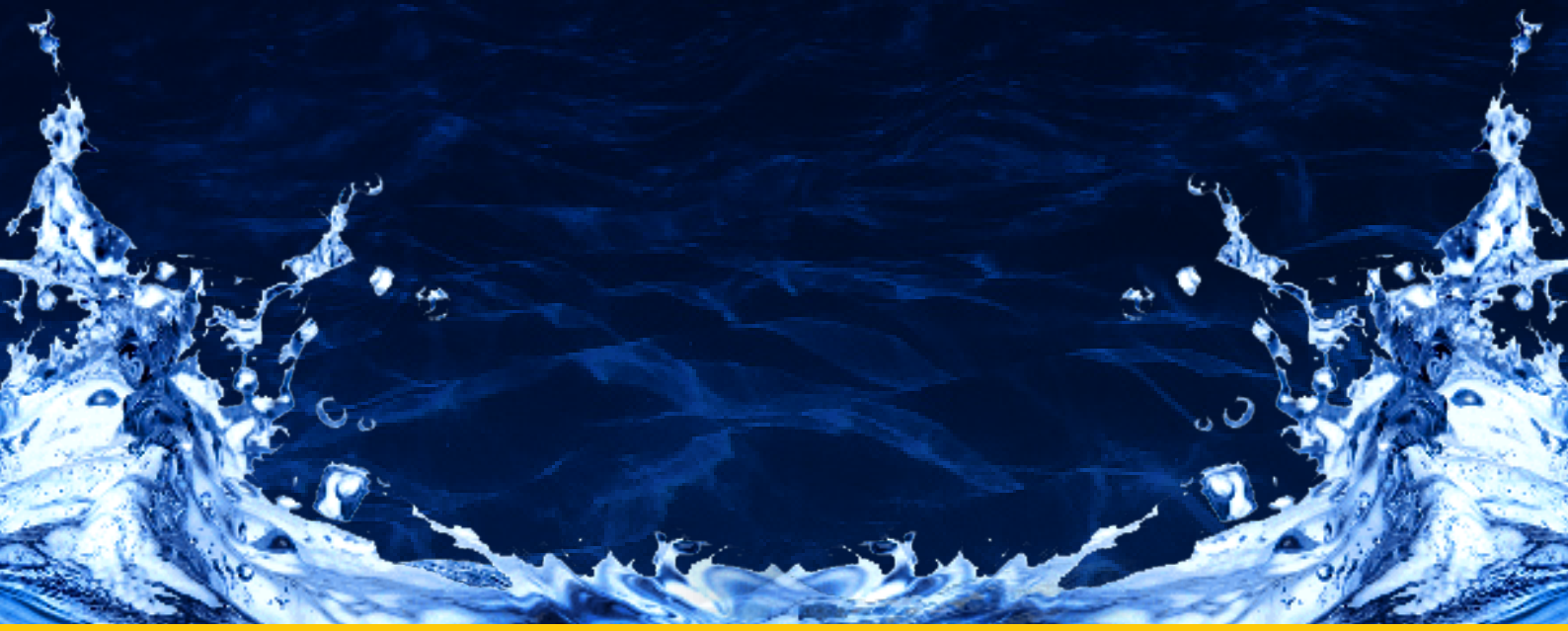
FINAL REPORT

"TECHNICAL ASSISTANCE FOR THE SA-EU DIALOGUE FACILITY"

"The impact of COVID-19 on the EU and SADC Water Research Agendas and Capacity Building Activities
- prospects for increased resilience and effective post-COVID- 19 recovery."



water & sanitation
Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

WATER RESEARCH COMMISSION

WATERnet
Building Capacity for Water Resources Management in Southern Africa

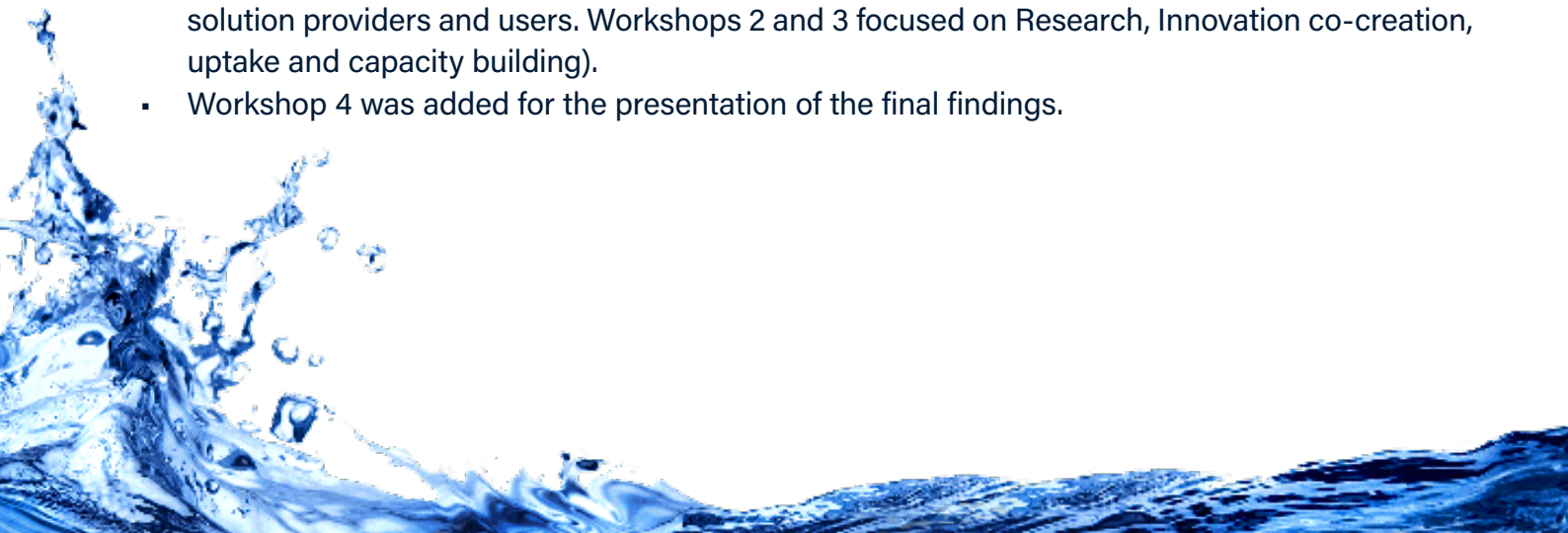
The project is funded by the European Union and implemented by a consortium led by the Water Research Commission of South Africa and WaterNet.

EXECUTIVE SUMMARY

The project entitled "The impact of COVID-19 on the European Union (EU) and Southern African Development Community (SADC) Water Research Agendas and Capacity Building Activities - prospects for increased resilience and effective post-COVID- 19 recovery" is part of the South Africa-European Union (SA-EU) Dialogue Facility. The dialogue served to gather information and facilitate the exchange of knowledge, solutions, and best practices of how the EU and SADC WASH Research Development and Innovation (RDI) sector stakeholders have organised themselves to contribute to the national responses to curb the COVID-19 pandemic and responded to the challenges and opportunities afforded by the pandemic for business continuity. The dialogue also investigated and shared the strategies established and adopted by the SADC and EU WASH sector stakeholders to build resilience and prepare for a recovery post-COVID-19 pandemic and future potential pandemics.

OBJECTIVES: The specific objectives of the study included:

- To conduct a desktop review of the effects of COVID-19 on the SADC and EU WASH RDI sectors and the capacity building activities.
- To develop a database of the key SADC and EU stakeholders (institution, contact person, and programmes) and other cluster them according to COVID-19 pandemic impact (least to most affected) on their WASH RDI capacity building planning and implementation of activities.
- To conduct an in-depth analysis of the effects of COVID-19 on the 5 SADC and 4EU countries and the United Kingdom (UK), now outside of the EU that are ranked in the top 5 of their regions as the most resilient, agile and responsive countries from the information collected in the broad analysis.
- To further analyse how the selected leading countries from SADC, EU and the UK managed to adapt their strategies, reprioritise funds and efforts, and adjust their planning and implementation of WASH RDI and capacity building activities to remain resilient to the COVID-19 pandemic.
- To identify, cluster, and prioritise the SADC WASH research, innovation and capacity building shifts needed for post-COVID-19 sector recovery and build future sector resilience.
- To propose recommendations on how the SADC WASH RDI stakeholders can prepare themselves to better respond to the COVID- 19 pandemic and other future pandemics and build sustainable sector resilience by drawing from the combined analysis of the best practice and considering the existing and required SADC enabling environment.
- To develop a position paper based on the content collected by the SADC, EU and the UK desktop study.
- To participate in the three consultative/information sharing workshops held as follows: Workshop 1 – Virtual session during the WRC Symposium on 22 September 2021; Workshop 2 – Hybrid one and a half-day workshop on 7 – 8 October 2021; and Workshop 3 – Hybrid session during the WaterNet Symposium on 22 October 2021. They aimed to share best practices and strengthen the partnership between the SA-EU and the rest of the SADC WASH stakeholder's solution providers and users. Workshops 2 and 3 focused on Research, Innovation co-creation, uptake and capacity building).
- Workshop 4 was added for the presentation of the final findings.



