In figure 16 the grouped stakeholders are visualised in the network.

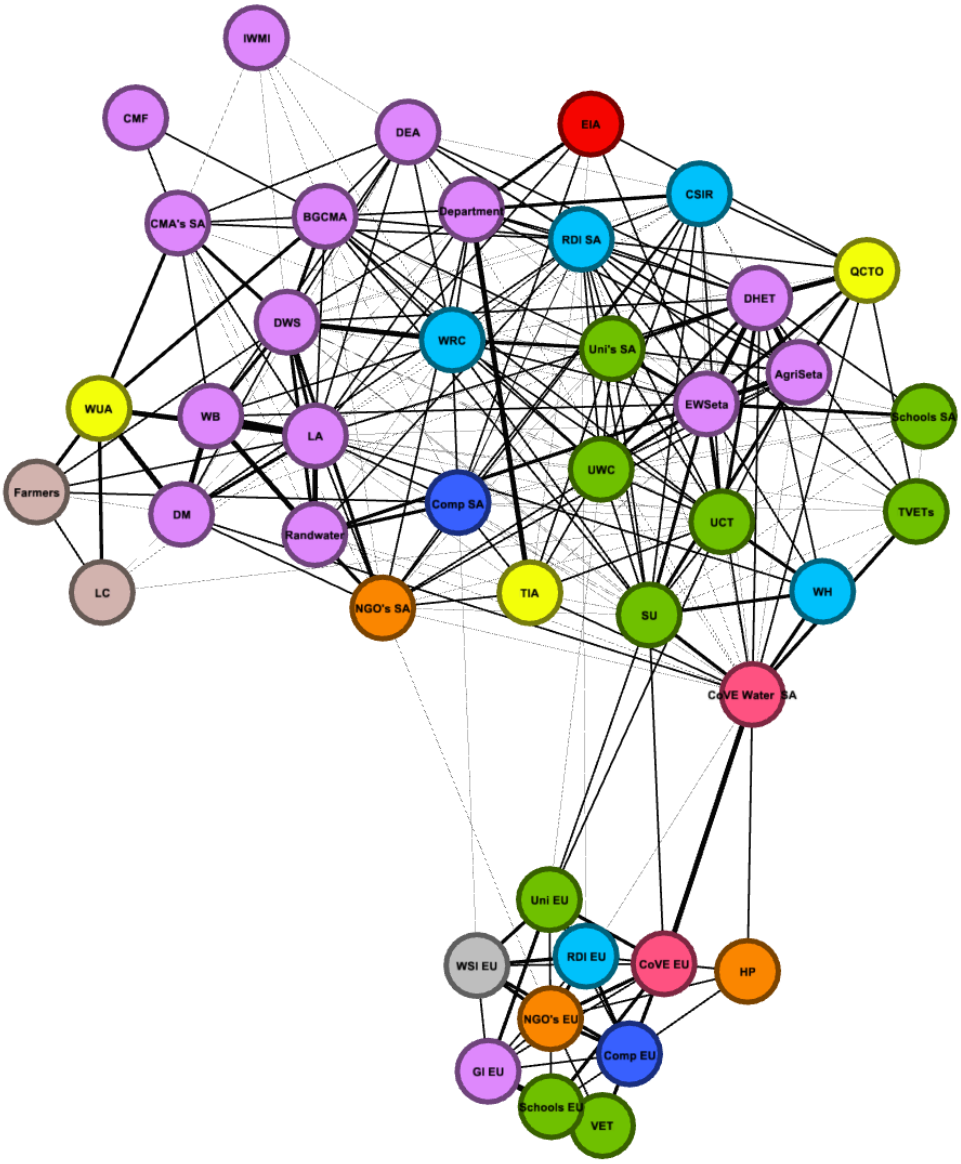

Figure 16: Visualisation network based on group type.

Brokerages in network

Different brokerages can occur in the network. These brokerages are visualised in figure 17

WUA as Liaison broker

The WUA can serve as a Liaison broker by connecting the local groups (Farmers and LC) to the rest of the network, particularly with governmental entities, with whom the WUA maintains a robust connection. The local organisations heavily rely on the WUA's efficacy, as it serves as their primary conduit to network participation. Given the overarching goal of heightening awareness and interest, it becomes essential for local levels to actively engage within the network, recognizing their potential to alter water usage practices and offer a valuable workforce for the water sector. Moreover, comprehending the local groups' challenges and needs is vital for the wider network. It can be seen as critical that the WUA is the only strong relation with them. Emphasising the importance of enhancing direct engagement of local groups within collaborations rather than solely relying on intermediaries.

Within this brokerage, the potential for biases to emerge is worth considering. The WUA exhibits a greater number of connections with other governmental groups, and these connections tend to be more robust than those with the local groups. Consequently, the WUA may find itself in closer proximity to the other stakeholders, potentially influencing the brokerage process. This could lead to a less neutral collaboration and have implications for collaboration effectiveness. Additionally, it may impact the local groups, who may perceive that their voices are not as effectively heard, which is something that also came up within the interviews. This, in turn, presents challenges in addressing issues when key stakeholders are reluctant to collaborate. Therefore, building trust with the local groups becomes essential to ensure their willingness to engage in collaboration.

In this brokerage, a form of cohesion is also evident. On the right side a cohesion between the governmental groups is noticeable. They all have a strong relation with each other, forming a cohesive unit. On the left side, the local groups are also interconnected, although their cohesion is not as pronounced as that of the governmental groups. These cohesions can impact the effectiveness of the broker, and therefore the collaboration between the two groups (local and government). If the broker's efforts fall short, it may lead to a division between these groups. Such division can negatively impact the effectiveness of the collaborations and, in turn, the dynamic of the network. This can eventually, in the worst case, lead to exclusion of the local groups. Concluding, the WUA plays an important role in improving collaboration within the network. However it is essential to ensure a balanced and resilient network, avoiding overreliance on the WUA. CoVE Water SA can actively contribute to achieving this balance.

EWSeta as Itinerant broker

EWSeta can function as an itinerant broker, establishing connections between various education groups, including schools, universities, and TVETs. These education groups do not engage in direct collaboration with one another, but their ties with EWSeta are notably robust. As a result, collaborative efforts are channelled through the intermediary, EWSeta, which aligns with the findings from the interviews. Schools and universities can mutually support one another in educational endeavours, allowing for curriculum adjustments based on shared insights. There is also much room for improving the relation between TVETs and the other education groups (schools and Universities). Currently, this connection is relatively weak, as indicated by personal communication, and is expected to primarily occur through the broker, EWSeta.

Enhancing the education group's network and increasing the participation of schools and TVETs in the network, as desired by numerous stakeholders (interviews), could benefit from strategies aimed at more direct involvement of these institutions in the network. This may also involve strengthening the direct connections with universities, given their prominent position within the network. Universities, with their influential presence, can play a pivotal role in improving the engagement of TVETs and schools.

In this brokerage the likelihood of bias is relatively low, reflecting the strong connections between EWSeta and schools and universities. In contrast, the relationship with TVETs is less robust. This corresponds with the project's objectives, which aim to increase the involvement of TVETs in the network and establish a network where TVETs assume a more

active role. The TVETs are eager to contribute to the network, and are likely to invest in creating a strong network and fostering collaborations with stakeholders (interview). However, it is important that the other stakeholders are also motivated to involve the TVETs more in the network, and this is an area where CoVE Water SA can have a significant impact.

Cohesion is not a concern within this brokerage; while the issue is that the same group, education group, are not collaborating as desired. There exists a gap in this regard which all participating stakeholders acknowledge and are eager to enhance. Consequently, any division arising from this is expected to be minimal. Nonetheless, it is crucial to invest time and effort into these collaborations to translate the identified needs into tangible outcomes, namely, the development of robust relations among education group stakeholders.

CoVE Water SA as Itinerant broker

The CoVE Water SA can be seen as an itinerant broker between the TVETs and universities. At the moment a direct collaboration between universities and TVETs is lacking, despite belonging to the same group type and sharing common objectives, such as enhancing student education and skills. CoVE Water SA is currently the broker in this collaboration. However, for long-term network efficiency, it would be advantageous for universities and TVETs to work directly together. CoVE Water SA can operate as an mediator for a period of time, however there will come a point where its influence should diminish, and the network should sustain itself independently, as indicated through personal communication.

Given the shared interests of TVETs and universities, as revealed in the interviews, and their alignment with CoVE Water SA's objectives, the likelihood of significant biases emerging from the broker toward either stakeholder is minimal. The same principle applies to cohesion; if both universities and TVETs are committed to investing time and effort in collaboration, the potential for cohesion to develop is substantial. However, there is a potential pitfall, namely, that TVETs might not actively participate in the network and could be left behind. Universities already hold a strong position within the network, so it's important that the universities see the benefits from collaborating with TVETs and engage them in the network. CoVE Water SA can contribute to highlight this and set up the first steps towards achieving this goal.

CoVE Water SA as Liaison broker

In addition to being an itinerant broker, CoVE Water SA can also be characterised as a Liaison broker. In addition to the universities, the TVETs are at the moment not actively involved in the network. The connection of the TVETs to the network mostly relies on a broker, CoVE Water SA. The TVETs' level of participation is contingent on the effectiveness of this broker. The goal of the project is to involve the TVETs more actively in the network. So eventually, the TVETs establish their own network with direct connections, including those with European Institutions. To achieve this goal, it is important that the CoVE Water SA function efficiently as a broker and actively facilitate the integration of TVETs into the network.

Biases are unlikely to arise in this scenario involving the broker, as CoVE Water SA is actively committed to enhancing the prominence of TVETs within the network. The strength of the relations is also the same between CoVE Water SA and the TVETs and CoVE Water SA and the rest of the network. So there is no difference in relations' strengths and therefore will not affect the way of communicating between the brokers and the others.

Nevertheless, cohesion within the network side of brokerage is feasible. It is important that the broker keeps the network motivated to collaborate with the TVETs. The network needs to see the benefits of involving them into the network and that it can contribute to their needs and interests. When the network is not willing to involve the TVET, it will tire broker's work to pursue collaborations.

DWS as Gatekeeper/Representative broker
DWS operates in this network as a gatekeeper/ representative broker. There is no distinction, since the relationships are undirected. DWS connects the CoVE Water SA to other entities within the governmental group, to which the DWS itself belongs. This connectivity facilitates potential collaborations between CoVE Water SA and the CMA network, a collaboration currently underdeveloped but interesting to develop. Especially since the CMA are close with WUA, which gives them a link with the LC. These collaborations are of importance for the CoVE Water SA, as the CMA network possesses valuable insights into the water management network and can also provide job opportunities.

While the DWS belongs to the government group, there is the possibility that biases occur. Even though the collaboration between governmental institutions is not always as wanted (interview), they do have a stronger relation with each other compared to the relation between CoVE Water SA and DWS. It is therefore crucial that the benefits of maintaining the collaboration with CoVE Water SA are clear and the broker invests effort in nurturing it.

Besides biases, cohesion can occur in the network. When the other governmental institutions are not as motivated, or do not see the benefits of involving the CoVE Water SA in the network. In such cases, they may form isolated clusters, impeding the broker's efforts and undermining collaboration between stakeholders and CoVE Water SA. Therefore, it is essential to elucidate the value that CoVE Water SA can bring to these institutions and what they can gain from a partnership. The broker plays a pivotal role in facilitating this understanding. However it is important that there will not be overreliance on the DWS and that the CoVE Water SA also actively contribute in fostering strong relations with other stakeholders.

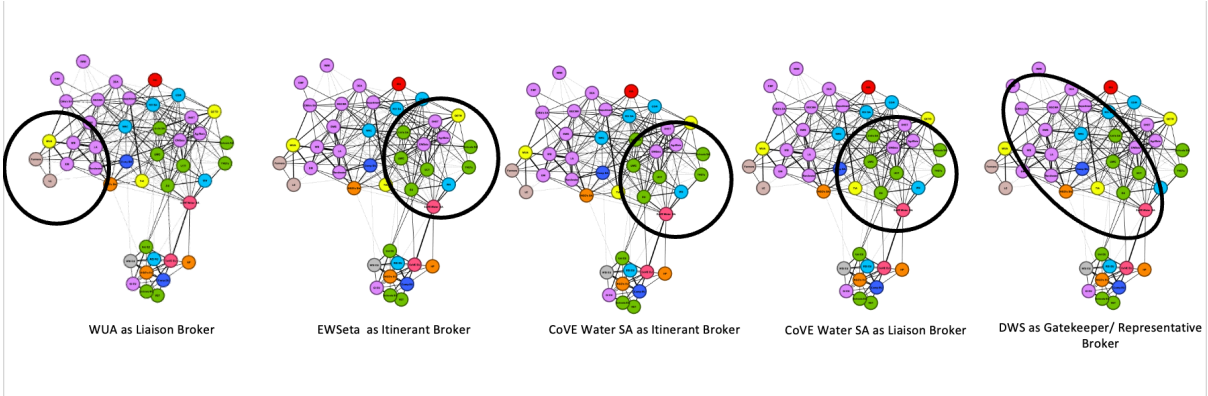

Figure 17: Visualisation of the brokerages in the network

6.3.2.2. Take-aways SNA

As indicated by the analysis results, there is a need to improve the water sector network in South Africa. Currently, many relations are weak or nonexistent, a fact supported by the density score. In an ideal network scenario, there should be minimal interdependence and healthy dynamism. CoVE Water SA has the potential to make a significant contribution to this improvement and serve as a pivotal mediator, as evident from centrality scores, brokerage results, and cluster results. Noteworthy, even though CoVE SA Water can operate as a mediator, it is essential for stakeholders not to develop interdependencies with CoVE Water SA. For example the TVETs school. At the moment the CoVE Water SA ensures their involvement in the network. To maintain the TVETs' connections in the network, CoVE Water SA and TVETs need to make sure the TVETs obtain direct connections with other stakeholders. As a mediator, CoVE Water SA can play a crucial role in creating a more extensive and notably stronger network for all stakeholders. Furthermore, CoVE Water SA must aim to foster numerous direct relationships while avoiding interdependence, as interdependence tends to hinder collaborative efforts.. Several actions can be taken by CoVE Water SA to achieve this.