APPROACH: The project started with a comprehensive desktop analysis of the impact of the water research agendas at the SADC, EU and UK levels. From the results of the broad analysis, the contracted experts selected 5 SADC countries (SA plus four others) and 4 EU countries and the UK that have shown the most agile response to the pandemic in terms of water sector research. The country selection allowed for further investigation and in-depth analysis of the impact of the COVID-19 pandemic on the key stakeholders and the WASH research development and innovation (RDI) sector in the selected countries. The selection was also based on the top countries that have proven to be resilient and managed to reprioritise and adapt to continue RDI and capacity building activities even in the COVID-19 pandemic. The selection was also intended to facilitate and promote joint learning and sharing best practices during the consultative dialogues.

The purpose and outcomes/output from the methods used are outlined below.

Method	Purpose	Outcome/Output
Desktop Study	To investigate all published (grey and peer-reviewed) literature on the impact of the research agendas on the water and sanitation sectors.	Insight on the impact of the pandemic on the water and sanitation research agendas and capacity development and implementation in SADC and EU countries. The selection of 10 (5 SADC and 5 EU) countries that were shown to be most agile to the pandemic. Baseline report providing the first review of the recommendations for SADC and European countries to follow based on extensive literature analysis.
Workshop 1	To share the results of the desktop study, gather more information and validate the existing data with the stakeholders.	Knowledge shared, additional information gathered and validated with the stakeholders.
Workshop 2	To share the final results of the desktop study, validate and share the draft structure and pillars of the Position Paper.	Knowledge shared, information gathered from the stakeholders and elements of the Position Paper identified.
Expert Surveys /Interviews	To validate the selection of the 10 countries. To further understand the impact of the pandemic on the water sector in the SADC and EU countries	10 countries validated. Further data was gathered.
Position Paper	To develop a position paper to guide the implementation approach and interventions towards building resilience capacity for -post-COVID-19 water security.	Position paper on "Building capacity for post-Covid-19 resilience of the SADC water sector."
Workshop 3	To share the final project findings with the main stakeholders	Project findings were presented to the main stakeholders in the EU and SADC water sectors.

FINDINGS: The study identified the challenges and positive impacts of the COVID-19 pandemic on the water sector and clustered the challenges into technology, capacity/skills, management and governance. For the SADC region, the study found that little has been done to investigate institutional, communal and societal responses to WASH facilities in relation to COVID is a critical aspect in the fight against the disease. The low level of preparedness/response to the COVID-19 pandemic, weak institutional architecture, low water-COVID-19 research capacity, and low water system governance was also observed.
In general, all EU and the UK countries benefitted from the coordination through the mechanisms and procedures existing at the EU and UK levels, e.g. the Joint Research Commission; the Common Implementation Strategy of the Water Framework Directive.

Further, it emerged from the EU and UK findings that the information encoded in wastewater, while seen as scientifically relevant, has not yet been thoroughly researched to uncover its full potential and value for the public health sector. The need for critical supply chains of chemicals for water treatment also emerged as a key finding, e.g. chemicals for the use in dewatering or water treatment were issues that must be addressed.

Overall, the link between public health and water sanitation emerged as a vulnerability for both the EU and SADC since the existing structure of governance struggled in most countries to enter a dialogue beyond business and failed plans for disaster management such as the Covid-19 pandemic.

The underlying challenge for the SADC water sector was observed as a lack of capacity to build resilience for post-COVID-19 water security, which is caused by a lack of research and technical capacity, capacity for knowledge creation, capacity for co-creation and uptake of technology and innovation solutions, and capacity for monitoring, evaluation and improvement of the WASH sector.

The recommendations derived from the findings take into account the multi-sectoral, multi-layered and multi-stakeholder aspects and focussed on research and technical capacity, collaborations/ partnerships, and monitoring and evaluation:

1. BUILD/STRENGTHEN THE RESEARCH AND TECHNICAL CAPACITY FOR THE SADC WATER SECTOR

SADC countries should leverage the services of the existing regional and international capacity development networks and the higher education sector to build research and technical capacity for the water sector. Regional networks/programmes, including the Southern Africa Development Community (SADC) subsidiary for capacity building on integrated water resources management (WaterNet), Capacity Building Network for Integrated Water Resources Management (Cap-Net), Global Water Partnership-Southern Africa (GWP-SA) and the new SADC Groundwater Management Centre are available to conduct the required training in collaboration with universities, research institutes and science councils, technical and vocational education and training (TVET) colleges, and water research, innovation and capacity-building funding institutions.

2. IMPROVE/STRENGTHEN EXISTING CROSS-SECTORAL AND MULTI-STAKEHOLDER COLLABORATIONS/ PARTNERSHIPS

- Develop stronger cross-sectoral collaborations between the energy, food, and climate change sectors with a stronger link to public health.
- Improve public awareness regarding the role of water not only with regards to COVID-19 but as a source of many other diseases.
- Build resilience capacity for post-COVID-19 water security at all managerial and governance levels, including transboundary, national, provincial/district and local/community.

3. STRENGTHEN AND/OR IMPROVE WASH PROGRAMMES IN SADC COUNTRIES

- Develop and utilise evidence to support programme adaptation and integration of climate change adaptation (CCA) and disaster risk reduction (DRR) elements into WASH programme design and implementation.
- Conduct inclusive and gender-sensitive risk assessments to strengthen WASH programme design and implementation and inform other sectoral programming and planning.
- Develop key advocacy messaging and communication, informed by evidence and risk assessment to support WASH sector investment and strategic action.
- Develop a comprehensive WASH resilience model, including developing tools and approaches for implementation, informed by experiences and consultations with the primary managers and users of WASH.
- Scale-up climate-resilient WASH services to urban and rural populations, including through rapid response teams and existing coordination mechanisms, and enhance community capacity, including supporting local and school health clubs.
- Support renewable energy and innovative approaches such as solarised boreholes and water kiosks.

The specific recommendations linked to the findings of the EU and the UK part of the study (and also relevant to the SADC states) are listed below:

4. DETECTION AND MONITORING

- To implement a standardised and harmonised method of sampling, storage, concentration, isolation, and detection of SARS-CoV-2.
- To further investigate the survival/infection of SARS-CoV-2 in the whole water cycle under different field conditions. Specific focus should be placed on rural areas.
- A standardised protocol should be implemented for water-based epidemiology (WBE) for tracking COVID-19 in water systems.

5. TECHNOLOGICAL

- Continue to support the digital revolution in the water sector to ensure future resilience.
- Strive to incorporate water-digital-human systems into platforms that enhance water management and capacity building of the research development and innovation (RDI).
- Incorporate artificial intelligence (AI) technology to enhance planning and build resilience in the sector.

6. SOCIAL ASPECTS AND CAPACITY DEVELOPMENT

- Investigate across Europe how water utilities communicated water conservation and quality measures to consumers during the period of the COVID-19 pandemic. Build a database of lessons learnt.
- Continue to develop co-sectorial partnerships and collaborations (e.g. build long term collaborations between the water sector and the health, agriculture, business, education, energy and environment sectors.
- Develop citizens' water-related skills and knowledge regarding all aspects related to transmission, particularly for young water professionals, youth and unemployed graduates
- Create water-related communities (for instance: living labs, competency groups, water observatories etc.).
- With the advent of new technology and monitoring protocols, develop training campaigns for staff to use specialised equipment for SARS-CoV-2 detection.
- Investigate the change in water use habits instigated by the pandemic.

7. GOVERNANCE

- Create long-term working groups that have an increased involvement of all the water relevant stakeholders to improve the governance of the water systems and management of waterborne and related diseases borrowing from the lessons learnt from COVID-19.
- Implement joint programmes and results frameworks that enhance water governance.
- Enhance synergies between water-related investments, implementing cross-border projects.
- Analyse how funding for COVID-19 was applied in the water sector with a specific focus on new policies that have emerged as a result.

Position Paper: The findings and recommendations informed the formulation of a position paper on "Building capacity for post-Covid-19 resilience of the SADC water sector" with the vision to "build capacity for co-creation and uptake of research, knowledge generation, and technology and innovation solutions for post-COVID-19 resilience of the SADC water sector".

The capacity interventions recommended that the position paper include:

- Building water research and technical capacity,
- Capacity for knowledge creation,
- Co-creation and uptake of water and wastewater technology and innovation solutions, and
- Improvement of the WASH sector.

CONTEXTUAL DESCRIPTION OF THE MAIN CONCEPTS

Agility – Ability, capacity, capability and flexibility to react swiftly to a situation/crisis

Resilience – Identifying and managing the threats and risks to the timeous delivery of sufficient and quality water, sanitation and hygiene services on which the society depends. The ability to avoid, cope with and recover from disruption.

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1. INTRODUCTION

1.1 OVERVIEW

Less than ten years (as of 2021) remain to reach the UN Sustainable Development Goals (SDGs) set by the Agenda 2030. Although we have seen promising advances in achieving the goals, the COVID-19 pandemic has shifted the focus and raised new public health, welfare, and education concerns that are key to implementing the SDGs (Water JPI, 2021). Indeed, the SARS-CoV-2 and climate change are seen as threat multipliers to the water sector (Keulertz et al., 2020).

Contributions from the research and innovation community are expected to play a pivotal role in bringing emerging technologies into practice to mitigate the pandemic crisis. The global water research community reacted quickly to the virus. Research undertaken by (Ji et al., 2021) shows that investigations focused on water and COVID-19 amounted to 262 papers from 67 countries. They clustered the research into four main research topics: Cluster 1 focused mostly on survival characteristics of coronavirus in an aquatic environment. Cluster 2 focuses on the methodology of virus detection and how the virus has affected daily life. Cluster 3 highlights "Water, Sanitation and Hygiene (WASH)" as a critical control measure in the COVID-19 pandemic. Cluster 4 concerns the impact of the COVID-19 pandemic on the water ecosystem. Hence, we note that the water research community has focused on the fate, transmission, survival, detection and control of the virus in water.

This report considers the pandemic's impact on the water research agendas and plans and implementation from SADC and European countries. This baseline report provides a first review of the recommendations for SADC and European countries to follow based on extensive literature analysis.

The overall objective of this assignment was to conduct a desktop study aimed at collecting preliminary information from peer-reviewed literature and grey literature from websites and published strategic documents such as policies, plans, frameworks, and analyse. The study looked at the impact of the COVID-19 pandemic on the planning and implementation of the SADC and EU WASH RDI and capacity building activities. The study identified both the negative and positive impacts, clustering the challenges into categories such as technology, capacity/skills, management and governance. The study also included virtual individual dialogues/interviews with selected key stakeholders to obtain further information on documented data and to elaborate on the information acquired.

Convenience sampling was used for the selection of documentation to be assessed. It should be noted that the selection of the studies does not have merit or ranking implications, and there is no intended ranking of research conducted in the region. The data was also accessed outside organisational boundaries, mainly from online sources, published research networks, and government databases.

Content analysis methods for drawing conclusions included observing patterns, themes and trends, making comparisons, building a logical chain of evidence and making conceptual, theoretical coherence. The content analysis yielded some descriptive data giving some picture of the impacts of the COVID-19 pandemic on the SADC, EU and UK water sector.
Interviews with the relevant water sector experts were conducted, focusing on the description of their water-related organisations and their relevance/contribution to the improvement of water sector resilience; other countries (excluding the 10 countries in this study) that have shown resilience to COVID-19 in the water sector, capacity deficiencies identified in the sector during the pandemic, awareness of other COVID-19 research trends in the EU, UK or SADC water sector, and the respondents' opinion on what constitutes a resilient water sector with regards to the current pandemic (see the

questionnaire in see Appendix A).

The project design was planned to obtain answers to the study questions, including;

- How has the SADC WASH RDI sector been affected by the COVID-19 pandemic?
- What mitigation strategies and plans have been established to enable the sector to continue with research and capacity building activities during the COVID-19 pandemic?
- What are the challenges making it difficult for the sector to operate effectively and efficiently during the pandemic?
- What are the knowledge and solutions needed to enable the sector to continue operating effectively and efficiently – best practices, case studies and SADC WASH RDI needs?
- How has the sector contributed to broader national responses to the pandemic?
- How is the sector preparing itself for post-COVID-19 and economic recovery to build national and sector resilience and sustainability?

2. CASE-STUDY IDENTIFICATION

In order to identify the most relevant case studies (represented at the country level) for further analysis, the outcomes from the baseline study were used to provide the grounding for the selection of the 5 SADC (4 including South Africa) and 4 EU countries as well as the UK. The literature analysis has also provided information for further review of the SADC, EU countries, the UK's resilience, agility and responsiveness to the pandemic and their ability to overcome the pandemic constraints. In selecting the countries for further analysis, a scoring system based on a high, medium or low scale was used, following an objective analysis of each case with examples to back up the choice. A graphical representation of the database matrix of the chosen countries is provided in Table 1.

TABLE 1: RESILIENCE AND AGILITY OF THE SELECTED COUNTRIES

	South Africa	Namibia	Mozam-bique	Zambia	Zimba-bwe	UK	France	Germany	Italy	Spain
COVID-19 Resilience	↑	↓	↓	→	→	↑	↑	↓	↑	↑
Agility and Responsiveness	↑	→	→	↑	→	↓	↑	↓	↑	↑
Ability to overcome the pandemic constraints	→	↓	→	→	↓	↑	→	↑	↑	↑
Number of current scientific publications (COVID-19 water sector)						31	10	12	24	21

FIGURE 1: DATABASE MATRIX OF THE CHOSEN COUNTRIES FROM SADC, EU AND UK KEY: ↑ HIGH → MEDIUM ↓ LOW

2.1 THE SELECTION OF SADC COUNTRIES

One of the challenges Southern African countries face is the restricted access to water and the maintenance of proper hygiene and sanitation. The lack of access to safe and clean water and sanitation facilities exposes inhabitants to the fatalities of COVID-19 if no action is taken to ensure improved WASH services (Howard et al., 2020). Also, institutions play a critical role in strengthening the systems to monitor, operate and maintain WASH facilities through community participation and hygiene promotion (Cooper, 2020; Krägeloh et al., 2020).

Before the COVID-19 pandemic, water research in the African continent comprised between 1,39% and 1,66% of total research undertaken (Elema, 2019). Within the SADC region, water research included 1,80% of all SADC countries combined. An increase in the share of SADC water research was observed by Elema (2019) for Namibia, Mozambique, DR Congo, Zambia and Swaziland. It is expected that the COVID-19 pandemic has affected the water research output of the region negatively. For example, Namibia's contribution to research output of the SADC was in the 6/7 position (based on % water research output contribution) before 2019 (before the pandemic); however, only one peer-reviewed journal article was produced on 'covid-19' during the pandemic, also not focused on 'covid-19 and water' per se. This potentially suggests a significant impact of COVID-19 on the human, infrastructure and financial resources of universities and research institutions within the region.

On the individual researchers' level, the restrictions imposed during the pandemic could have hampered the commissioning of field and laboratory-based research. The desktop studies would not have yielded much either, as the SARS-Cov-2 and water was an emerging research focus area which was already confounded by a lack of baseline in the region.

Further, the research priorities and flexibility of researchers and research disciplines could have played a significant role in the limited/lack of peer-reviewed research output on 'covid-19 and the water'. This could confirm what the African Academy of Sciences observed during a priority setting exercise for the study on 'Research and Development goals for COVID-19 in Africa', where only 2 out of 15 potential priorities (the Environmental studies of SARS-Cov-2 including waste and sewage management practices; and Research into water sanitation and hygiene practices in communities during the outbreak during the pandemic) was selected by researchers (AAS, nd.).[1]

Therefore, the criteria for the availability of scientific literature could not be applied consistently due to the limited information for all SADC countries. Instead, reports on WASH initiatives, capacity and responses (during the pandemic), and the representation of transboundary shared river basin organisations/watercourse commissions (Table 2) were used as additional selection criteria.

TABLE 2: TRANSBOUNDARY RIVER BASIN ORGANISATIONS WITH A MEMBERSHIP OF SADC STATES

River Basin Commission	Member States
Limpopo Watercourse Commission (LIMCOM)	Botswana, Mozambique, South Africa, Zimbabwe
Cuvelai Watercourse Commission (CUVECOM)	Angola, Namibia
Orange-Senqu Commission (ORASECOM)	Botswana, Lesotho, Namibia, South Africa
Zambezi Watercourse Commission (ZAMCOM)	Angola, Botswana, Malawi, Mozambique, Namibia, Tanzania, Zambia, Zimbabwe
Okavango River Basin Commission (OKACOM)	Angola, Botswana, Namibia

Transboundary shared watercourses (mainly river basins) and watercourse commissions are at the core of water and wastewater management and service delivery in the SADC. If managed well, the river basins form a natural system that underpins the resilience of the water sector in the Region. In this case, the shared water sources are seen as a key enabler of post-pandemic long term resilience. For effective assessment of the COVID-19 resilience, agility and responsiveness of the SADC, and the ability of the Region to overcome the pandemic constraints, five countries – Mozambique, Namibia, South Africa, Zambia and Zimbabwe were identified.

2.1.1 SOUTH AFRICA

South Africa also had its share of water quality and supply challenges before the COVID-19 pandemic. Nationally, over 3 million people did not have access to basic water supply services, and 14.1 million people did not have access to safe sanitation (van Koppen et al., 2020). At the provincial and local levels, the funding, infrastructure and technical capacity had already started to

[1] https://www.aasciences.africa/sites/default/files/2020-04/Research%20and%20Development%20Goals%20for%20COVID-19%20in%20Africa.pdf

decline. For example, in rural Limpopo Province, Ramugondo et al. (nd.) found that only 14% of water infrastructure implemented is fully functional, while 15% is sub-functional and 71% is dysfunctional.