First of all, it is essential to ensure that the network holds appeal for all stakeholders. They need to highlight that the network is aligned with the needs and interests of all the stakeholders and that a broad network will make it easier to improve the issues in the water sector. Key interests and needs that can be realised through a broader and robust network include raising more awareness in the water sector, setting up international collaborations and increasing the number of collaborations in the water sector in general.

To enhance awareness in the water sector, it is important to strengthen relations with local authorities and communities. These stakeholders are often overlooked in collaborations, despite their significant importance as indicated by centrality scores and brokerage results. CoVE Water SA should explore opportunities to incorporate them in collaborations and convey the necessity of their involvement to other stakeholders. Many times strategies formulated at a higher level, between governmental institutions, do not align with the actual needs of the local groups. This can result in a waste of time and effort, with minimal strategy results. Besides on a local level, awareness can be increased. Also on an educational level the awareness and interest should be increased. Integrating the water sector more into the curricula of universities, schools and TVETs can generate more interest and awareness in

the water sector. This highlights the importance of establishing effective relationships with educational institutions.

There are also opportunities for expanding the network internationally, not only to Europe but also across other African countries, according to the SNA. The network analysis (centralties, cluster results and brokerage results) indicates that this connection is relatively weak at the moment. Regarding the European connection, the CoVE Water SA has an important collaboration with European CoVE Water, which they should leverage to strengthen the connection with European institutions. Currently, the only link to Europe is through universities, but this connection is not particularly robust and not a solid foundation to build upon. CoVE Water SA has a strong connection with Europe, making it valuable to cherish this relation. CoVE Water SA should however utilise universities to establish more relations with Europe, while they can offer Europe for example exchanges. In addition to Europe, it's also interesting for South Africa's water network to establish more connections with other water management institutions in broader Africa. These institutions probably experience the same challenges as in South Africa and share a more similar background, which can lead to vulnerable resource exchanges. Further improvements in collaboration can be made between educational groups, including TVETs, schools, and universities, as indicated by brokerage results. Their objectives align and therefore they can provide substantial support to each other.

Another interest of the stakeholders is to increase the number of employees in the water sector. TVETs can play an important role here and CoVE Water SA should capitalise on this opportunity, while this also aligns with CoVE Water SA's objectives. CoVE Water SA aims to foster stronger integration of TVETs into the network, resulting in them having a strong network themself, also internationally. To establish this, the other stakeholders should recognize that the TVETs can significantly contribute to expanding the workforce within the water sector, as they represent the future employees. Establishing connections with key stakeholders, who have a strong link with the labour market, is therefore interesting for the CoVE Water SA. The SNA, both the network based on collaboration and the network based on the PI Grid, showed that DWS, EWSeta, BGCCA, LA and RDI are key players in the network. Some of them also have the potential to offer job opportunities. Additionally, they can also provide funding,which aligns with one of CoVE Water SA's important objectives.

Concluding, there are many gaps within the network where opportunities lie. The CoVE Water SA should use these opportunities and respond to them.

7 Conclusion & Recommendations

This section consolidates all findings to provide a response to the primary research question: '*What actions should be taken to improve the effectiveness of CoVE Water SA?*'
This main question is addressed based on the answers to the sub-questions provided below.

The first sub-question *'What makes the CoVE Water SA effective?'* has been explored through a literature review and personal communication. According to these sources, CoVE Water SA is deemed effective when several key factors are in place. These factors include the requirement for TVET colleges to exhibit robust network mobility, a significant emphasis on VET education in the water sector, a strong relation between TVET colleges and the labour market, adequate funding support, and an interdependent and dynamic network.

Subsequently, the stakeholders were analysed to answer the sub-question *'Who are the key stakeholders and what is their current participation and collaboration with the platform?'*. Based on the Social Network Analysis (SNA) and the Power Interest grids (PI grids), several key stakeholders have emerged, each playing a pivotal role in establishing connections that ensure an enhancement of CoVE Water SA's effectiveness. These stakeholders have been classified into three groups: Government, Research and Education. Government entities include DWS, EWSeta, and BGCMA. These key players possess extensive networks and wield significant influence, making it crucial for the CoVE Water SA to establish strong connections with them. Additionally, they can offer numerous job opportunities and play a vital role in funding, aligning with the needs of CoVE Water SA. It can be asserted, based on the interviews, that initial connections with government departments have been established, but it is vital to further nurture these connections.

Local Authorities also emerge as prominent key players. Establishing strong connections with them is crucial, particularly because the SNA reveals that these connections are currently weak or non-existent. Building these ties is vital, as Local Authorities maintain connections with numerous pivotal stakeholders. For instance, they have connections with farmers, who are not yet affiliated with CoVE Water SA. Establishing this link aligns with CoVE Water SA's objectives of involving these stakeholders more in addressing the problem, as they possess significant expertise and play a crucial role in water usage. Furthermore, the SNA also highlighted the significance of research organisations as key stakeholders. Research organisations are highly valuable due to their extensive knowledge of the problem, enabling them to provide useful insights into potential solutions for water-related issues. Moreover, these research organisations exhibit a multitude of connections within the social network. Lastly, the SNA revealed that universities have extensive connections within the network. These connections not only encompass links within South Africa but also extend to the European network. Since one of the objectives of CoVE Water SA is to expand its network to Europe, it is crucial to collaborate closely with the universities to enhance and broaden the relationship with the European network.

Based on the analysis of the conducted interviews, the sub-question *'What should the CoVE Water SA offer to achieve the goals and needs of the stakeholders?'* is investigated. Six key themes, addressing the needs of stakeholders and areas where CoVE can make a valuable

contribution, have been derived from important quotes in the interviews. These themes include raising awareness, reducing the skills gap in the water sector, fostering international collaborations, mitigating the labour shortage in the water sector, improving education material, and establishing desired collaborations. Within each theme, the interviewed stakeholders have presented their views and numerous suggestions on how CoVE Water SA can assist in addressing these issues. For instance, CoVE Water SA can play a role in organising activities to raise awareness. To narrow the skills gap between students and the water industry, the platform can aid with improving curricula, supporting the preparation of students for the workforce, and making the education more practical instead of only theoretical. Furthermore, CoVE Water SA can provide training and learning resources as well as comprehensive courses. It is also important to facilitate international collaborations for exchange opportunities and knowledge sharing, as well as fostering more partnerships within South Africa, as also concluded by the SNA. Moreover, stakeholders have also mentioned possible failures of CoVE Water SA, which can aid in preventing any shortcomings of the platform.

In addition to how CoVE Water SA can align with the needs of stakeholders, it's important to consider what stakeholders can contribute to the platform. Therefore, the sub question *"What can stakeholders offer to the CoVE Water SA?"* is explored. The interviewed stakeholders noted ongoing initiatives related to the six themes mentioned before. For example, EWSeta is currently conducting research to assess the demand for skills in the water industry, which may lead to accrediting the curricula and qualifications. They are also providing tools and activities to increase students' awareness of the various careers available in the water sector, aiming to stimulate their interest. In addition, DWS, UWC and UTC have already taken steps in connecting education with real-world practice, making the education more practical. However, considering the available resources of these stakeholders, they likely have the capacity to offer assistance to the platform in ways that may extend what was discussed in the interviews. Furthermore, the analysis of the PI grids highlighted the potential contributions of stakeholders to the CoVE Water SA, encompassing knowledge, collaboration, and power. Governmental stakeholders can potentially enrich the platform with knowledge and power in the form of regulatory authority and financial support, as well as collaboration. Universities and regional CoVEs Water primarily offer knowledge and collaborative opportunities, while businesses are likely to contribute power in the form of financial support.

Finally, the sub-question *‘What can CoVE Water SA contribute to improve the network?’* was examined using information derived from the SNA and the PI grids. These analyses show the potential role of CoVE Water SA as a mediator within the water network, establishing a broad and robust network, and thereby fostering collaborations among various stakeholders. However, it is necessary for this network to eventually operate with less interdependence while maintaining a dynamic character. Stakeholders should not become too dependent on CoVE Water SA, but should see CoVE Water SA's contribution as a guide to a robust, dynamic and interdependent network in the water sector. There are specific collaborations where the CoVE Water SA should focus on.

First of all, there is a need to enhance collaboration among educational groups. These collaborations are currently lacking, yet they could provide essential resources to each other. Given CoVE Water SA’s aim to enhance VET education, it would be beneficial to invest time

in enhancing the educational network. Second, CoVE Water SA can contribute to improve the relationship with international institutions. Both stakeholders and the CoVE Water SA recognise the significance of international involvement within the water sector. The platform should also engage TVET colleges, and secondary and primary schools within the water network. These educational entities are not fully integrated into the network, but their participation would be beneficial for all the stakeholders. For instance, TVET students could potentially reduce the workforce shortage in the water sector. CoVE Water SA can invest in these opportunities, and, in its role as a mediator, facilitate the demonstration of potential contributions of these educational groups to the network. Apart from engaging TVETs and schools, CoVE Water SA can also enhance the involvement of the local communities in the water network. Their participation will result in more knowledge about water issues. Now, these communities are not involved in the decision-making process, resulting in mismatched solutions.

Finally, the analyses showed that the current water network lacks density. CoVE Water SA can broaden and strengthen the network by involving more stakeholders. A broader and more robust network can create greater awareness and interest in the water sector, potentially reducing the workforce gap. Additionally, such a network can facilitate the establishment of more collaborations, both on a national and international scale.

8 Discussion & Limitations

The limitations inherent in this study provide insights into the challenges confronted throughout the research process. It is imperative that future research takes these limitations into account for a more comprehensive understanding of the issues and the corresponding actions that CoVE Water SA should undertake. These limitations also warrant consideration in the context of addressing the provided recommendations in this report. The limitations of the research are:

- The scope of this research is limited by the available resources and time. Only 12 interviews have been conducted and the majority of these stakeholders are government institutions. Expanding the number of interviews will provide a broader understanding about needs of all stakeholders within the water sector, as well as how stakeholders may contribute to the platform and issues in the water sector in general. To gain a better understanding of the water sector's challenges and the potential contribution of CoVE Water SA, it would be advisable to conduct interviews with a broader and more diverse range of stakeholders, for example including the local communities and farmers.
- The network analysis focussed primarily on water related stakeholders. However, the network and the issues comprise often interaction with other sectors. Future research should consider a more interdisciplinary approach to capture the interplay between sectors, as collaboration or conflicts may arise between them.
- Throughout the interviews, responses varying in level of detail and diversity were observed, making it challenging to interpret stakeholders' perspectives consistently. These discrepancies could be attributed to differences in background, communication styles, or individual perspectives, potentially leading to varied interpretations of the questions.
- Sometimes while conducting the interviews, there were challenges in mutual understanding between the interviewer and the interviewee. Variations in background knowledge between the two parties often contributed to potential misunderstanding and differing interpretations of the discussion.
- The strength of relations between stakeholders in the SNA relies on estimations, derived from partial information. Not all the nuances and details of these collaborations were fully known, which may have influenced the results of the network.
- Certain analytical techniques, such as Comparative Cognitive Mapping, were not applicable due to the early stage of the CoVE Water SA project. However, these techniques could provide interesting insights for the project. Hence, for future research, when the project has reached a more advanced stage, exploring such analyses would be of interest.
- Differences in the South African regions, for example the Northern provinces compared to the Western Cape, might limit the generalizability of the findings. Water-related challenges and stakeholder networks can vary significantly, which in turn may restrict the broader relevance and applicability of the results.
- Some of the correspondence of the interviewees could be biased. There is a possibility that interviewees provided somewhat generalised or overly optimistic responses. These biases could also occur while individuals of the organisations are

interviewed. They may not fully represent the viewpoints of their respective organisations. Individual opinions can vary from the organisational standpoint.

- The dynamic nature of stakeholder networks and the rapid changes within the water sector suggest that the findings and recommendations might become outdated over time. Stakeholders' perspectives, needs and involvement can evolve, impacting the relevance and usefulness of the research outcomes. Despite the rapid evolving network, the environment in South Africa can also undergo changes, such as those resulting from climate change. The challenges faced today may differ from those encountered in the future, even just a few years later.
- Not the same questions were asked to the interviewees. Instead, the questions were tailored to the background of each stakeholder. Consequently, not all stakeholders provided answers and opinions on the same theme, which were established during the analysis of the interviews.

These limitations are essential to consider when interpreting the research findings and recommendations. They also present opportunities for future research.

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Appendices

Appendix A. Stakeholder analyses

A.1 Stakeholder information

The table below gives a description of the objectives, perceptions, resources and collaborations of the key stakeholders.

Table A.1: Objectives, perceptions, resources and collaborations of the stakeholders.

stakeholder	***Objectives***	***Perceptions***	***Resources***	***Collaborations***
Department of Water and Sanitation (DWS, n.d.a)	Promote equality and fair water resource distribution. Ensure future water security for economic growth. Use water for development and poverty reduction. Harness water's economic potential and job creation. Practise sustainable, equitable water resource management. Engage and raise awareness among young people. Increase public awareness to address water-related issues. Monitor and protect water resources and management. Ensuring that our citizens are provided with water and sanitation services	Come up with non-conventional solutions Building skills and capacity Effective institutional arrangements and governance Technology and innovation Prioritising practical solutions and cooperation Addressing funding challenges Training and mentoring students Use of research and assessment resources for skills demand. Education and training through cooperation	Access to expertise and personnel in the field of water management and environmental protection. Legal instruments. Connections with local governments, NGOs, technology providers, and universities.	Collaboration for curriculum and accreditation development. Training for TVET students, university students and workers. Partnerships with experts and industry for curriculum. Education and training through cooperation with universities, TVET colleges, and private institutions. Online resources for raising young people's awareness.

	they deserve			
Capricorn TVET *(*Kruss & Petersen, 2016), (Department: Higher Education and Training & Capricorn TVET college, n.d.).	Providing practical education and skills to students to prepare them for careers in various fields	Responsive, flexible and quality education Partnerships	Skills in specialised areas Willingness/motivation to interact organisational planning Organisational structures (e.g. technology transfer office, research centres) research collaboration	Other TVET schools Government They do already collaborate a little bit with: primary and secondary schools, universities and companies, but they want to collaborate more with them.
Vhembe TVET *(*Kruss & Petersen, 2016), (Vhembe TVET college, n.d.).	Providing practical education and skills to students to prepare them for careers in various fields	Responsive, flexible and quality education Partnerships	Skills in specialised areas willingness/motivation to interact organisational planning Organisational structures (e.g. technology transfer office, research centres) research collaboration	Other TVET schools Government They do already collaborate a little bit with: primary and secondary schools, universities and companies, but they want to collaborate more with them.
Energy Water Sector Education Training Authority (EWSeta, 2023)	Annual assessment of skills demand in the water and energy sectors Oversight of curriculum and qualification accreditation is maintained. Bridging the gap between identified skills requirements and the national-scale	Collaborative curriculum and accreditation development. Skills enhancement training for TVET, university students, and workers. Focus on technical, soft skills, ethics, and critical thinking. Use of research and	Power Money Infrastructure Partnerships Training and education programs for specific knowledge Regulatory authority	Employers and industry associations A long-standing partnership exists with the Water Institute at Stellenbosch University, focusing on research and projects. Desired collaborations include partnerships with regional waterboards to promote alignment.

	actions to meet them is prioritised.	assessment for skills demand. Partnerships with experts and industry for curriculum. Cooperation with educational institutions for training. Online resources to raise youth awareness.		Increased participation of TVET colleges in the CoVE platform is sought. The value of international collaborations and exchanges, especially with EU initiatives, is recognized. Contacts with technical experts, schools, and universities are maintained for the development and implementation of education and training programs
Drakenstein Municipality (Nkonyane, 2023)	Address high personnel vacancies. Tackle funding shortages for projects, operations, and human resources. Deal with challenges related to the ageing workforce. Raise awareness about water issues within the population. Encourage interest in the water sector, especially among young people.	Prioritising a passionate and hardworking team. Focusing on awareness and education, beginning with children. Closing the gap between theory and practical education. Exploring partnerships with universities and colleges. Maintaining a strong relationship with the Department of Water and Sanitation for regulatory support.	A dedicated and motivated workforce. Advocacy for educational changes to incorporate practical aspects. Potential collaboration with universities and colleges. Existing communication and interaction with the Department of Water and Sanitation.	Current collaborations are primarily internal within the organisation. Potential collaborations with universities, colleges, and technical schools. A focus on connecting education with practical experience.
Council for Scientific Industrial Research (Council of Scientific and Industrial Research, n.d.).	Providing knowledge solutions for the inclusive and sustainable progress of industry and society while cooperatively inventing and localising technology Contribute to the improvement of the	Targeted & multidisciplinary research and technological innovation, in the national interest and in areas that it considers should be given priority Researching, developing,	Research	Entities in the public and private sector

	quality of life. Promote industrial and scientific development: Enhance the competitiveness of important industries to support South Africa's re-industrialisation	localising, and spreading technologies.		
University of Western Cape (Institute for water studies) (University of the Western Cape, n.d.)	Impactful integration of undergraduate and postgraduate programs with research Contributions to the knowledge ecosystem Enhance student career preparedness, job search support, and employability. Strengthen UWC's position as a research-led university	Offer students a holistic career preparation experience from orientation through graduation. Provide high-quality, evidence-based learning and teaching Create responsive curricula and a variety of methods for learning, teaching and assessment. Optimise the state's subsidy potential and actively pursue initiatives to generate and secure new revenue streams to effectively support UWC's academic mandate	Knowledge and research Partnerships	Strategic partnerships with international universities. Companies and governmental officials Aiming for strong partnerships in Africa and beyond Other universities Department of Water and Sanitation
University of Cape Town (Future Water Institute) (Bester et al., 2020), (Future Water Institute, n.d.), (University of Cape Town, n.d.).	UCT in general: Be an inclusive, research-intensive university meeting the challenges of this period in time with cutting-edge teaching, research and facilities Future Water Institute: Create sustainable and resilient water	UCT in general: Provide excellent teaching Future Water Institute: Consult their official publications, reports, or conduct surveys and interviews with relevant stakeholders.	Research Centers UCT and services. Partnerships Knowledge	Academic and research partnerships with universities worldwide. Community engagement initiatives. Government partnerships for policy and public health. Future Water Institute: municipalities, Department

	futures. Strengthen the ability to manage water scarcity and build resilience. Innovate to ensure water supply aligns with demand. Raise knowledge and understanding of water issues, improve water management & governance	Conduct impact-driven, multidisciplinary and collaborative research Support postgraduates to enhance our understanding of water issues Organise short courses, workshops, symposia and seminars to promote cooperation and knowledge exchange between academics, industry, government and civil society.		of Water and Sanitation, industries, international research groups and national research groups.
Breede Gouritz Catchment Management Agency (Catchment Agency) (BCGMA, n.d.)	Sustainable water resource management taking into account ecological, social, and economic stakeholders. Protect and preserve the ecological health and integrity of the catchment's ecosystems. Address water quality, availability, and improvement. Stakeholder engagement, including government, local communities, industries, and agricultural sectors. Complete the transformation of irrigation boards into water user associations.	Each agency must draw up a management strategy for the catchment and will have to perform core functions to implement the Act, functions that include the active promotion of community participation. Review reports and publications to provide insights into various perspectives. Engage with stakeholders. Collaborate with research institutions.	Human resources and knowledge. Data and information Stakeholder networks Constraints on funding and resources, particularly for water supply projects in certain areas. The Catchment Management Agency (CMA) operates with limited resources, affecting staff numbers and task execution.	Stakeholder participation is a prerequisite. Formally recognised institutionalised bodies and irrigations boards. But also loosely associated rural communities. Desired collaborations involve increased engagement with universities and colleges and a stronger connection with local communities to address water-related issues. Collaboration with other CMAs and regional government agencies is also pursued.

	Promote community participation in the protection, use, development, conservation, management, and control of water resources.			
Mendelu University (Mendelova univerzita v Brně, 2023)	Remote and conduct research and innovation activities related to a specific thematic area or project focus, which may include areas such as water management, environmental sustainability, public health, or education. This increases the interest in the water sector among students. Enhance educational programs and capacity-building efforts related to the project's goals, including the development of courses, training programs, and educational materials.	Academic excellence Research and innovation International collaboration as a means to strengthen its network of research and innovation activities that contribute to academic excellence. Which emphasises practical, industry-related skills in education. Sustainability and environmental impact.	Financial resources Academic expertise Laboratory facilities International networks Supporting infrastructure Strong partnership with a prominent environmental education organisation. Collaborations with various schools and industry partners.	Other universities and research institutions. Government agencies responsible for environmental protection, public health, water management and education. European Union Institutions that may fund and oversee the projects they are working on. Academic networks and consortia that facilitate collaboration and knowledge exchange among European universities and institutions.
Katapult (Katapult, n.d.)	Strengthening vocational and professional education for a sustainable future. Emphasising the importance of shared knowledge and interdisciplinary connections to address social challenges and transitions Improve the	Connect public-private partnerships with each other Providing tools to build & grow public partnership: business models, stakeholder analysis, peer review Analysing the needs and problems of partners and mentor them	Knowledge Experience Partnerships Funding	EU commission Dutch government and regional governments Companies Educational Institutions

	connection between the labour market and knowledge institutions.	Organising activities to satisfy the needs of partners		
PoVE Water (PoVE Water, n.d.,a), (PoVE Water, n.d.,b).	Scaling up the Platform of Vocational Excellence Water Integrate Vocational Excellence in the water sector, thus ensuring high quality skills and competences that lead to quality jobs and careers, meeting the needs of an innovative, inclusive and sustainable economy. Establish the essential infrastructure to integrate vocational excellence in the water sector in Europe	Addressing the fight to reduce CO2 and climate change and slow down global warming, needs to be addressed with Water related education for VET students. Setting up CoVE's in new regions International mobility activities	Additional learning materials to all partners Skills and knowledge Partnerships	5 regional CoVes Water North-South collaboration by connecting to an existing water and water smart agriculture cluster including 6 VET Schools via Stellenbosch University in South Africa. European cooperation (on a strategic level and for vocational student exchanges) is even more pressing for the water sector as the environment is changing in such a rapid way that knowledge exchange and sharing of experiences is crucial. Need for EU Partnerships VET is a crucial partner and needs to have a front seat in regional water innovation ecosystems.
CoVe Water SA (PoVE Water, n.d.,a)	Attract and retain talent, make water studies appealing to students, and raise public awareness about the sector's importance. Implementing a new way of educating people to make sure they are the sustainable water sector professionals that society and the labour market needs.	Explore project reports, publications and documentation Interview project stakeholders Consult with NGOs and government agencies Contact funding partners or organisations that support the project to understand their motivations and perspectives Organise strategic	Partnerships Access to research findings, data on water quality health outcomes Knowledge and specific trainings Policy support Technology and equipment	Government agencies responsible for water resource, public health and community development NGOs focused on water and sanitation, public health or community empowerment Educational institutions (TVETs and universities) Research institutions Water experts and engineers Companies

		promotional campaigns and other activities		Advocacy and media partners
Hanse-Parlament (Hanse-Parlament, 2014)	Small and medium-sized enterprises are supported by the Hanse-Parlament in the Baltic Sea region and Europe. Centres of vocational excellence are created, with a particular focus on the fields of green economy and water management. The impact of the CoVE Water project on various stakeholders is aimed to be measured by Hanse-Parlament.	Objectives are approached through project-based work, which involves multiple partners such as chambers of craft, chambers of commerce, universities, and vocational schools. Workshops, side visits, and knowledge sharing are facilitated to address regional problems within the water sector. Open communication channels are created, information is exchanged, and active engagement with various stakeholders is pursued for successful collaborations.	Funding is utilised from the European Union and Erasmus Plus. Surveys, impact stories, and qualitative interviews are used for measuring project impacts. Collaborations with various partners within the CoVE Water project are actively maintained. A small organisation is represented.	Partnerships are established with various organisations, including chambers of craft, chambers of commerce, universities, and vocational schools in the Baltic Sea region and beyond. Close work is done with the CoVE Water project to measure its impact on students, companies, and teachers. The aim is the expansion of their network and engagement with more stakeholders, including companies, policymakers, and educational institutions, for a more comprehensive approach.

A.2 Issue Tree

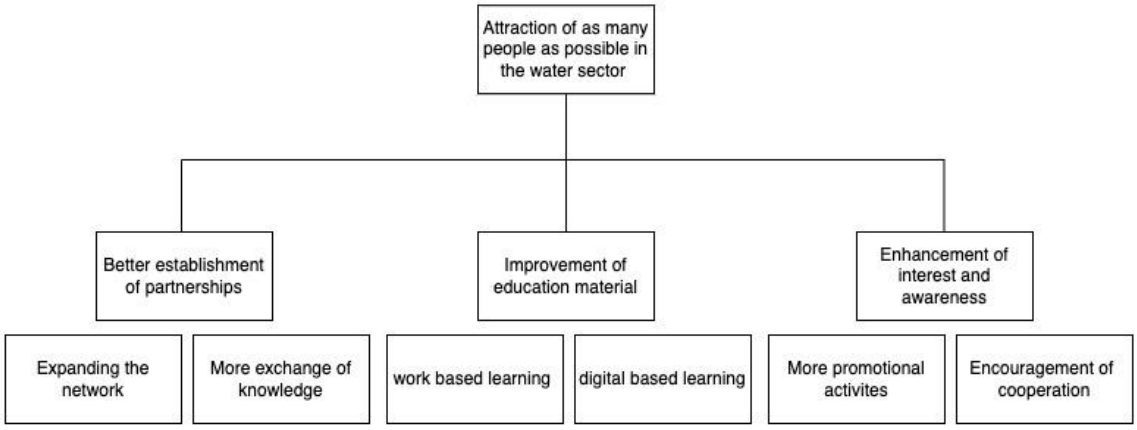

Figure A.1: Issue Tree

In Figure A.1 the Issue Tree of the CoVE Water SA is presented. In the first layer, the main objective of the platform is stated, which is to attract as many individuals as possible to the water sector. This goal can be achieved through establishing more partnerships, improving the education materials and creating more interest and awareness.