At the local/community level, van Koppen et al. (2020) confirmed the presence of a knowledge gap between domestic water needs and productive water needs, where people combine multiple water sources (rain, run-off, ponds, wetlands, soil moisture, groundwater) through a mix of individual or communal infrastructures that are publicly financed or self-financed.

During the pandemic, thousands of water storage tanks and water tankers were delivered across the country to provide citizens with the clean water needed to maintain the required health and hygiene. Meanwhile, wastewater-based surveillance to monitor SARS-CoV-2 prevalence in South African communities was conducted (Pocock et al., 2020). The water quality results for the surface water samples taken showed that all sources were contaminated with untreated or poorly treated sewage. The quality of the surface water runoff from Alexandra was characteristic of raw, high, strength sewage, as indicated by an overflowing sewer manhole in the area. The water quality for the Jukskei River, Blougatspruit and Hennops River was also poor. All three river samples had ammonia, suspended solids and E. coli concentrations in excess of the general wastewater discharge limits. The Blougatspruit and Hennops River exceeded the chemical oxygen demand (COD) general limil. All rivers displayed qualities similar to that of low strength domestic wastewater (Pocock et al., 2020).

South Africa's water research, development and innovation (RDI) is directed by the 'Water RDI Roadmap', a 10-year innovation plan (2015–2025) that provides strategic direction, a set of action plans and an implementation framework to guide, plan, coordinate and manage South Africa's water RDI investment.[2] The water RDI is managed by the Water Research Commission (WRC), which is spearheading interventions including; Innovations in water quality and environmentally sensitive water development, a fundamental diversification of water supply options, smart – beneficiation oriented and decentralised (localised) – wastewater treatment; Innovative water sensitive design, embracing the water-energy-food nexus and fully implementing a 4th industrial revolution (4IR) approach to water and sanitation management.[3] The WRC hosted a series of webinars on knowledge regarding COVID-19, including the 'Water quality, sanitation and hygiene in light of COVID-19' webinar (WRC, 2020).

2.1.2 ZAMBIA

Thirty-three per cent of the 17.35 million Zambian population do not have access to basic sanitation, and only 24% have access to basic hygiene services. Also, a large proportion of the Zambian population does not have access to basic water use (UNICEF, 2020). However, WaterAid Zambia is currently working with the Zambian government and other partners through the hygiene behaviour change Kutuba Campaign – to promote the identified key hygiene behaviours that prevent the spread of the Coronavirus building on existing WHO and Ministry of Health (MOH) guidelines. The country has made efforts about the monitoring and evaluation the WASH programme.

The Zambian government has made commendable efforts to assess progress on implementing Pillar 3 of the 7th national development plan (NDP): Reducing developmental inequalities – Key drivers and enablers (2016-2020). The impacts of COVID-19 on SDG 6: Ensure availability and sustainable management of water and sanitation, and SDG 7: Ensure access to affordable, reliable, sustainable and modern energy for all were assessed. The following impacts were recorded; Loss or reductions in household income, increased prices of goods and services, further increase of household vulnerabilities due to lack of water; and households with income challenges failing to keep up with payments for water supply (ENVIROLINK SOLUTIONS, nd.). However, measures taken to mitigate COVID-19 and medium-term impacts were only limited to moratoriums on water service cut-offs.

[2] https://www.wrc.org.za/water-rdi/
[3] https://www.wrc.org.za/
[4] WaterAid is a global leader in WASH, hygiene promotion, and behaviour change and is a key actor in the WASH sector in Zambia.

2.1.3 ZIMBABWE

The fragile economy represents the greatest challenge in the fight against COVID-19. The economic decline has also exacerbated the delivery of critical services such as health and the provision of water, which are critical in ensuring the prevention of COVID-19.

The water, sanitation and hygiene (WASH) service delivery varies from improved access in urban areas to poor services in rural areas. About 3.7 million people in Zimbabwe need WASH support services, which increased to 7.3 million during the COVID-19 pandemic (UNOCHA, 2020). To address these gaps, the Humanitarian Response Plan targets about 4 million people in rural and urban areas and an additional 2.1 million people under COVID-19 programs (UNOCHA, 2020). Also, despite the challenges, Zimbabwe has prioritised critical needs such as health, water and sanitation above all other considerations. However, business continuity plans are required by WASH sector partners to ensure that essential WASH services can continue as COVID-19 cases increase (UNOCHA, 2020).

2.1.4 NAMIBIA

The Namibia Water Corporation (NamWater) made efforts to ensure that the normal water supply was not disrupted or affected by the COVID pandemic. However, the country's focus was on temporary monetary relief programmes, including the water subsidy during lockdown so that people could access water without water cards at an estimated cost of N$10m for the first lockdown; and the tax-back loan scheme and water subsidy. NamWater lifted water rationing to all Village Councils, which were previously affected to supply water 24 hours to such Councils; and moved all users of pre-paid water metering systems to a by-pass system to allow for access to water in their respective Towns or Village Councils. A number of communities were also identified and supplied with water using Water Tankers. Also, provision was made for customers to pay their water bills and connections/re-connections at places and institutions announced in the media.[5]

2.1.5 MOZAMBIQUE

UNICEF's WASH programme in Mozambique supported the national priorities laid out in the Government's Five-Year Plan, which are in line with the Sustainable Development Goals (SDG), including SDG 6 – to 'ensure availability and sustainable management of water and sanitation for all'. UNICEF will work in partnership with the government to ensure vulnerable groups have access to safe water supply and sanitation infrastructure in rural, small towns and peri-urban areas.

Mozambique's economy was expected to recover in 2021 gradually, but substantial downside risks remain due to uncertainty surrounding the path of the COVID-19 (coronavirus) pandemic. While the economy registered its first contraction in 2020 in nearly three decades, growth is expected to rebound over the medium-term, reaching about 4% by 2022.[6]

As the recent Mozambique Economic Update (March 2021) notes, the country needs to press ahead with its structural reform agenda as the pandemic subsides. In the near-term, measures to support viable firms and households would be crucial for a resilient and inclusive recovery. Targeted interventions to support women, alleviate gender inequalities, and harness the power of mobile technology would support sustainable and inclusive growth in the medium term.[7]

2.2 THE SELECTION OF THE EU COUNTRIES AND THE UK

Several considerations were contemplated in selecting the European countries and the UK for further investigation into COVID-19 resilience, agility and responsiveness, and the ability to overcome the pandemic constraints. For instance, Spain, Italy, France and UK were among the countries that recorded the highest number of COVID-19 cases in Europe.[8] The number of scientific publications with a specific reference to water-related responses to the pandemic and grey literature published articles on water sector responses to the pandemic were also considered. Therefore, the 5 selected countries from Europe published the most articles. Thus analysis provides the following 4 countries from the EU countries: France, Germany, Italy, Spain, and the UK made the 5th the country from Europe.

[5] https://www.namwater.com.na/images/docs/Media NW Lockdown Period Initiatives.pdf
[6] https://www.worldbank.org/en/country/mozambique/overview#1
[7] Ibid

2.2.1 THE UNITED KINGDOM

In terms of resilience to the COVID-19 pandemic, a study by Cotterill et al. (2020) has indicated that water professionals in the UK perceived that there were adequate procedures in place from the water companies to mitigate the virus threat. However, the agility and responsiveness of the UK to the virus were inconsiderate of the scale of the COVID-19 pandemic, resulting in some utilities now having to re-evaluate their response plans (Lawson et al., 2021). Their ability to overcome constraints, argues Lawson et al. (2021), was the cross-industry preparation, collaboration and collective working, which was successfully implemented among different sectors, including the water sector.

2.2.2 FRANCE

Regarding its resilience to COVID-19, France set aside €3 billion towards the social and fiscal cost for utilities, including deferred water bills and water-related investments, thus supporting and strengthening the sector during the pandemic. This recovery plan – or "France relance" – was decentralised to a regional level, accommodating the agility and responsiveness in connection to the pandemic, thus scoring high. In particular, "France relance" will distribute:

- €350 million to improve freshwater infrastructure and rainwater treatment
- €250 million to a biodiversity program, including maintaining and restoring aqua, maritime and coastal ecosystems.

The financing for these specific areas of the water cycle will enable France to continue to overcome the constraints of the pandemic. However, perhaps a greater investment in digitalisation could further improve certain digital constraints related to the water sector; thus, we perceive the ability to overcome the constraints as a medium.

2.2.3 GERMANY

There were no specific water-related responses from the German government during the pandemic, and thus Germany scored low in its water-related COVID-19 response and resilience plans. However, according to research conducted by Water Europe and Antwi et al. (2020), an alliance of institutions, including municipal water operators and universities, have been examining wastewater monitoring during the pandemic, thus scoring high on the ability to overcome the pandemic constraints.

2.2.4 ITALY

During the peak of the pandemic, the Italian government introduced a €0.6 billion fiscal package to help reduce utility bills on small production and commercial activities, providing resilience to COVID-19 and thus scoring high in this area. Simultaneously, the government suspended water bills and other utility payments to further reduce constraints from the pandemic leading to a high score in this area. The Italian government provided a national directive for immediate responsiveness to the pandemic within the water sector; thus, their agility and responsiveness have scored high.

2.2.5 SPAIN

In terms of its agility and responsiveness, Spain scored high, as assessment studies from 2020 show that Spain launched a national control network to detect COVID-19 genetic material in waste and bathing water and a study on the virus's impact on the urban water cycle.[9] Furthermore, to increase its resilience, the Spanish government implemented mechanisms to support "vulnerable groups" with water bills, such as solidarity funds and discounts in the tariff structure. To overcome the constraints of the pandemic, the Spanish government ordered a ban on restricting water, electricity and gas supplies to households during the peak of the pandemic, scoring high in this area. Simultaneously, the government established a €58 million fund to support deferral of expenses for business and self-employed workers and vulnerable households resulting in a high score in the ability to overcome the pandemic constraints.

[8] https://www.statista.com/statistics/1103227/coronavirus-recoveries-in-europe/,
[9] https://www.eureau.org/resources/publications/member-publications/5389-the-urban-water-sector-as-a-vehicle-for-sustainable-recovery-post-covid-19/file

3. STAKEHOLDER ANALYSIS

To identify the key stakeholders, the reviewed documentation was subjected to the first analysis. The stakeholders include representatives of the water sector working with community water systems (CWSs), wastewater treatment facilities (WWTFs), water research organisations and/or researchers, water supply/utilities organisations, and WASH Agencies, Capacity Organisations, transboundary water commissions/river basin organisations.

All stakeholders that appear in the documentation were tethered out and listed according to the institution, contact person and programmes they are involved in (Table 3 & 4).
The stakeholders were further clustered according to the following criteria:

- Level of COVID-19 pandemic impact (least to most affected) on their WASH RDI and capacity building planning and implementation of activities,
- Potential capacity to act,
- Relevance in the sector,
- Capacity to mobilise resources,
- Potential to influence policy

The aim of the list of stakeholders is, firstly, to allow an overview of central institutions for the steering of water research agendas and capacity building activities on the EU, UK and SADC levels. Secondly, based on the stakeholder list, suitable candidates for subsequent interviews were identified. The interviews allowed the study experts to gain a more detailed understanding of the impacts COVID-19 has on the water sector in the respective countries from the respective institution's perspective.

TABLE 3 SADC INSTITUTIONS AND THEIR ABILITY TO RESPOND TO THE PANDEMIC IN THE WATER SECTOR

Institution	Contact person	Programmes involved or responsibility	Pandemic impact	Capacity to act	Relevance in sector	Capacity to mobilise resources	Potential policy influence
Southern African Development Community (SADC)	Dr Patrice Kabeya	Senior Programme Officer	↓	↑	↑	↑	↑
SADC Groundwater Management Institute (SADC-GMI)	James Sauramba	Executive Director	↓	↑	↑	↑	→
SADC WaterNet	Dr Krasposy Kujinga	Programmes Manager	→	↑	↑	↑	↑
Water Research Fund for Southern Africa (WARFSA)			↑	↑	↑	↑	↑
AUD Southern African Network of Water Centres of Excellence (AUD SANWATCE)	Dr Nico Elema	Project Manager	→	↑	↑	→	→
Cuvelai Watercourse Commission (CUVECOM)	Mr Silvanus Uunona	Programme Manager	→	↑	↑	→	→
Limpopo Watercourse Commission (LIMCOM)			→	↑	↑	→	→
The Permanent Okavango River Basin Water Commission (OKACOM)	Mr Phera Ramoeli	Executive Secretary	→	↑	↑	→	→
Orange-Senqu River Commission (ORASECOM)	Mr Lenka Thamae	Executive Secretary	→	↑	↑	→	→
Zambezi Watercourse Commission (ZAMCOM)	Ms Leonissa Munjoma	Executive Secretary	→	↑	↑	→	→

Water Research Commission, South Africa	Dr Stanley Liphadzi	Executive Manager: Research & Development Chairperson: COVID-19 Surveillance Programme	→	↑	↑	↑	→
Namibia Water Corporation	Mr Johannes Sirunda	Mr Johannes Sirunda Head of Research & Development	↑	↑	↑	↓	→

TABLE 4 SADC INSTITUTIONS AND THEIR ABILITY TO RESPOND TO THE PANDEMIC IN THE WATER SECTOR

Institution	Contact person	Programmes involved or responsibility	Pandemic impact	Capacity to act	Relevance in sector	Capacity to mobilise resources	Potential policy influence
JRC	Bernd M. Gawlik	Head of JRC. Lead author of the JRC's umbrella wastewater monitoring study		↑	↑	↑	↑
Water Europe	Durk Krol	Executive Director		↑	↑	→	→
DG Environment	Florika Fink-Hooijer	Director-General for DG Environment		↑	→	↑	↑
Water JPI	Dominique Darmendrail	Water4All		↑	↑	→	↑
Centre for Freshwater and Environmental studies, Ireland	Sarpong Hammond Antwi	Lead author of the study on EU government responses regarding the water sector		→	↑	↓	↓
UFZ	Prof. Dr. Georg Teutsch	Wastewater monitoring study		→	↑	↓	↓
German Ministry for Education and Research	Dr. Stefan Kaufmann	Coordinator of the ministry's research and development		↑	↓	↑	↑
Aqua publica Europea	Milo Fiasconaro	Executive director		→	↑	↑	↑
Sorbonne Université	Vincent Maréchal	Obépine, a research consortium for wastewater monitoring		↑	↑	↓	↓
OECD	Kathleen Dominique	Programme Lead "Financing Water"		→	↑	↑	→
DWA (German association for water and waste management)	Dr. Friedrich Hetzel	Lead the water and waste department		→	↑	↑	→
Aeas (Spanish association for water supply and sanitation)	Fernando Morcillo Bernaldo	President of the association		→	↑	↑	↓

KEY: ↑ HIGH → MEDIUM ↓ LOW

4. IMPACT OF COVID-19 PANDEMIC ON THE WATER RESEARCH AGENDA

The World Health Organisation (WHO) described the SARS-CoV-2 virus as a Water Access, Sanitation and Hygiene (WASH) disease. Furthermore, they reiterated the importance of safe water and sanitation during the pandemic: "The provision of safe water, sanitation and waste management and hygienic conditions is essential for preventing and protecting human health during all infectious disease outbreaks, including of coronavirus disease 2019 (COVID-19)".[10] Therefore, the water sector in Europe (and indeed across the globe) quickly became a focal point for the potential for the virus to be transmitted. However, as water and sanitation processes are designed to eliminate pathogens and viruses, this threat was soon quashed. Attention then turned to the early detection and tracing of the SARS-CoV-2 and its RNA in wastewater. In this section, we provide a deep dive into the impacts on the SADC and EU research agendas, providing a focus on the new research trends and the impacts on planning and implementation.

4.1 SADC WATER RESEARCH AGENDA

The strategic objective of the SADC Water Research Agenda is to promote the evidence-based implementation of SADC water programmes and projects through multi- and inter-disciplinary research and synthesis of existing and new information, which will lead to a realisation of SADC developmental goals (SADC, 2015).

While the SADC water research agenda (summarised in Table 5) acknowledges that many research efforts are undertaken in the region, a need has been identified at the SADC Water Division to consolidate, streamline and institutionalise the research to ensure that research stays relevant to the needs of the region (Elema, 2019).

TABLE 5: SADC WATER RESEARCH AGENDA RESEARCH

Theme	Topic(s)
Focus Area 1: Infrastructure for Health, Livelihoods and Economic Development	
Theme 1: Development and sustainable implementation of resilient water-related infrastructure	1. Water supply and sanitation in rural areas 2. Water supply and sanitation in urban areas 3. Water supply and sanitation in peri-urban areas/slums 4. Agricultural water management for food security and poverty alleviation
Theme 2: Innovation in affordable and appropriate technologies and innovative approaches and practices	1. Wastewater treatment technologies in urban, peri-urban and rural settlements and industrial areas 2. Support self-supply technologies for domestic uses and agriculture water management
Theme 3: Sustainable Water institutions	1. Responsive local public and public-private partnerships water institutions 2. Decision-support tools to enable effective planning and management of water resources 3. Accountability, transparency, and integrity for maximum societal benefits 4. Implementation and monitoring methods of water and sanitation services.

[10] https://www.who.int/publications/i/item/WHO-2019-nCoV-IPC-WASH-2020.4

Theme 4: The Human Right to Water	1. Social, economic and environmental viability of large-scale investments in agriculture 2. Support local investments incorporating gender, and legal and social protection of small-scale water users 3. Implications of the human rights to water supply, sanitation and hygiene 4. Core minimum service levels for multiple uses, including the right to food.
Focus Area 2: Water Resource Management and Environment	
Theme 1: Assessment of surface and groundwater resources	1. Water quantity and quality assessment 2. Regional water quality guidelines for rivers, lakes and aquifers 3. Data processing, storage standards and dissemination 4. Suitability of water productivity performance indicators 5. Optimisation of monitoring networks
Theme 2: Operational Rules for Water Resources Management	1. System operating rules for environmental flows, irrigation management and flood response 2. Impact of hydropower reservoir discharges on downstream productive uses and the environment.
Theme 3: Impact of Urbanisation on Water Resources	1. Urban hydrology across various human settlements and economic zones 2. Sustainable urban design
Theme 4: Water Governance and Institutional Arrangements	1. Institutional models for effective water governance.
Theme 5: Water and Land	1. Assessment of irrigation resources 2. Sustainable land management, including the land-water nexus.