Partnerships play a central role in the platform's strategy as they facilitate the exchange of knowledge between stakeholders. This approach ensures that knowledge doesn't get lost, and stakeholders can use the insights obtained from others, rather than having to discover them independently. It is important to expand the network of partners to make CoVE become a greater success. Improving the education materials comprise both work based and digital based learning. Finally, the platform can raise interest and awareness by organising more activities and encouraging collaborations.

A.3 Instrumental / Normative view

In the process of identifying relevant stakeholders for problem analysis, it is common to distinguish between two perspectives: the instrumental perspective and the normative/ ethical perspective. The instrumental perspective focuses on stakeholders who can influence the problem and are involved in the activities needed to change the situation. On the other hand, the normative/ethical perspective focuses on stakeholders who are likely to be influenced by actions aimed at changing the problem situation.

A more nuanced categorization of stakeholders is employed within the frameworks proposed and discussed by Mitroff (1983), Bryson (2004), and Wang et al. (2015) to classify them into distinct types. The outcome is a comprehensive list of stakeholders, accompanied by the primary identification techniques associated with each, as detailed in Table A.2.

Table A.2: Instrumental view / Normative/ethical view

Instrumental view	**Involvement**: University of Western Cape Hanse Parlament
	Position: Department of Water and Sanitation Drakenstein Municipality
	Opinion Leadership: Energy Water Sector Education Training Authority Breede Gouritz Catchment Management Agency
Normative/Ethical view	**Interest and affected stakeholders**: Capricorn TVET (University) Vhembe TVET (University) CoVe Water Scale Up (South Africa) University of Cape town
	Demographic: Mendelu University (CoVe Europe) Katapult (CoVe Europe)

What becomes clear from the table is that there is a substantial presence of stakeholders with distinctly instrumental views, as well as a significant representation of stakeholders who

have a normative/ethical view. This difference may be caused by the fact that not every stakeholder has the same amount of power in the field. For example, the instrumental view stakeholders will have more power because they can influence the problem.

In addition, TVET schools will be subject to the influence of the platform and function primarily as recipients rather than contributors, since they do not provide resources or services to the water network at the moment.

A.4 Dedicated / non dedicated stakeholders

To assess how other stakeholders will react, the framework of Enserink et al. (2010) is used. He proposes an overview table that offers the problem owner insights into potential responses from stakeholders within their environment regarding the problem formulation and intended solution. The stakeholders are evaluated by whether the stakeholder is dedicated, critical or supporting (or not). These concepts include the following:

- Dedicated stakeholders have a high interest in the problem;
- Critical stakeholders have important resources; and
- Supportive stakeholders have objectives that align with the objectives of the problem owner.

Table A.3: Dedicated / Non dedicated stakeholders

	Dedicated stakeholders (High interest)		**Non-dedicated stakeholders (Low interest)**	
	Critical stakeholders (Important resources)	**Non-critical stakeholders**	**Critical stakeholders (important resources)**	**Non-critical stakeholders**
Supportive stakeholders	• Breede Gouritz Catchment Management Agency (Catchment Agency) • Energy Water Sector - Education Training Authority • University of Western Cape • University of Cape Town	• Capricorn TVET (University) • Vhembe TVET (University) • CoVE Water Scale Up (South Africa)	• Department of Water and Sanitation • Mendelu University (CoVE Europe) • Katapult (Cove Europe)	• Hanse Parlament
Opposing stakeholders	-	-	-	-

What is clearly evident from the table is that all stakeholders are classified as supportive. There is no stakeholder explicitly opposed to the proposed solution. One might assume that this unanimity among stakeholders would facilitate collaboration and thus make problem resolution relatively straightforward. Consequently, it becomes increasingly critical to

investigate why a solution has not yet been reached and where the core of the problem truly lies.

A.5 Formal Chart

Figure A.2 shows the Formal Chart, which visualises the most important formal relations between stakeholders. Not all formal or informal relations have been included, while the focus lies in the water sector and only on the stakeholders who will be interviewed. The reason for only involving the interviewed stakeholders, is based on the argument that this chart is used to get a better idea of the stakeholders before conducting interviews.

The chart is made in the situation the CoVE Water SA Project is in its start up phase and not yet optimal running. This indicates why there are no arrows from CoVE Water SA to other stakeholders. It is not clear yet what the CoVE Water SA can offer them, while their needs and interests are not yet known and will become more clear after conducting the interviews. Because it was interesting to know beforehand what resources other stakeholders could contribute to the CoVE Water SA project, these rows with resources are visualised in orange. So, these exchanges of resources are not taking place yet, but it could potentially be possible when they are involved in the project.

As the chart shows, the CoVE Water SA project can integrate the TVETs with the other stakeholders. Also, the chart shows that the other stakeholders are already exchanging resources. As the orange lines show, these stakeholders can possibly contribute a lot to CoVE Water SA and therefore it is interesting to see where opportunities lie within collaborations.

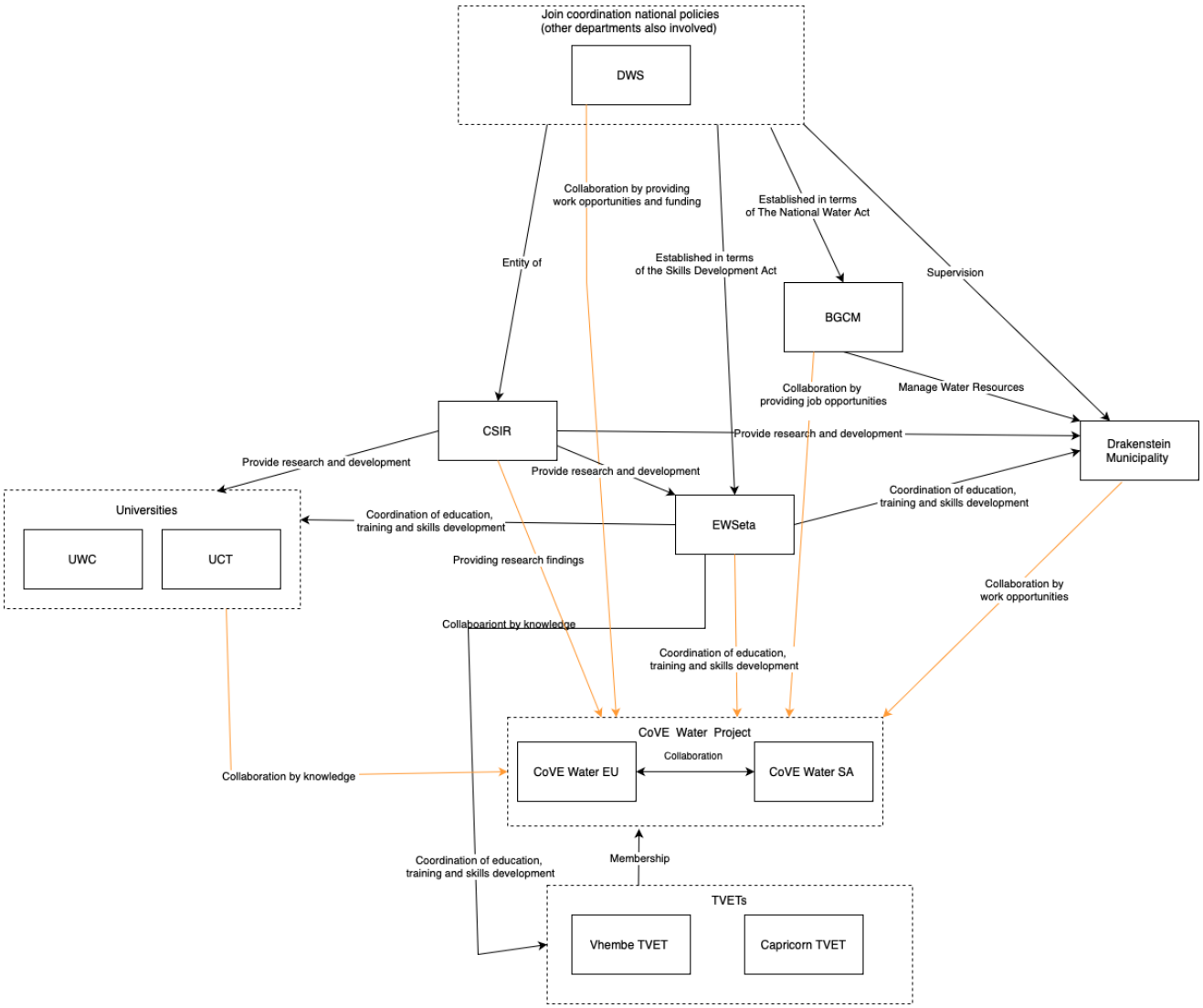

Figure A.2: Formal chart

Appendix B. Interview

B.1 Interview Questions Education

It is interesting to learn more about two distinct subjects during the interviews with colleges and public schools: to increase students' knowledge of and interest in the water industry (usability), as well as how they might contribute to improve the platform (platform improvement participation). First, to evaluate the interest in the water sector by students. The platform aims to increase the appeal of the water industry; and it is established to enhance interest of key stakeholders in the Water Sector concerning Vocational Education and Training. Analysing the cause of this and potential solutions is therefore interesting. Second, universities are also key players who are required to develop the platform and maintain the quality of the education and training.
What role do these universities envisage themselves participating on the platform and in working with other stakeholders?

General questions

- How known is the water resource management and their issues at the schools/universities. And how did that come?
- According to your view, what is the level of interest in the Water Sector?
- What is needed to increase the interest of the students and make them more aware of water management?
- Are there other projects/solutions that have been implemented to increase the interests and awareness? What was the outcome?

Platform usability

- Are you familiar with the CoVE Water SA platform?
- Do you think a platform, like the CoVE Water SA, will be useful for you? And also, just in general?
- Have you ever implemented this type of education at your university? And why not/ did you?
- What are key aspects to be included in the platform?

Platform improvement participation

- The platform is also about collaborating with other stakeholders. Do you already collaborate with other stakeholders on this subject? Or with whom do you want to collaborate?
- What barriers do you face when interacting with these people/organisations and with those that you do not yet work with?

B.2 Interview Questions Government

Governmental stakeholders
South Africa is a water-stressed country and is facing several water challenges and concerns, which include security of supply, environmental degradation and resource pollution, and the inefficient use of water. To achieve the objective of South Africa's

sustainable, egalitarian, and secure water for a better life and environment for everyone, it is crucial for governmental institutions that solutions be created. Therefore, it is interesting to ask about the existing difficulties in achieving this goal and how these difficulties affect their strategies and solutions. In addition, it is intriguing to learn their perspectives on the current situation and what it would be like in a perfect world in order to truly acknowledge the gap. Once a general understanding of their viewpoint is established, more in-depth questions can be asked about their opinion of this platform, the perceived barriers, and their suggestions for prevention. Lastly, it will be interesting to analyse the different interactions and collaborations with other stakeholders. Are they willing to collaborate, who are interesting key players and what do these stakeholders trade with one another?

General questions

- What challenges do you face in general related to Water Resource Management?
- How do these water technology challenges impact your organisation?
- How do you deal with the issues within Water Resource Management?
- What does an ideal situation look like, within the water management sector?
- Why is it important to increase the general interest of Water Resource Management?
- Why is there little to none interest in the water management sector?

CoVE project related questions

- What can CoVE Water SA contribute to you and the current challenges in the water sector?
- Do you think a platform, like the CoVE Water SA, will be useful for you? And also, just in general?
- What makes a collaborative platform successful in supporting you with the implementation of water technologies?
- What are key aspects to be included in the platform?

Collaboration related questions

- The platform is also about collaborating with other stakeholders. Do you already collaborate with other stakeholders on this subject? Or with whom do you want to collaborate?
- What barriers do you face when interacting with these people/organisations and with those that you do not yet work with?
- For which Water Resource Management challenges do you need support from others?

B.3 Interview Questions Private Sector

As literature review showed, these private stakeholders are needed to obtain the vision of making South Africa sustainable, egalitarian, and secure water for a better life and environment for everyone. Therefore, the questions can be about evaluating awareness/interest in the water sector. And what possible needs are, according to them, to improve the situation, if any. Also questions will be asked about the CoVE Water SA. Their opinion about an educational platform and what they can contribute to this project. Lastly, questions about relations with other stakeholders, especially between public stakeholders (governmental) and? Private stakeholders.

General questions

- What are the main issues in Water Resource Management?
- How do these challenges impact your organisation?
- According to your view, what is the level of interest in the water sector?
- What is needed to improve the current situation?
- As a company, how do you make sure to recruit enough people for the water industry?

Questions about the CoVE Water SA

- Are you already familiar with the CoVE Water SA?
- Do you think this platform can tackle some water-related issues?
- What are key aspects to be included in the platform?

Questions about relations with stakeholders

- How is your relationship with the other stakeholders? Especially with the public, governmental, stakeholders?
- What barriers do you face when interacting with these people/organisations and with those that you do not yet work with?
- What can you offer to the platform?

B.4 Interview Questions CoVE Europe

Because the CoVE project was originally set up in Europa and has been implemented for a while, it is interesting to analyse why it did work out there. This interview can help to analyse the differences between Europe and South Africa and therefore maybe contribute to define what is needed in South Africa and maybe need to be adjusted.

General Questions

- What is the main reason for setting up these platforms in Europe?
- How is the collaboration between the different stakeholders on the platform?
- Are parties interested in contributing to the platform?
- What are key aspects to be included in the platform?

Questions about the CoVE platform in that region

- What is the current situation of the usability of the platform?
- Is there a high demand by students?
- Do you see differences between the situation before and after the implementation of the platform?
- What are still challenges of the platform?
- Have you already received feedback from platform users (students and participating companies)?

CoVE platform in South Africa

- What could be key differences between the usability of the platform in South Africa compared to European regions?
- Do you think this platform can succeed in South Africa?
- Do you think stakeholders are willing to contribute to the platform?
- Do you think this type of education suits the interest of students in South Africa?

- Are there changes needed to the platform to make it work? Or are the key challenges related to the implementation of the platform?

Appendix C. Interview Analysis

C.1 Interview quotes arranged by the established themes.

Table C.1: Quotes about what CoVE Water should offer.

Raising awareness	Skills gap in the water sector
● Organise activities: ○ Hackathon (Katapult, Mendelu University, Hanse-Parlament) ○ (International) Waterweek (Katapult, Drakenstein municipality) ○ Community projects (Capricorn TVET) ○ Roadshows (Capricorn TVET) ○ Workshops (Mendelu University, UWC) ■ Ways to improve these: not providing the students with ready-made solutions, let the students choose the topics, allow more interaction time among themselves and ask the students for feedback. (Mendelu University) ○ Campaigns for lateral entrants (Katapult) ● Different things to keep in mind when organising activities: ○ Only organise activities when there is a real need for them. (Katapult) ○ There are some logistical obstacles when organising such face to face activities, like obtaining permission for off-hours visits and organising transportation. (DWS) ○ Keep all kinds of different target groups in mind when the question is asked: how do you make the water sector more attractive? (Hanse-Parlament) ● Marketing of water resource management at primary and secondary schools by presentations or small projects (Vhembe TVET, Drakenstein municipality) ● Ensuring that more TVET colleges offer course related to water resource management (Vhembe TVET, Capricorn TVET)	● Students are not ready for the working life ○ Graduated university students are unequipped for the workplace experience (CSIR, EWSeta, BGCMA) ○ Graduates often lack job experience when they start working. (Drakenstein municipality) ○ The biggest challenge for the whole project is finding properly qualified people. (Drakenstein municipality) ○ Gap between theoretical knowledge and practical skills. (Drakenstein municipality, EWSeta, CSIR) ■ The CoVE will bridge the experience gap between new students and the practical work they will be engaged in. (Drakenstein municipality) ● Things that do and do not enhance the workforce preparedness: ○ Extend the courses by a year in which you mentor students to give them more strengths, in order to offer an extra bridge between university and the working world. (UWC) ○ Offer standalone courses that are about general work readiness. (EWSeta) ○ The outdated teaching tools and methods, coupled with the deficiency in keeping up with current technologies, contribute to a skills gap in the workplace. (EWSeta) ● Skills transfer and retention in the water sector ○ Many municipalities are staffed with older individuals who retire with their skills, which are not sufficiently passed on to the younger generation. This results in a lack of well-equipped youth in the water sector (Capricorn TVET) ○ The challenge lies in ensuring that the skills cultivated are retained within these workplaces, as capable individuals may opt to seek

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In schools there's a lot less children doing science. That's actually the basis for the lack of interest. (DWS)
The Department of water and sanitation should organise more campaigns to create water awareness. (Drakenstein municipality)
People want to know what they're going to do afterwards, what kind of jobs are available. (UWC)

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opportunities abroad due to their frustrations and the desire for a more conducive work environment. (EWSeta, Vhembe TVET, DWS)

Work environment's impact on skill utilisation

Even if well-educated and skilled professionals enter the workforce, their ability to make meaningful contributions is contingent on the overall work environment. Multiple factors play a role in this: (EWSeta)

Organisational culture
Level of support

Political factors in the public sector workplaces can sometimes hinder the effectiveness of skilled individuals, even though they are competent. (EWSeta, CSIR)

The most prevalent skills gaps:

Soft skills (CSIR, UWC, EWSeta)
Ability to adapt to the workplace environment. (EWSeta)
Capacity to problem-solve and think critically. (CSIR, EWSeta)

It's crucial for farmers to recognize the importance of hiring well-rounded individuals. Because this can save time and effort that would otherwise be spent on educating them from scratch. (BGCMA)
Bring also non-technical skills to the water sector, like economists and legal people (CSIR, Katapult)
Not only look at the lack of skills of the students but also look at the lack of skills of the people who are already employed in the sector. (Mendelu University)

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<td>Labour shortage in the water sector</td>
<td>Improving education material</td>
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Enhancing diversity of employees

Focus on attracting lateral entrants (Katapult, Vhembe TVET, CSIR)
Broader education, meaning students choose their specialisation later on, makes students more widely employable as workers (Katapult)

Enhancing financial support

Encourage companies to sponsor students

In return for their commitment to work for the company.

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Improving curricula (Vhembe TVET, Capricorn TVET, Katapult, BGCMA, DWS)

Integrate the needs of industries (Capricorn TVET)
Link TVETs with universities to assess curriculum needs (Katapult)
Apply for occupational qualifications and apply for funding to be able to have equipment for the occupational qualifications. (Vhembe TVET)
Include more water-related topics into the school curriculum. (DWS, Vhembe TVET, Capricorn TVET, BGCMA)

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(UWC)
        - Encourage them to go back to their rural communities when they are really skilled. (UWC)
    - Encourage SETA's to provide funding. (DWS)
    - Shortage of funding for both projects, operational tasks and human resources. (Drakenstein municipality)

- Addressing talent drain
    - Engineers tend to leave the profession or the country. (DWS, BGCMA)
    - Loss of experienced individuals who have worked for many years results in the erosion of valuable knowledge that isn't adequately captured. (DWS, Capricorn TVET, EWSeta, Vhembe TVET)
        - Trouble with replacing retiring people. (Drakenstein municipality)

- It is not attractive for students to work at the government (DWS):
    - They often perceive government work as primarily involving paperwork and being bogged down by excessive red tape.
    - Students might not be fully informed about the diverse disciplines and roles within the sector.
    - The government is not effectively promoting its activities.
    - Government used to employ people, but due to the finances they can't employ a lot of people anymore. (DWS) This also holds for the CMA. (BGCMA)
        - Unemployment rate is very high and it's the highest among graduates. (DWS)

- The sector is not attractive to work in for youngsters:
    - The sector is very conservative and not innovative enough (CSIR, UCT, DWS)
    - There is too much failure and uncertainty because there is invested so poorly in the infrastructure (UCT)
    - The salary is too low (DWS, BGCMA)
    - Adjust to the needs and expectations of farmers when it comes to employing people. (BGCMA)l

- Training and learning resources
    - Retraining of employees through a training (Vhembe TVET, Capricorn TVET, Katapult, EWSeta)
    - Develop learning material together with all CoVEs Water
        - online learning material (Hanse-Parlament)
        - training programmes such administrative training besides only technical training (Capricorn TVET)

- Preparing students for the workforce
    - Extend the courses by a year in which you mentor students to give them more strengths, in order to offer an extra bridge between university and the working world (UWC)
    - Internship at companies and governmental institutions (UWC, EWSeta)
    - Offer standalone courses that are about general work readiness. (EWSeta)
    - Create educational materials that equip students with the skills needed for the industry, rather than focusing solely on academic skills. (Mendelu University, BGCMA)

- Providing comprehensive courses
    - Sometimes smaller modules (short information sessions) are also sufficient instead of a whole course (Katapult)
    - Provide (extra) courses: 'lifelong development' (Katapult)
    - Broader education, meaning students can choose their specialisation later on and are more widely employable as workers (Katapult)
    - The CoVe can look where the gaps are and provide courses about these gaps. (DWS)
    - Developing courses, such as those for process controllers and offering training in water conservation. This ensures a continuous supply of skilled individuals who can efficiently operate water treatment facilities. Which is a

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In schools there's a lot less children doing science. That's actually the basis for the lack of interest. (DWS)
Involving more municipalities is crucial. They have the potential to become significant employers for young people. However, we must illustrate the value of the platform for them. (DWS)
Shortage of people at different levels, for example planning, installation ect. (Drakenstein municipality)
Encourage students with setting up their own business. (DWS)

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significant benefit to municipalities. (DWS)

Not sure if the universities are going to listen to this. (Drakenstein municipality)

Make the learning also practical and not only theoretical (Capricorn TVET, UCT, Katapult, DWS, EWSeta, BGCMA, Drakenstein municipality)

have sites where you can demonstrate and experience both practical and theoretical education (UCT)
The condensed time frame of programs at TVET colleges leaves limited room for practical work (Capricorn TVET)

It is important that we start educating kids at primary and secondary schools about water. (Drakenstein municipality, Vhembe TVET, Capricorn TVET)

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<td>International collaborations</td>
<td>Possible failures of the CoVE Water SA</td>
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Exchanges

of students (Katapult, CSIR, UWC, Mendelu University, DWS Hanse-Parlement)
of Lecturers (Capricorn TVET, EWSeta)
of working people (CSIR, EWSeta)

International knowledge sharing initiatives

Exchange knowledge between countries (Katapult, CSIR, Hanse-Parlament, UCT)
Conducting research abroad (UWC)
Develop specific training materials, which will be made available for everyone to use. (Hanse-Parlament, Katapult)

Attend international workshops, conferences, public events(UWC)
Receive sponsoring for master and PhD students (UWC)

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Partnerships can fail due to:

Personal aspects (Katapult)
Bureaucratic obstacles (Katapult, Vhembe TVET)
Losing interest because there is not enough added value created. (Katapult, Mendelu University, DWS)

However when everyone brings something to the table, we can collectively make more progress than we have in the past (DWS)

Partners can be overly assertive (Katapult)
Forget to involve the higher management (Katapult)
Different mindsets regarding collaboration. (DWS)
Other initiatives (Drakenstein municipality)

Challenges hindering progress

Lack of political support (UWC)
Lack of funding (UWC, UCT, Capricorn TVET, CSIR, Mendelu University, DWS, Drakenstein municipality)
Lack of trust (DWS)
Limited international reach (UWC)

Stakeholders don't see their win or gain from the platform, that's why they don't want to collaborate. (Hanse-Parlament, CSIR)

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	○ Show them the perspective that we can make a change here and that there are opportunities for them. The payment also needs to be fair. (Hanse-Parlament, CSIR) ○ Show companies that: (Katapult) ■ they have access to new talent (Katapult, UWC) ■ Students can remember the company as possibility for a future workplace (Katapult) ■ developing a course together produces a better course than if it is done from only one perspective (Katapult) ■ Access to knowledge (Katapult) ● Challenges in engaging stakeholders ○ Stakeholders cannot fully engage with the platform due to the fact that everyone already has a lot on their plate, are stretched thin and don't have too much time on their hands. (Drakenstein municipality, EWSeta) ■ Seeing the necessity is one thing, but then to act on it and to make it a priority, when there are hundreds of other priorities as well. (Hanse-Parlament, EWseta) ○ Attracting stakeholders (UCT, UWC) ■ Difficult to attract municipalities due to their involvement in other crises. (UCT) ● Mindset for sustainable success ○ Be careful with unrealistic expectations of your achievement targets. (CSIR) ○ Considering CoVE not as a mere project but as something that will endure and persist. (Mendelu University) ○ With a hard working, passionate and capable team it is possible to overcome the failures of the platform. (Mendelu University, Drakenstein municipality) ■ If we participate in it properly. (EWSeta) ● Ensure everyone contributes ○ Ensure that everyone has to invest in the partnership, with money or other resources. (Katapult) ○ Structures and systems must not rely

	solely on individuals. The CoVE should be able to continue even if key figures step aside. (UWC) ● A significant challenge is communication. ○ Water scientists struggle to convey their message to the private sector and the public. (UWC) ○ All partners in a partnership must understand the common area of interest. Set up a common goal and don't collaborate from your own goal. (CSIR) ○ Bridge the communication gap between generational perspectives. (CSIR) ● Without strong leadership, followers may not take action on their own. The key is to maintain innovation continuously. (Mendelu University, CSIR) ● Challenging to change established structures. (Mendelu University)
Desired collaborations	Successfactors of the CoVE Water SA
● Involve: ○ Parties other than the water sector. (Katapult, CSIR, DWS) ○ Primary and secondary schools (Vhembe TVET, Capricorn TVET) ○ General public, communities (Vhembe TVET) ○ Banks and insurers (Katapult) ○ Department of Higher Education and Training, to promote the expansion of water-focused education (Capricorn TVET) ○ Industries that involve water in their production processes, such as mining companies (Capricorn TVET, DWS, BGCMA) ■ This would be easier if there is a list of all industries (Capricorn TVET) ○ Government (UCT, UWC) ■ Risk leads to ignorance of the possibilities to improve services, so assure officials who want to collaborate that the risk is low and that there is room for improvement (UCT) ■ create effective policy briefs, get access during parliamentary sessions, where we can identify	● Opportunities for students ○ Do or help with the recruitment of TVET students through the platform. (EWSeta, Vhembe TVET) ○ Reach TVET students. (DWS) ○ Creating opportunities for students to learn from real-world problems and explore potential solutions. (UWC, Katapult) ● Factors to make the platform a success: ○ Create moments where interaction can take place, for example meetings, workshops or site visits (Hanse-Parlament, UCT, UWC) ○ Achieve balance between formal and informal meetings (UWC) ○ Exchange information and listen to each other. (Hanse-Parlament, UCT, UWC) ■ This means conducting surveys, understanding people's needs, staying informed about current events, engaging with students and government, and ensuring that the right individuals are in the right positions (UWC) ○ Good content and training (Hanse-Parlament)

windows of opportunity (UWC)
    - Private entrepreneurs. They can provide new skills, developments and fresh perspectives, faster than what the governments can. (UCT, UWC)
    - Farmers (UCT, Drakenstein municipality, BGCMA)
        - difficult because they tend to operate independently and they are often too busy or confident with their own land management skills to attend organised workshops and meetings
    - Educational stakeholders (UCT)