Before the COVID-19 pandemic, most SADC countries made implementation arrangements as proposed in the water research agenda; however, the pace of development differed vastly because of a lack of technical capacity and/or limited access to financial investments for water programmes. The rapid urbanisation and declining water supply and sanitation services in urban areas also add to the delayed improvement of access to WASH facilities in rural areas and the continued decline of the existing infrastructure in many urban areas. Also, while it is acknowledged in the research agenda that "the majority of SADC citizens live in the rural areas where infrastructure for water supply is used for multiple purposes and is shared by many people and communities" – (SADC, 2015), the efforts made by SADC countries to improve on the infrastructure needs to be commended.

However, the pandemic highlighted the poorly serviced communities, the need for a multi-sectoral approach to water supply, the possible introduction of emerging contaminants and the pressure to implement new methods/systems of water supply and payments. These, together with the need for digitisation and the interconnectedness and interdependence of different sectors, were already implied in the Research Agenda in Focus Area 1 – Theme 1 and 4, and Focus Area 2 – Theme 3 and 4, as described in Table 5.
Other gaps highlighted by the pandemic, i.e., the need for clarity on priorities of the water sector, equity of provision, and transparency and inclusive approach to planning and budgeting, are also emphasised in the Agenda in Focus Area 1 – Theme 1 and 3, and Focus Area 2 – Theme 3 and 4.

While the Agenda emphasised the inter and intra-disciplinary collaborative approach to research, planning and implementation; and the pandemic amplified the need for transboundary partnerships, it should be acknowledged that the SADC research agenda also made provision for the implementing agencies of the SADC Water Division, including the NEPAD Southern African Network of Water Centres of Excellence (NEPAD SANWATCE) as implementing agent of WARFSA, and WaterNet, a subsidiary of the SADC Water Division to drive as the synchronisation of systems, methods and data formats across the participating member states. There is, therefore, an urgent need for all the relevant role-players and stakeholders to collaborate in building the resilience capacity of the water sector in the Region.

4.2 WATER EUROPE STRATEGIC RESEARCH AND INNOVATION AGENDA

Even before the pandemic hit Europe in early 2020, the world was facing multiple crises and challenges. Throughout the 2010s, global warming continued to escalate and became more pronounced on the political agenda (McCright and Dunlap, 2011). New record temperatures and extreme weather events dominated our planet throughout the decade. Similarly, combating pollution and climate change started to take center stage in the media, with new movements (e.g. Fridays for Future) and initiatives calling for drastic and immediate change to combat these challenges (Kühne, 2019). Thus, 2020 was seen as a new dawn and an age of reckoning to right the wrongs of the past and care for the planet for future generations. The Water Research Agendas across Europe thus had a focus on this significant date to make the 2020s the start of a new decade to create change and to overcome new and old challenges in the water sector. The most influential European water research agendas were updated to reflect the changes required in the European water sector at the turn of the decade.

The Water JPI was published in April 2020, and the Water Europe Strategic Innovation and Research Agenda (SIRA) in 2019.[11] Thus, these research agendas that were developed over extensive periods to focus on the next 5 to 10 years did not incorporate any research focus on SARS-CoV-2. Once the pandemic was known, position papers and guidance documents were provided, and their insights are provided in the section below on COVID-19 induced Water Research Trends in Europe.

The strategic research and innovation agenda from the Water JPI Vision 2030 focuses on 4 themes: Theme A: Ecosystems; Theme B: Health and Wellbeing; Theme C: Water Value and Usage; Theme D: Sustainable Water Management. These 4 themes are all in line with the good functioning of water bodies and the environment, which goes hand in hand with reducing the risk of virus (COVID-19) transmission.

The Water Europe "Value of Water" Strategic Research and Innovation Agenda points to 6 key components for research and innovation in Europe. The key components include:

Key Component 1: The Value of Water.

Key Component 2: Technologies – enabling insight and manageability.

Key Component 3: Hybrid Grey and Green infrastructure.

Key Component 4: Governance.

Key Component 5: Real-life living labs.

Key Component 6: Horizontal. As with the JPI research agenda, fulfilling these research components covers the risks associated with virus transmission (including SARS-CoV-2).

[11] https://watereurope.eu/wp-content/uploads/2019/07/Water-Europe-SIRA.pdf
[12] https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/covid-19

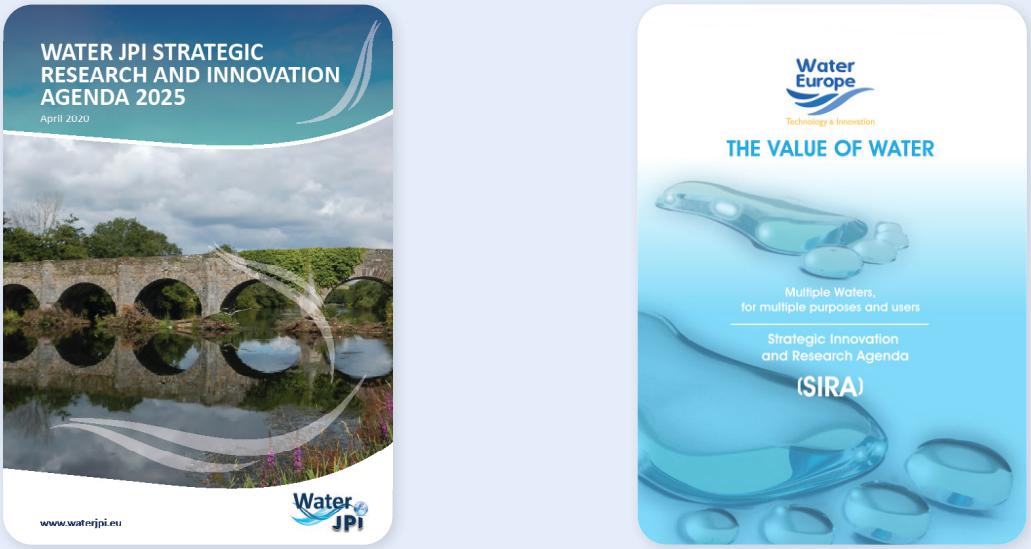


FIGURE 2: THE WATER JPI AND WATER EUROPE STRATEGIC RESEARCH AND INNOVATION AGENDAS

In addition to the research agendas, the much-revered European Water Framework Directive (WFD) (2000/60/EC) that has underpinned the EU's water policy since 2000, together with the associated Groundwater Directive and the Floods Directive (2007/60/EC), underwent a fitness check that was completed in December 2019. The key findings show that the directives are still as relevant as when they were adopted and have led to a high level of protection of the European water bodies and improved flood management. However, a delay in implementing the directives by the Member States and the threat multipliers of Climate Change has added to the known stresses within the water sector. Furthermore, following the advent of the pandemic, no update to the WFD was provided.

Although the research agendas and framework directives were not updated, the European Commission did launch several calls for research into the impacts caused by the virus, which culminated in the development of the "European Research Area Corona Platform".[w] For instance, there were 18 research projects that were developed under the call "SC1-PHE- CORONAVIRUS-2020: Advancing knowledge for the clinical and public health response to the [COVID-19] epidemic"; however, no projects were funded with a specific water focus.

However, changes of focus in water research have taken place since the start of the pandemic and position papers provide guidance on where research should focus as we move towards a COVID-19 resilient future. The following section indicates where those water research trends line in Europe.

COVID-19 INDUCED WATER RESEARCH TRENDS IN EUROPE

Although there seems to be no immediate need to update the European water research agendas, undoubtedly, COVID-19 has and will continue to have an impact on water research and innovation in Europe. The main research areas have focused on detection and monitoring of the virus, digitalisation of the water sector, water law and policy and social innovation.

In Europe, sampling and detecting the SARS-CoV-2 and its RNA in wastewater has been the hottest topics of research in the water sector in 2020 and 2021 (Keulertz et al., 2020). According to Bhowmick et al. (2020), the virus can take many routes into the urban water cycle, where currently there is a research gap on the full infectivity of the virus in wastewater (specifically sewage sludge) (Amereh et al., 2021). With limited information regarding the virus in wastewater sludge, the risk of virus transmission in sludge disposal cannot be ignored.

As mentioned above, the SARS-CoV-2 RNAs in wastewater have been widely studied; however, gaps

still remain in the methods of sampling, storage, concentration, isolation, and detection under different field conditions (Amereh et al., 2021). Further, the investigation is required to continue to understand the potential virus risk in wastewater, especially regarding the virus fate in untreated wastewaters or from inefficient wastewater treatment plants (WWTP) or those that do not incorporate activated sludge (Bivins et al., 2020). Research is also required into the continued potential transmission of SARS-CoV-2 in the entire water cycle (Nemudryi et al., 2020). Water-based epidemiology (WBE) research for tracking COVID-19 has provided an advance in tracking and monitoring the transmission of the virus (Gonzalez et al., 2020; Rooney et al., 2021).