- Collaborations between TVET schools and:
    - Universities (Capricorn TVET)
    - Other TVET schools. (Mendelu University)
    - The department. (DWS)
    - Regional water boards. (EWSeta)

- Actively involve and engage the younger generation in conferences. (DWS)
- To have dedicated training units in the regions where we implement legislation. (DWS)
- Establishing collaborations between municipalities and universities. (Drakenstein municipality)
- Establish a collaboration between EWSeta and the Waterhub. (EWSeta)
- Establish more regional collaborations to create regional networks. (Hanse-Parlament, EWSeta, Capricorn TVET)
    - Involve also the other water boards besides Randwater (EWSeta)
- Stakeholders should engage with each other through the platform, not through the EWSeta. (EWSeta)

- Creating space for collaboration
    - Bringing people with the same topic together and giving them space to collaborate. (Mendelu University)
    - A platform like this could provide a space to discuss new policies and seek input from various stakeholders, including the public. Which can improve decision making. (DWS)

- Enhancing research
    - The success of the platform is the research and the knowledge that comes from the platform and then also the networks to the other participants in the platform because that strengthens our initiatives. (EWSeta)
    - The platform can serve as driving force to stimulating research (Capricorn TVET)

- Effective collaborative communication
    - Keep the dialog open, be very interactive and participative. (UWC)
    - How do you have meaningful communication? be very focused and have clear intentions in what you want to achieve when you collaborate. (CSIR)
    - Understand people in the partnership: how to push people out of their comfort zones to maximise their strengths and capabilities during gatherings. (CSIR)
    - People prefer working with someone they are familiar with, which encourages honest and open discussions. (UWC, Capricorn TVET)
    - Know who to go to for what, and what to do with whom. (Katapult)

- System-wide insight
    - The platform has a view of the whole system, it can see where everyone fits in. (UWC)
    - Be the glue in the space: gain the strengths of all partners (CSIR)

- Optimising existing resources
    - The platform is a channel to direct our resources in a way that's required, and we can achieve more with the resources that we have because we've channelled it and because we're not all doing our own thing. We are all

	coordinated so there is less duplication of effort. (EWSeta, CSIR) ○ The platform is good for retaining developed skills. Skills of someone leaving the sector must be transferred to other people. (Vhembe TVET, EWSeta) ○ Protection of intellectual property is very important. Avoid stealing ideas. (CSIR) ● Making contact with partners easier. (Vhembe TVET, Capricorn TVET) ● Ensure that concrete activities actually take place. Just get started. The moment success comes out, then others will join. (Katapult) ● Establishing interconnected collaborations to engage with communities to raise awareness and create pathways for young people to receive training and education. (DWS) ● Have a CoVE Water SA newsletter where we can share information about who we are, what we are working on and who our partners are. (Capricorn TVET) ● Some needs are very specific. Don't think that you as the platform must be able to address all of those by yourself. (CSIR) ● Consider what is going to make the platform sustainable. Considering risks is essential to distinguish our organisation from others and ensure its longevity. (UWC) ● Opening people's minds to see that there isn't just one way to do things. There is actually another way. Inspire people. (DWS, UCT)

Table C.1.2: Quotes about what stakeholders can offer to the CoVE Water SA platform.

Raising awareness	Skills gap in the water sector
● Organise activities: ○ Educational site visits to the Waterhub in Franschoek to illustrate the full scope of what we deal with. This showcases the principles of a circular economy. (DWS, UCT) ○ Symposiums to encourage students to work in the water sector (UCT) ○ Competition among students in the water sector to present new ideas and projects. Goal is to win the bursary from the department and to work there after they finish their	● Preparing students for the workforce ○ The issue here is that students do not have any experiences, while this is most of the time a requirement for the industry. Therefore, training, like we provide, can really help. (DWS) ○ Facilitate internships to bridge the gap between education and being prepared for the workforce. (EWSeta, BCGMA) ● Addressing skill gaps in the water sector ○ Conducting extensive research, or utilising industry research, to assess

studies. During their time they work at the department they will receive training. (DWS) ■ When there is low interest in the competition, the department will go to universities and schools to pitch the competition. ● Students often lack a clear career path. They may not be aware of the various careers available in the water sector. (EWSeta) However this can be solved by: ○ Career guidance through a career opportunities booklet that showcases various water and energy-related careers. ○ Life orientation teachers who play a pivotal role in advising learners about career options, providing them with insights into the various careers available within the sector. ○ Practical exposure through interaction with small models of technologies or witness the real-world applications. ○ Encourage professionals in the water sector to visit schools, sharing their personal experiences and explaining why their work is intriguing. ○ Provide information through a careers portal on our website, allowing learners to research various careers in-depth. ● Our marketing departments within colleges should play a central role in raising awareness. (Capricorn TVET)	the specific skill needs of the water industry. (EWSeta) ○ Bridge the gap between the identified skill demands in the water sector and the actions taken to meet those demands on a national scale. (EWSeta) ● The industry needs to understand that graduates may not be fully job-ready upon entering the workplace. We encourage a shift in mindset and an acknowledgment that a certain level of skill related to the world of work is necessary. (EWSeta) ● We are committed to producing a skilled workforce for the water sector and, as such, collaborate directly with universities and TVET colleges. (EWSeta)
Labour shortage in the water sector	Improving education material
● Supporting students with their idea to set up a business (UCT, CSIR) ● Offering occupational qualifications to people who don't have a job at the moment, so that they can start work in the water sector. (Vhembe TVET)	● Do curriculum development through the platform because the industry and the TVET colleges are there. (EWSeta) ○ Direct all of our effort towards the platform, even with skills demand. And whatever research happens on the platform, we should benefit from it directly. (EWSeta) ● Conducting research to assess the demand for skills in the energy and water industries. Which then can lead to accrediting the curriculum and qualifications. (EWSeta)

	○ If there's a need for specific skills, we assemble a group of expert practitioners. They are responsible for crafting curriculum and accreditation qualifications or programs. We facilitate and guide this process. ○ In some cases, certain skills are best taught through short courses, which don't require formal accreditation. We seek out capable providers to deliver these short courses. ○ Offer training programs to help people obtain the qualifications they deserve who have spent years working but lack formal qualifications. ○ Assist professionally trained individuals in refreshing their skills to keep up with emerging technologies. ○ Working with private institutions that provide training outside the realm of TVETs. ● Promoting water sector career paths ○ Offer many graduation projects within the water sector to try to motivate students to work in the water sector. (UCT) ○ UWC provides a unique master on integrated water resource management. (UWC) ● Connecting education with real-world practise ○ Collaboration with the Waterhub to create an inspiring centre so that you see different ways of thinking about water. It is about a very different approach to education. (UCT, DWS) ○ Organising events that bring the private sector and government officials into the academic environment. (UWC) ● We know where the gaps in education are, so we can analyse whether the designed courses will be useful or not. (DWS) ● Develop online learning material together with all CoVEs Water. (Katapult)
International collaborations	Possible failures of the CoVE Water SA
● Collaborating with other CMA's in the country and also abroad. Exchange of knowledge to understand each other's operations and work. (BGCMA)	

Desired collaborations	Successfactors of the CoVE Water SA
● Providing the NGOs with the necessary materials and guidance which they can use to educate people. (DWS) ● Existing collaboration between UCT and the WaterHub in Franschhoek (UCT)	● Have a big project meeting with all the different partners twice per year. To see what kind of problems they have. (Hanse-Parlament) ● The water sector institution of the University of Cape Town identifies themselves as an expert in leading collaborative efforts. (UCT) ● Knowledge about obtaining collaborations between public and private organisations. (Katapult)

Appendix D. Power Interest Grid

For the PI Grid analysis three different grids are made by changing the type of power: power as power, power as knowledge and power as collaboration. The level of interest is in all cases the same. Only the 12 interviewed stakeholders are positioned in the stakeholders, why these play an important role in the start up phase of the project (personal communication). To define the position of each stakeholder, information is used obtained from literature review, interview data and personal communication with the problem owner.

D.1 Level of interest

The level of interest is based on the interest they have in the CoVE Water SA project. Whether they are interested in collaborating with the CoVE Water SA project and see potential in it.

CoVE Water SA
The level of interest is high for the CoVE Water SA, while they are strongly motivated to set up their project in South Africa. They really see there is a gap in the water sector, where their project can contribute to.

DWS
The interest of DWS in the CoVE Water SA project is high, while they see potential in it to address several issues in the water sector. For example there is a gap in the education level in the water sector, shortage of employees in the water sector and a general lack of awareness of the water related issues. Because of their busy schedules certain issues are being addressed slowly or, in some cases, not at all. In this regard, the platform can offer assistance by alleviating some of the burdens these institutions face, facilitating a more efficient and expeditious problem-solving process.

EWSeta
EWSeta is equally eager to engage with the CoVE Water project, as they recognize the need for assistance in enhancing the educational network, as revealed in interviews. At the moment many stakeholders rely on the EWSeta, which can slow down the process. They genuinely perceive the potential for an intermediary within the network to strengthen connections between stakeholders and reduce their reliance on EWSeta. Given their hectic schedules, EWSeta is unable to initiate such projects themselves.

Drakenstein municipality
Drakenstein Municipality has a high interest in the CoVE Water project in SA. First of all, it would be an opportunity to be more involved in the water network. They believe CoVE Water SA will bridge the experience gap between new students and the practical work they will be engaged in (interview).

Vhembe & Capricorn (TVETs)
TVETs schools have a high interest in the CoVE Water project in SA, while it can really support them in creating a stronger network and make the water sector more interested among TVET students.

Mendelu & Katapult
The CoVEs in Europe have a medium level of interest in the CoVE Water project in SA. Of Course they are supportive in setting up a new CoVE, while this will strengthen their objectives. However, while this CoVE Water SA is not located in their country, they will be less interested then stakeholders in South Africa because they will experience less of the positive effects of the project.

Hanse Parlament
The interest of Hanse Parlament in the project is relatively low, while they are not involved in the Water Sector and its issues in South Africa at all. They stand apart from the issue and serve as a supportive aid.

BGCMA
This organisation oversees water resource management and exhibits a strong interest in the industry. While they acknowledge the project's potential, their familiarity with the project is limited, as indicated in the interview. Consequently, their level of interest in the project is somewhat lower compared to other stakeholders.

CSIR
The CSIR acknowledges the necessity for a mediator to coordinate the appropriate steps and unite various stakeholders. They view the CoVe Water SA project as a means to enhance their contributions effectively. However, given that the institution's primary focus is on research, extending beyond just the water sector, their interest in the project falls into a moderate range, as they have multiple other areas of interest that go beyond the scope of the water sector.

UCT & UWC
The university sees potential in the CoVE Water SA project, especially focused on the implementation of more practical education and VET programs. They are motivated to implement these types of education in their curriculum and are therefore interested in the training and education programs the CoVE Water SA can offer. Furthermore, they are also eager to broaden their network by engaging with TVET schools.

D.2 PI Grid based on Power

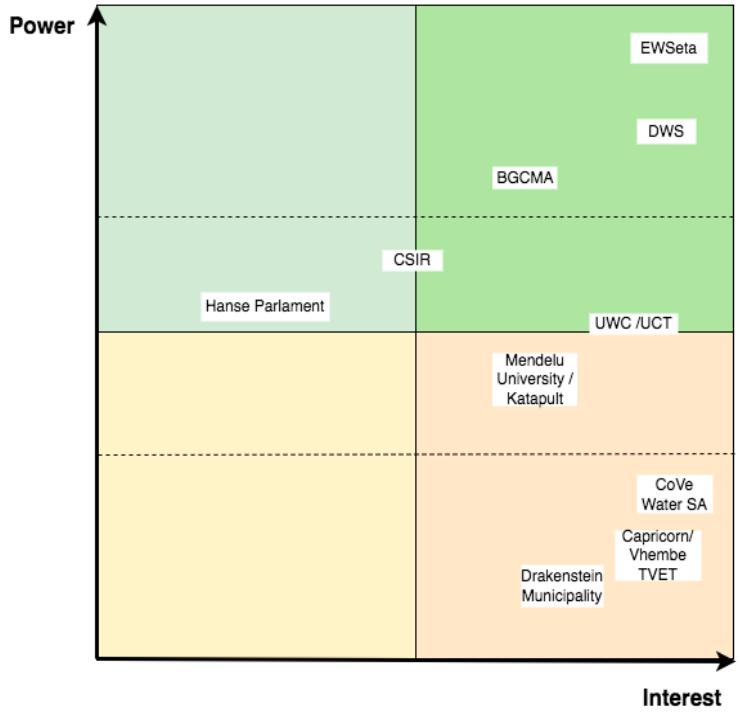

Figure D.1: PI grid based on power

CoVE Water SA: The CoVE Water SA has a low level in terms of power. This can be explained because of the start up phase they are currently in. At the moment they are working to get enough fundings to set up the activities and project. The extent of their influence will need to grow as the project advances through its early phase. Thus, there should be room for expansion to facilitate this growth.