Indeed, the successful applications of WBE has prompted some countries to plan and implement national wastewater monitoring programs (e.g. Spain), which can be used as virus tracking tools to supplement existing public health indicators (D'Aoust et al., 2021). Through WBE monitoring SAR, S-CoV-2 RNA can be detected in sewage before clinically confirmed cases emerge, supporting that WBE could be a sensitive and an early warning tool for COVID-19 epidemiological surveillance (Ji et al., 2021). Furthermore, there is a correlation between the concentration of SARS-CoV-2 RNA in municipal wastewater and the rise and fall of cases in the COVID-19 pandemic (Peccia et al., 2020).

Seeing the importance of a coordinated and homogenised approach, the European Commission published a recommendation for a national wastewater surveillance system targeted at data collection of SARS-CoV-2 and its variants in wastewaters.[13] Based on the advice from the Joint Research Commission, the recommendation sets out guidance for the Member States on the design and management of SARS-CoV-2 wastewater surveillance systems and the rapid transmission of the data collected to the competent health authorities. The Water4SDGs Knowledge Hub (an expert group consisting of members from JPI, UN-Water and the European Commission) has called for continued research into early warning systems linked to better sampling, testing and monitoring techniques.

There is also a call for an investigation into the harmonisation and update of water law and policy to respond to COVID-19 and future pandemics (Ji et al., 2021; Larson, 2020). Indeed, the Water4SDGs Knowledge Hub[14] has observed a need for improved water governance solutions to increase resilience against the long term socio-economic impacts of the pandemic outbreaks. During the pandemic, governments reacted to support the water sector, and 11 countries from the European Member States introduced policy interventions to mitigate the impacts of the virus. Several interventions focused on economic relief. The policy changes related to water of the five (4) selected countries from the EU of this study include:

FRANCE: A €3 billion financial package towards the social and fiscal cost to the utility, including deferred payment of water bills (Bashir et al., 2020)

GERMANY: No published political interventions with a focus on the water sector

SPAIN: A ban on restricting water, electricity and gas supplies to households during the peak of the COVID-19 crisis. Under the stability programme of Spain, a €58 million fund to support deferral of expenses for business and self-employed workers and vulnerable households was also announced (De España, 2019)

UNITED KINGDOM: Credit programs, deferred payments from retailers of up to 40% of primary charges, temporary vacancy flags, retailers could mark premises as temporarily vacant (making them exempt from fixed and, in some cases, volumetric charges) (OFWAT, 2021)

ITALY: A €0.6 billion fiscal package to help reduce utility bills on small production and commercial activities were introduced by the government, as well as suspension of water and other utility bills during the peak of the pandemic (Water Europe, 2020)

[13] https://ec.europa.eu/environment/pdf/water/recommendation covid19 monitoring wastewaters.pdf
[14] http://www.waterjpi.eu/resources/document-library/water4sdgs-position-paper-COVID-19-june-2021.pdf

Digitalisation in the water sector has already advanced significantly in the last few years; however, with the advent of the pandemic, digital solutions were placed at the top of the agenda. Research and innovation call for integrating the Internet of Things (IoT) and Big Data analytics to change the conceptualisation of new water treatment infrastructures (Poch et al., 2020). D'Aoust et al. (2021) propose that research is also required into water-human-data systems to increase citizens' confidence in public water services. The advancement of artificial intelligence (AI) in the water sector is also an emerging field of research. During the pandemic, an AI platform matching supply to human behaviour and weather patterns was established in Germany, opening the scope for further research (Poch et al., 2020). In July of this year, Water Europe published a position paper specifically mentioning the role of digitalisation research in the recovery and resilience to COVID-19 in the water sector: "A truly inter-operable, intelligent and data-centric digital ecosystem will provide the framework for water-driven sustainable growth. It will contribute to reduce energy demands, enhancing disaster management processes, improve analysis, modelling, and use of environmental data for addressing climate-related challenges and COVID-19 resilience. Investigation into standardisation and cybersecurity will be key to realise this recommendation."

Apart from new research requirements and the evident impacts of water research in Europe, a significant impact on planning and implementation in the European water sector has also taken place.

5. IMPACT OF COVID-19 ON PLANNING AND IMPLEMENTATION

Resilience is about identifying and managing the threats and risks to the timeous delivery of sufficient and quality water, sanitation and hygiene services on which the society depends. Therefore, assessment of the impact of the COVID-19 pandemic on the planning and implementation within the water sector should focus on challenges and positive drivers to inform the delivery of services and improvement/ amendment of the existing plans and monitoring and evaluation tools is crucial.

5.1 IMPACT ON PLANNING AND IMPLEMENTATION WITHIN THE SADC

The COVID-19 pandemic has highlighted the poorly serviced communities, both in urban and rural areas while showing the urgent need by SADC countries to adopt multi-sectoral approaches to the water supply. Prevalence of the pandemic also suggests the need for capacity development, new methods/systems of water supply and payments, improvement of planning, management and decision support tools, and improvement of service provision for remote communities.

The transboundary nature of water sources coupled with the different levels of socio-economic development of the member states also adds to the complex situation. The SADC relies on transboundary shared watercourse commissions and transboundary aquifer systems to ensure the implementation of the SADC protocol on shared watercourses, the regional Water Strategy (RWS), and Regional Water Policy (RWP), Protocol and related policies and strategies. The SADC region was acknowledged by Nijsten et al. (2018) for having a relatively advanced transboundary aquifer management system. However, the success of the transboundary watercourse commissions was hampered socio economic factors, including unequal access to resources caused by the COVID-19 pandemic.

Changes in the availability of skills and capacity in the labour market present potential resilience issues for water companies, supply chains and other partners (Ofwat, nd.). Though the COVID-19 pandemic affected the economy negatively, it also highlighted the need for improved water supply and digitised billing and payment systems within the SADC water sector.
Sustainable water resources management and development in Africa were already challenged by inadequate data and information (Gaye & Tindimugaya, 2019) needed to guide the planning and implementation of augmentation programmes before the pandemic. However, the pandemic also highlighted the need to improve institutional research and technical capacity. Within the Region,

only South Africa, through the Water Research Commission, seemed to be more responsive on the 'research front' and managed to commission research projects; and implement research capacity webinars on the pandemic.

Transboundary collaborations help to close the gaps created by distance – e.g., in the monitoring of availability and quality water resources across countries sharing a specific water source. The pandemic also impacted the collaborations negatively due to travel restrictions and the limited/absence of remotely operated research infrastructure. Thus, the pandemic worsened the limited collaboration and/or communication that was already a challenge. Communication is often hampered by language barriers – e.g., Cuvelai Watercourse Commission (CUVECOM) with two riparian states, Angola and Namibia, one using Portuguese and one English as an official language.

5.2 IMPACT ON PLANNING AND IMPLEMENTATION WITHIN THE EU

The impact on the planning and implementation of water services across the European continent can be separated into the challenges in the sector and the positive drivers.

5.2.1 CHALLENGES IN THE WATER SECTOR

The main challenges regarding planning and implementation during the pandemic are seen as infrastructure deficiencies, engineering project disruptions and increased financial costs.

Infrastructure deficiencies

The ageing water sector infrastructures in Europe have been a significant talking point for several years, even before the pandemic. Southern Water (a UK private water company) received a £90 million fine (the largest in the water sector in Europe) in July 2021 for repeated failures of their treatment plants and pollution incidents.[15] As the pandemic struck, the water companies had to upgrade their water services, including last-minute ICT upgrades, urgently. Monitoring of water services had to go fully digital, and many workers needed to connect from home, all of which showcased the deficiencies in digital systems within the water industry.

Engineering project disruptions

During the pandemic, all water sector construction projects were paused across Europe when specific measures were put in place, including strict lockdowns. Major changes occurred in the construction phase risk assessments and method statements to incorporate pandemic-related factors. Renukappa et al., (2021), in their study on the impacts of the virus on the water sector, listed several challenges related to water engineering project implementation:

- Site visits were restricted unless necessary during the design phase. Video live streaming and recording of site surveys to members of the design team (working remotely) were used instead.
- There was a need to revise site visit risk assessments to comply with COVID-19 procedures.
- Habit changes in relation to the virus added to project implementation time.
- A requirement for social distancing,
- Enhanced cleaning of the construction sites
- Continued handwashing, and hygiene processes
- Car sharing was strongly discouraged, which was previously encouraged for site visits.
- There was an acceleration of the implementation of digital technologies adaptation, including the need for all technical drawings, deliverables, site plans, contracts and digital signatures to be shared online.
- There were longer construction program times, by up to at least 3 months longer, as the workforces were smaller with social distancing implemented and continued and consistent hand washing on site.

[15] https://beale-law.com/article/record-90-million-fine-sends-a-message-to-all-polluters/

Other than project implementation, engineering project planning was also disrupted during the pandemic, with an increase in the demand for domestic water as business demand decreased (40% reduction in the UK) (Renukappa et al., 2021).