DWS and EWSate : These stakeholders exert a high level of power, primarily owing to their status as governance entities. Their substantial authority stems from the fact that numerous stakeholders depend on the DWS and EWSate. Notably, EWSate establishes the guidelines for education, upon which universities and TVET schools rely. Additionally, the DWS issues directives to other governance bodies, including entities like Drakenstein, which, in turn, are dependent on these directives. This interdependence was evident in the interview analysis. Even Though, DWS holds significant power regarding the water sector, EWSeta occupies a higher position in the PI grid due to its greater influence over the school curriculum, which is a critical component of CoVE Water Sa. Consequently, due to their power, these entities wield significant influence in addressing the problem, which is a crucial facet of the platform's objectives, allowing for effective problem resolution.

Drakenstein Municipality
Even Though Drakenstein Municipality is a local authority, there is an absence of adequate resources to make big changes in the water sector. As revealed during the interview with Drakenstein Municipality, there is a substantial dependence on the Department of Water and Sanitation (DWS). Should DWS cease their funding or no longer assist in addressing issues, Drakenstein's municipality also faces difficulties. Several projects like Water Week, set up by

Drakenstein Municipality, are pulled aways because there was no funding (Interview). As a result, they are designated with a low level of power in the PI grid.

Vhembe & Capricorn (TVET schools)
The TVETs schools are dependent in several areas, including resources. Therefore, they have low power. However, TVETs possess limited authority, as they lack the ability to establish the criteria for specific job-related knowledge within sectors. In addition, they are also reliant on the requirements set by governments, regarding the education and learning materials they offer. Furthermore, they are also very dependent on money they get from governments.

Mendelu University and Katapult: The power of Mendelu University and Katapult is at a moderate level. Their resources are comparable to that of the CoVe Water in South Africa (SA), while they are also in terms of resources dependent on other stakeholders. However, while the European CoVE's have been operating for longer, they already have more possession of resources.

BGCMA
As a governmental stakeholder, they possess the necessary resources to address water management concerns. They collaborate closely with the Water User Associations (WUA), which rely on the resources supplied by BGCMA. BGCMA provides help to the WUA to address these issues. In addition to their influence in addressing these matters,CMA for addressing issues. In addition to their influence in addressing these matters, they can also create employment opportunities, which is of significant interest to CoVE Water SA, as they aim to expand the workforce in the water sector.

UWC & UCT
Their power is somewhat constrained by funding and support from government education institutions, which play a pivotal role in approving changes to courses and curricula. However, they are in possession of these funds and they are incorporated in setting up courses and changing the curriculum. Despite their reliance on resources from government institutions and companies, they maintain a moderate level of influence, as they receive these resources to a limited extent.

CSIR
Since they are a governmental institution, they are dependent on the level of funding from the government. Therefore their power is limited. However, since their research findings and recommendations influence government policies, regulations and decision-making, they will provide some funding from the government. Therefore their power is at a medium level in the PI grid. So while they are promising stakeholders for the project, it's important to note that their impact in each dimension is reliant on cooperation with other stakeholders, who provide them with resources.

Hanse Parlament
Hanse Parlament is assigned with a medium level of power. They play a supportive role in determining effective activities and steps to address issues in the CoVE Water SA projects, while they focus on impact assessments. With the different expertises within their company, they are able to address the issues and initiate new actions, granting them some power.

D.3 PI Grid based on Knowledge

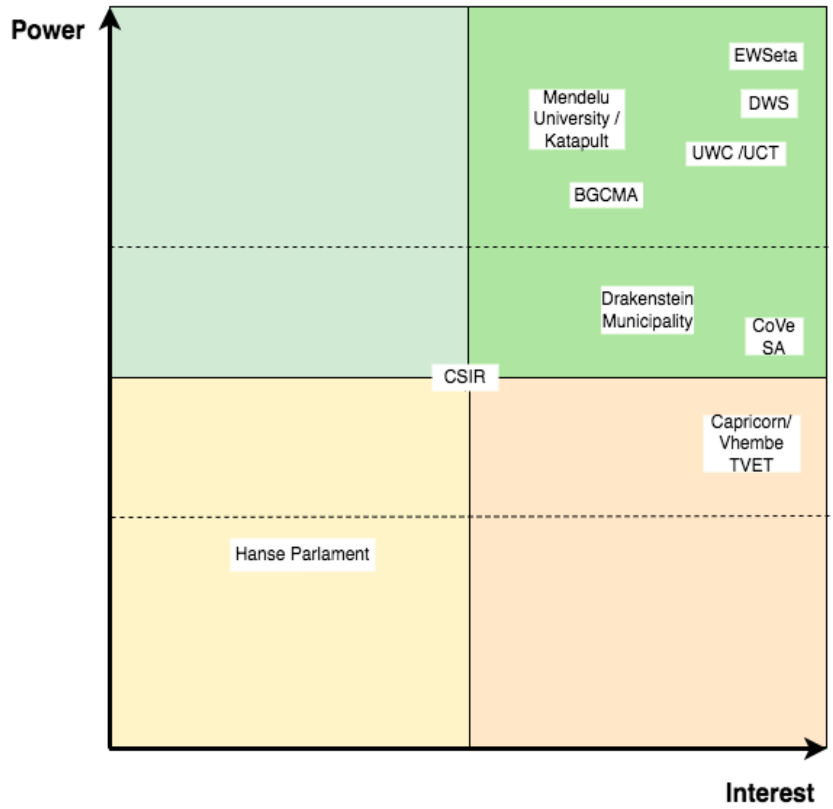

Figure D.2 : PI grid based on knowledge

CoVE Water SA

CoVE Water SA has a moderate level of power across all knowledge. They possess a deep understanding of the problem and what the platform needs to offer to drive change and address the issue. However, they do not possess all the knowledge required to fully resolve the problem. To bridge this gap, they need to engage with other stakeholders who possess the expertise needed to devise solutions for the problem. Therefore, collaborations with other stakeholders are of paramount importance.

DWS and EWSate

These governance entities possess substantial knowledge about the issues in the water sector, a valuable asset in the quest for solutions. They acknowledge the existing gap within the water sector and the need for action to address these issues. However, their busy schedules prevent them from exclusively focusing on water sector concerns, making support in this regard essential. Thus, while they acknowledge the problems and can pinpoint areas of deficiency, they have a high level of power in knowledge. EWSeta, in particular, has slightly greater insight into the problem, as it can identify gaps in education and the education group network, which is a primary focus point of CoVE.

Vhembe & Capricorn (TVETs)

The TVETs have a moderate understanding of the issues at hand. They are aware of the specific characteristics of the problem and especially focussed on the educational level of TVETs. Therefore, their knowledge primarily centres on a specific area, lacking the broader, all-encompassing expertise required to address the problem on a holistic scale.

Drakenstein Municipality
Drakenstein municipality had long experience with water shortages and therefore setted up different measures to face this challenge. These measures strengthen their water resource management. Due to these measurements they increased their knowledge in the water resource management and therefore have a good idea what skills are needed in the water sector. However, because their knowledge development is mainly locally oriented,it has a moderate understanding of the issues at hand. They are aware of the specific characteristics of the problem and the local context. Their knowledge primarily centres on the local domain, lacking the broader, all-encompassing expertise required to address the problem on a holistic scale.

Mendelu University & Katapult
Mendelu University and Katapult possess a substantial knowledge base, thanks to their operational platforms. Their practical experience grants them valuable insights into what works and what doesn't within the context of the problem. Furthermore, these CoVE's can also serve as examples for the CoVE Water SA. They can provide support during times when the CoVE Water SA faces challenges, likely having encountered similar obstacles themselves. This support, along with the provided examples, can expedite the platform's development, which may not be possible without such assistance and guidance. This results in a high level of knowledge.

BGCMA
Their expertise primarily lies within the water sector, and they consistently strive to enhance the current situation by identifying gaps. Therefore their knowledge about the issues and the problem gaps is high, enabling them to provide valuable insights into the skills required by students and the content of new educational programs. Their power in terms of knowledge also increases due to their strong connections with local communities. This connection provides them with a deep understanding of the issues faced by these communities, a crucial asset for crafting effective solutions.

UWC & UCT
Both UCT and UWC possess extensive knowledge of water sector issues and are adept at identifying gaps in education. They see what is lacking in education and how it may be enhanced. During the conducted interviews, they highlighted the need for more practical education in existing courses, although they rely on other stakeholders' support to develop such programs. They do see possibilities within the CoVE Water SA project to set these types of education up.

CSIR
During the interview, it became evident that they recognize the problem but face challenges in addressing its root causes and identifying necessary solutions. In the interview they emphasised the need for a mediator to coordinate the appropriate steps and unite various stakeholders. They view the CoVE Water SA project as a means to enhance their contributions effectively. Therefore their level of knowledge is medium, while they do need knowledge and help from other stakeholders, to highlight precisely what the gap and issues are.

Hanse Parlament

Hanse Parlament expertise doesn't specifically pertain to water sector issues, but they offer valuable insights into the project's impact. Therefore, their knowledge on the issues is low and they are therefore not able to address the root causes or gaps. This was also confirmed in the interview.

D.4 PI Grid based on collaboration

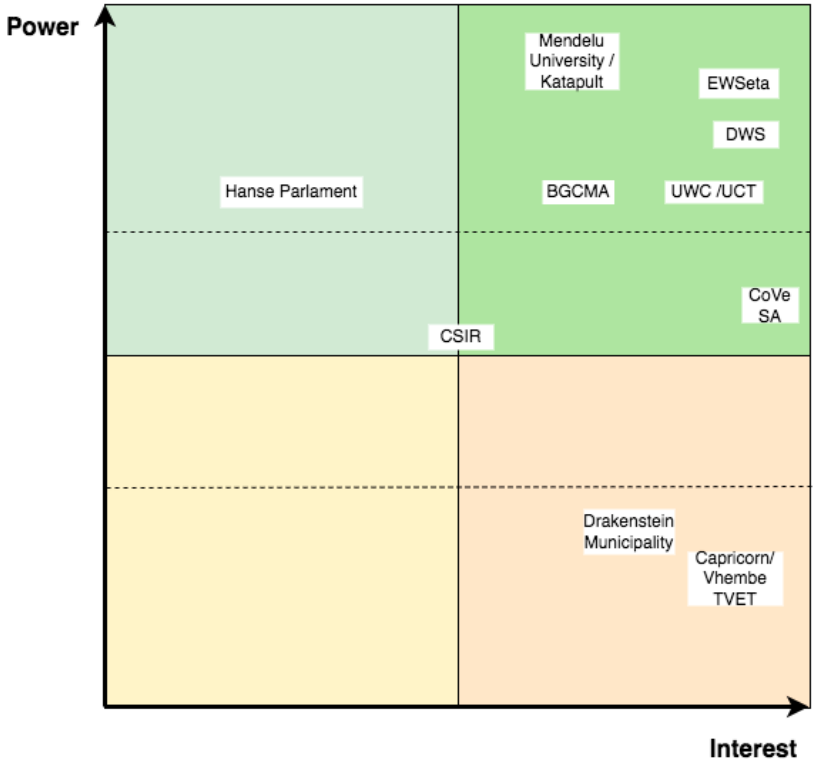

FIgure D.3: PI based on collaboration

CoVE Water SA

CoVE Water SA has a moderate level of collaboration. The level of collaboration is not yet at its peak since the platform is still in an early phase. Their focus right now is to develop a strong network, while expanding their network will be essential to make the platform function effectively.

DWS & EWSeta

Bothe DWS and EWSeta engage in extensive collaborations with various stakeholders, thereby establishing numerous connections within the network. To establish projects and strategies, they require knowledge and assistance from other stakeholders, and conversely, this results in them having an extensive network. This interconnectedness could prove invaluable if these institutions choose to align themselves with the platform, as it has the potential to significantly expand the network. EWSeta has a slightly higher power of collaboration, while they possess strong connections with important stakeholders for the CoVE Water SA project, like educational institutions.

Drakenstein Municipality
Drakensteins main collaborations are locally and therefore a gap arises in the connection with other stakeholders. Many other stakeholders do not incorporate the local level in their collaboration, resulting in the municipalities left behind in the network. Therefore, the level of collaboration is low.

Vhembe & Capricorn (TVETs)
As interviews and personal communications have revealed, the TVETs are currently not actively engaged in networking. This results in a low level of collaborative power. Their connections with other stakeholders are constrained, and they consequently rely on these stakeholders to be actively involved in the network.

Mendelu University & Katapult
The significant value these stakeholders can bring to the platform lies in the strength of their extensive networks. While one of the primary objectives of CoVEs is to establish a wide-reaching network, and they are a well-established CoVE in Europe,as indicated in the interviews, their existing broad network can play a pivotal role in extending the network's outreach.

BGCMA
As evidenced in the interviews they possess an extensive network and maintain constant communication with WUAs to address water-related challenges. In the CMA process stakeholder participation is a prerequisite. One of the functions of CMA is to promote community participation. Therefore they have not only a strong connection with other governmental institutions, but also with stakeholders at the local level. This makes them powerful stakeholders according to collaboration.

UWC & UCT
Both universities maintain a wide network of collaborations with various parties, governmental, other education groups but also with companies, making them essential contributors in seeking solutions for water-related challenges. Notable is that their relations are not only water related.

CSIR
The CSIR is involved in many different projects, while they can provide significant research. However, as became clear during the interviews, they highlighted the need for a strong and broader network. At the moment there is a gap in the collaboration with the different stakeholders, making the relations not as strong. Therefore their collaborative power is medium.

Hanse Parlament
Their effectiveness heavily relies on collaboration with other stakeholders. When the other stakeholders are not willing to participate or to collaborate, they are not able to do their work. Therefore, they have a wide network and acknowledge the importance of a broad network. So, Hanse Parlament can be seen as a supportive stakeholder to give new insights and a stakeholder with a high collaborative power.

Appendix E. Social Network Analysis

E.1 Network Stakeholders

Table E.1 shows the stakeholders involved in the network. The first column provides the network nodes labels, and the second column presents the full written labels. A more in depth description of all these stakeholders is explained below. Noteworthy is that only a description of stakeholders, other than the interviewed stakeholders, is provided in this section. A description of the interviewed stakeholders can be found in Appendix B.

Table E.1 Stakeholders in Network

SNA Label	***Name***
CoVE Water SA	Centre of Vocational Excellence South Africa
DWS	Department of Water and Sanitation
EWSeta	Energy Water Sector Education Training Authority
CoVE EU	Centre of Vocational Excellence Europe
BGCMA	Breede Gouritz Catchment Management Agency
UWC	University of Western Cape
UCT	University of Cape Town
CSIR	Council for Scientific Industrial Research
DM	Drakenstein Municipality
TVETs	Capricorn , Lovedale, Vhembe, Nkangala, Orbit, Elangeni, Motheo
HP	Hansa Parlament
Randwater	Randwater
Farmers	Farmers
Departments	Other departments, mining and activities, public works, Rural development
Uni's SA	Other Universities in general in South Africa
CMA's SA	Other Catchment Management Agencies, South africa
DHET	Department of Higher education and training
TIA	Technology and innovation agency
QCTO	Quality Council of Trades and Occupations
DEA	Department of Environmental Affairs
CMF	Catchment Management Fora
AgriSeta	Agriculture Sector Education Training Authority

SU	Stellenbosch University
NGO's SA	Non-Governmental Organisations South Africa
WUA	Water User Associations
LA	Local Authorities
RDI SA	Research Development Innovation South Africa
EIA	Energy Industry Associations
WRC	Water Research Commission
WB	Water Boards
WH	Water Hub
VET	VET Schools Schools in Europa same as TVET but different name
GI EU	Governments Institutions Europe
Comp EU	Companies EU Investment, initiatieven, authorities
Uni EU	Universities in Europe
Schools EU	Primary and Secondary Schools Europe
Schools SA	Primary and Secondary Schools South Africa
LC	Local Communities
Comp SA	Companies South Africa
WSI EU	Water sector Institutions Europe
RDI EU	Research Development Innovation Europe
IWMI	Andere landen in afrika International Water Management Institutions
NGO's EU	Non-Governmental Organisations Europe

CSIR: The CSIR's mission encourages collaboration with public and private sector entities. They acknowledge that a cooperative research approach yields superior results and fosters innovation (Collaborations and Partnerships | CSIR, n.d.).

Randwater: To serve as a supplier of sustainable water and sanitation solutions that are globally competitive for the Gauteng province in the northern region of South Africa (About Rand Water, 2023).

AgriSeta: AgriSETA strives to establish and foster opportunities for social, economic, and employment advancement within the agri-business sector by delivering education, training, and development that is pertinent, high-quality, and easily accessible, covering both primary and secondary agriculture. This is achieved through collaborative efforts with other agricultural stakeholders (National Government of South Africa, n.d.,e).

DHET: To offer national strategic guidance in advancing the Post-School Education and Training system, ultimately enhancing the quality of life for the people of South Africa (Department of Higher Education and Training (DHET), n.d.).

TIA: TIA is a national public entity that plays a pivotal role in bridging the innovation gap between research and development conducted by higher education institutions, science councils, public entities, and the private sector, ultimately facilitating commercialization (National Government of South Africa, n.d.,e).

QCTO:
The QCTO's primary function is to guarantee the existence of occupational qualifications that align with South Africa's skills development needs. It oversees the Occupational Qualifications Sub-Framework (OQSF), a component of the National Qualifications Framework consisting of three integrated sub-frameworks (QCTO n.d.,a).

DEA: The Department of Environmental Affairs strives for a significant overhaul in its approach to environmental preservation, with due consideration for the equilibrium with socio-economic development (Department of Forestry, Fisheries and the Environment, n.d.).

CMF: These forums serve as a venue for coordinated efforts in Water Resources Management within their specific geographical regions (*Catchment Management Forums*, 2014).

Stellenbosch University: Considerable efforts are being devoted to the establishment of CoVe Water SA from this university

Water Hub: A joint initiative between the Future Water Institute at the University of Cape Town, Stellenbosch municipality, and the western cape government (Stellenbosch University, 2023).

Water user associations: While water user associations function as institutions for water management, their primary objective, in contrast to catchment management agencies, does not solely revolve around water management. These associations operate on a limited, localised scale and essentially function as cooperative bodies composed of individual water users pursuing water-related activities for mutual advantage (Institute for Water Quality Studies, n.d.).

Local Authorities: South Africa is divided into local municipalities, with each municipality housing a council responsible for decision-making, alongside municipal officials and staff tasked with executing the municipality's duties. The council comprises elected members who sanction policies and by-laws for their respective regions (UNDERSTANDING LOCAL GOVERNMENT, n.d.).

Research Innovation Organisation (EU)(SA): Research and Development (R&D) and Innovation encompass the progression of new concepts, the implementation of novel methodologies, or the alteration of how your business generates revenue. It can also be regarded as the essential endeavours to ensure your business remains competitive and

viable over the long run. Settled in Europe or South Afrika (Metis Partners, 2023).

EIA: Environmental Impact Assessments (EIAs) in South Africa are undertaken when a new development or activity is suggested, in accordance with the National Environmental Management (South African Government, n.d.a).

WRC: The mission of the Water Research Commission (WRC) is to serve as a worldwide hub for water knowledge and South Africa's leading centre for water knowledge. It operates throughout the Innovation Value Chain, influencing policy and decision-making, fostering the creation of new products, innovations, and services for socio-economic development, and nurturing human capital (Water Research Commission, n.d.).

Water boards: Water boards play a crucial role in ensuring universal access to water resources. I am pleased to introduce this pioneering report to Parliament and the public, detailing the financial and performance management status of South Africa's water boards (Auditor-general South Afrika, 2022).

VET schools: Similar to the TVET schools in South Africa, but within Europe.

EU Governments Institutions: Governmental institutions established in Europe.

EU Companies: Businesses established in Europe with the aim of generating profit.

UNI EU: Universities established in Europe

Primary / secondary schools EU: Primary and secondary schools in Europe

Primary / secondary schools SA: Primary and secondary schools in South Africa

Local Communities: Local communities in South Africa

Companies SA: Businesses established in South Africa with the aim of generating profit.

Water Sector Institutions EU: Water Sector institutions settled in Europe

International Water Management : Water management institutions located in the African continent.

NGOs EU: non-governmental organisations, are independent nonprofit entities dedicated to a variety of causes such as humanitarian aid, human rights, and environmental conservation, operating separately from the government. Settled in Europe (Folger, 2023).

NGO’s SA: non-governmental organisations, are independent nonprofit entities dedicated to a variety of causes such as humanitarian aid, human rights, and environmental conservation, operating separately from the government. Settled in South Africa (Folger, 2023b).

E.2 Sources Weights and relations

In table E.2 the sources per stakeholder are listed, which are used to define the relations and their strength in the network. Beside these sources, information from the interviews and personal communication with the problem owner are used to define the relations and their strengths.

Table E.2 Sources used to define relations and weight

Stakeholder	***Source***
TIA	● *About us – Technology Innovation Agency*, n.d. ● (National Government of South Africa, n.d.,e)
CSIR	● (National Government of South Africa, n.d.,c) ● (*Collaborations and Partnerships | CSIR*, n.d.)
EWSeta	● (*Energy and Water Sector Education and Training Authority*, n.d.) ● (EWSeta, n.d.)
CMA	● Weaver et al. (2017) ● Department: Water Affairs, 2013 ● ("Overview of Catchment Management Agencies (CMA's)", n.d.)
Local Authorities	● Weaver et al. (2017) ● Department: Water Affairs, 2013
DWS	● Weaver et al. (2017) ● Department: Water Affairs, 2013 ● (South African Government, n.d.b) ● (Odendaal, 2023) ● (Department of Water and Sanitation, n.d.b)
CMF	● Weaver et al. (2017) ● Department: Water Affairs, 2013 ● (USAID, 2017)
WUA	● Weaver et al. (2017) ● Department: Water Affairs, 2013
Water Boards	● Weaver et al. (2017) ● Department: Water Affairs, 2013
DEA	● (Department of Environmental Affairs, n.d.) ● (Department of Forestry, Fisheries and the Environment (DFFE), n.d.)

QCTO	• (National Government of South Africa, n.d.,d) • (QCTO, n.d.,b)
UCT	• (University of Cape Town, n.d.)
AgriSeta	• (National Government of South Africa, n.d.,a)
WRC	• (*Institutional oversight*, n.d.,b) • (Water Research Commission, n.d.)
CoVE Water SA	• Excel Sheet, provided by supervisors

E.3 Output SNA

Table E.3 displays the results of the network. The table contains all the centrality scores per stakeholder: Degree, Weighted Degree, Closeness Centrality & Betweenness Centrality.

Table E.3 Output SNA; Degree, Weighted Degree, Closeness Centrality & Betweenness Centrality

Stakeholder	***Degree***	***Weighted Degree***	***Closeness Centrality***	***Betweenness Centrality***
CoVE Water SA	**21**	**72**	**0.66**	**95.36**
DWS	21	82	0.63	28.73
EWSeta	22	98	0.64	29.83
CoVE EU	11	58	0.51	37.48
BGCMA	17	64	0.58	42.03
UWC	18	56	0.63	17.00
UCT	20	72	0.65	38.86
CSIR	17	54	0.58	5.37
DM	12	48	0.53	17.81
TVETs	**10**	**30**	**0.53**	**3.03**
HP	5	20	0.45	2.59
Randwater	11	52	0.54	3.42
Farmers	6	24	0.44	1.47
Departments	15	64	0.55	8.27
Uni's SA	17	60	0.61	15.64

CMA's SA	13	48	0.53	21.68
DHET	17	82	0.58	11.70
TIA	12	42	0.54	3.71
QCTO	10	44	0.51	3.73
DEA	13	46	0.55	5.74
CMF	2	8	0.38	0.0
AgriSeta	14	62	0.55	3.40
SU	20	74	0.66	50.23
NGO's SA	19	64	0.65	47.74
WUA	6	40	0.45	2.66
LA	25	96	0.65	66.59
RDI SA	24	82	0.68	71.72
EIA	6	24	0.47	1.00
WRC	19	67	0.62	45.36
WB	9	50	0.51	1.41
WH	7	32	0.49	0.38
VET	5	26	0.37	0.00
GI EU	8	38	0.40	2.30
Comp EU	9	44	0.41	3.82
Uni EU	11	48	0.49	48.10
Schools EU	6	30	0.38	0.64
Schools SA	**9**	**28**	**0.49**	**0.69**
LC	5	16	0.46	1.25
Comp SA	**17**	**53**	**0.59**	**19.73**
WSI EU	7	34	0.47	12.79
RDI EU	8	38	0.5	18.34
International Water Management Institutions	5	10	0.46	0.18

NGO's EU	11	48	0.53	49.20

E.4 Typology of brokerage structures

To analyse the network the typology of brokerage structure by Gould & Fernandez (1989, 1994) is used. This typology is visualised in figure E.1. The typology consists of 5 types of brokers: Liaison, Coordinator, Itinerant (also named consultant), Gatekeeper and Representative.

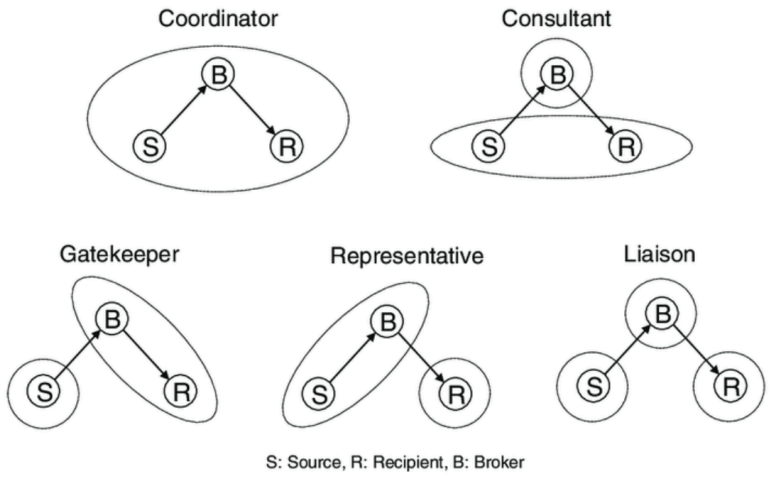

Figure E.1 Visualisation of the typology of brokerage structures (Lee, 2014)

Liaison
In this brokerage the broker (B) is between two different groups (S & R) to which the broker also does not belong. The broker connects two groups, but is not part of either group.

Itinerant
In this brokerage two unconnected stakeholders belong to one group (S & R) , while the broker (B) belongs to a different group. An itinerant acts as a consultant to both unconnected stakeholders of the same group.

Coordinator
In the coordinator brokerage all the three stakeholders (B, S & R) belong to the same group. Brokering happens therefore within the group. Members of the same group are not connected to each other and have contact via another member.

Gatekeeper / Representative
In this type of brokerage the broker (B) belongs to one of the two unconnected stakeholders (S or R) . The other unconnected stakeholder (S or R) belongs to a different group.