Increased Financial costs

Before the pandemic, water poverty in terms of affordability had grown to become a serious sanitary and social problem in certain European cities (Jones & Moulton, 2016; Martins et al., 2016). The COVID-19 pandemic removed that burden from customers and placed it on the water operators. Revenue collections fell by 40% in the UK due to the suspension of water charges as a strategy to cushion consumers from the effect of COVID-19 on personal finances (Renukappa et al., 2021). In Spain, water utilities offered rebates to industrial and commercial businesses requiring them to pay only for the water they used and not the fixed charges (Mastropietro et al., 2020; McDonald et al., 2020). Water operator's requirement to adapt to newer technology saw an increase in costs, including digital meter reading (smart meters), virtual home visits, and digital channels for communication (Antwi et al., 2020).

A study by WaterAid and End Water Poverty[16] has raised the concern that spending on the achievement of the SDGs will decline with the COVID-19 effect. They state that throughout the pandemic, public spending on development in 2020 and 2021 was projected to decrease by $400 Billion, with negative effects on WASH services. They see this due to the fact that OECD countries are set to reduce aid spending as a result of their own deep recessions and worsening public finances and recovery plans.

5.2.2 POSITIVE DRIVERS

The positive impacts of the pandemic in terms of planning and implementation almost outweigh the negative. We have seen an improved integration of sectors, improved management, an injection of finance and funding, and technology acceleration.

Improved integration of sectors

During the pandemic, sectors started to work together to overcome the effects and impacts of the virus. A positive outcome has been the simultaneous collaboration between water and sanitation, water resources, health and the economy. There is the realisation that all these sectors should be considered together to ensure a resilient future. Across the European continent, conversations were initiated between a more diverse spectrum of players, which has implemented political resolve that will be necessary to develop comprehensive solutions (Pories Lesly, 2020).

The Union for the Mediterranean (UfM) published an article entitled UfM Water Response to COVID-19 and Public Health Nexus in July of 2021[17]. The recommendation from the article is for sanitation to be recognised as a multi-sectorial issue that has an impact on health, social development, education and the economy. Further, they recommend that lead institutions need to develop multi-sectorial sanitation policies that use inter-sectorial coordination mechanisms and planning processes. They further recommend promoting a twinning strategy of institutional cooperation between public administrations and partner countries.

Progress in sector collaboration during the pandemic has already started taking place. For instance, the European funded project entitled Serious gaMes for digitAl Readiness of waTer EducatioN (SMARTEN)[18] - led by the Norwegian University of Life Sciences - aims to support and enhance digital transitions in the fast-evolving education and water resource sectors. The project, conceived during the virus outbreak, looks to better adapt to the pandemic and post-pandemic working conditions. The project builds a digital bridge between students of water-related programs, young water professionals, water educators in academia and industry, water society and the European community at large, collaborating with various stakeholders.

[16] https://www.wateraid.org/uk/media/COVID-19-set-to-take-400-billion-from-poverty-battle
[17] https://ufmsecretariat.org/wp-content/uploads/2021/04/WASH-Report-1.pdf
[18] https://smartenproject.eu

Improved Water Management

The pandemic raised the question if water utilities should move towards public ownership and public management of water for a more equitable and democratic response to emergency services (McDonald et al., 2020). Indeed, Water Europe provided a recommendation to have more involvement of citizens in the management of water resources: "Encourage an inclusive Water-Smart Society for our citizens. An increased involvement of all relevant stakeholders in the governance of our water system requires disclosure and consideration of water risk management and the development of citizens' water-related skills and knowledge, particularly for young professionals (Water Europe, 2020)

The city of Terrassa in Spain showed a good example of citizen involvement and collaboration that worked during the pandemic. The Terrassa Water Observatory (TWO), legally approved in 2018 and set up in 2019, is described by Satorras et al. in McDonald et al. (2020) as "an innovative body of citizen participation designed to define policies and guide strategic decisions affecting the municipal water supply service". The goal of the TWO is to ensure the participation of citizens, civil society organisations, local businesses and other water stakeholders to facilitate their co-responsibility in the government of the city water supply. The TWO has been heralded as a success during the pandemic as various stakeholders, including local citizens, formed part of the decision-making processes and promoted community-driven governance of Terrassa's water service.

Technology advancement

The changes provoked by the pandemic (social distancing, working from home etc.) has single-handedly pushed digital technologies adoption and adaption to the top of the European water agenda. According to (Renukappa et al., 2021), project teams and contractors have been experiencing the benefits associated with the use of digital technologies, which include efficiency, coordination and remote working.

For instance, in the city of Karlsruhe in Germany, during the pandemic, Stadtwerke Karlsruhe, a municipal water utility in the state of Baden-Württemberg, used a platform to support the operation and management of its drinking water distribution system. The platform operated a Demand Forecast System (DFS) that applies Artificial Intelligence and Pattern Recognition Techniques, adapting dynamically to meteorological parameters (such as temperature, rainfall, and humidity) and to changes in consumer behaviour – which was especially important during the pandemic as household consumption patterns changed (Water Europe, 2020).

In the UK, there has been an acceleration of ICT upgrades in the water sector, which matches the UK government's push for "Digital Transformation". The water operators have also taken steps to ensure that they are resilient to impacts requiring people to work remotely. According to Renukappa et al. (2021), staff have been embracing the change to remote work, social distancing on sites, and good hygiene.

Increased Financing and Investment

To mitigate the socio-economic impact of COVID- 19, the European Union initiated several interventions, including a €540 billion financial packages, "Recovery and Resilience Facility (the 'Facility')", to support businesses and workers in the EU.[19] There was € 808 million more than was pledged for sustainable recovery and resilience for utilities (which would include the water sector). The concept behind the injecting of financing is to help Member States address the economic and social challenges they are facing regarding social, employment, skills, education, research and innovation, health issues, and the business sector. It is seen that these investments will ensure a continued focus on the challenges and investment needs related to the green and digital transitions, ensuring a sustainable recovery.

Furthermore, a position paper from the Global Water Partnership (GWP) on a Green Recovery in Central and Eastern Europe from a Water Perspective reiterates the benefit of water sector investment: "Water Investments Boost Climate Resilience".

6. RECOMMENDATIONS

6.1 RECOMMENDATIONS FOR THE SADC WATER SECTOR

6.1.1 BUILD/STRENGTHEN THE RESEARCH AND TECHNICAL CAPACITY

SADC countries should leverage the services of the existing regional and international capacity development networks to build research and technical capacity within the institutions. Regional networks/programmes, including the Southern Africa Development Community (SADC) subsidiary for capacity building on integrated water resources management (WaterNet), Capacity Building Network for Integrated Water Resources Management (Cap-Net), Global Water Partnership-Southern Africa (GWP-SA) and the new SADC Groundwater Management Centre are available to conduct the required training. Participation by SADC member states is summarised in Table 6.

TABLE 6: PARTICIPATION IN SADC AND RELATED CAPACITY BUILDING INSTITUTIONS AND NETWORKS

Member state	SADC WaterNet	GWP-SA	AGW-Net	Cap-Net	SADC GMC	SADC GMI
Angola	x	x	x	x	x	x
Botswana	x	x	x	x	x	x
Comoros	x		x	x	x	x
Democratic Republic of Congo	x	x		x	x	x
Eswatini	x			x	x	x
Lesotho	x	x	x	x	x	x
Madagascar	x		x	x	x	x
Malawi	x	x	x	x	x	x
Mauritius	x		x	x	x	x
Mozambique	x	x	x	x	x	x
Namibia	x	x	x	x	x	x
Seychelles	x		x	x	x	x
South Africa	x	x	x	x	x	x
Tanzania	x		x	x	x	x
Zambia	x	x	x	x	x	x
Zimbabwe	x	x	x	x	x	x

Looking at Table 6, one may assume that SADC countries are all engaged in crucial regional water capacity institutions and networks. In reality, only a few countries go beyond the signing of a memorandum of agreement to the implementation, monitoring and reporting stages of the joint research and technological capacity initiatives linked to the institutions and networks listed in Table 6. The lack of participation may be linked to different priorities and the economic backgrounds of the countries. Thus, it is also important for SADC member states to use the networks to share best practices and improve their water research technological and management profiles.

6.1.2 IMPROVE/STRENGTHEN EXISTING COLLABORATIONS/PARTNERSHIPS

The findings related to settlements/communities, e.g. rural vs urban, the challenges at different management and government levels (e.g. local, district, provincial and countrywide), and the multi-disciplinary of the COVID-19 pandemic calls for a multi-stakeholder, multi-sectoral and multi-layered approach to building post-covid resilience of the water sector. A district-level layered approach to building resilience through multi-stakeholder partnerships developed by Suresh et al. (2018), shown in Figure 3, is recommended to form partnerships for planning, resource mobilisation and implementation (including procurement) of the infrastructure, research and technology development programmes.

[19] https://ec.europa.eu/info/sites/default/files/com 2020 408 en act part1 v9.pdf

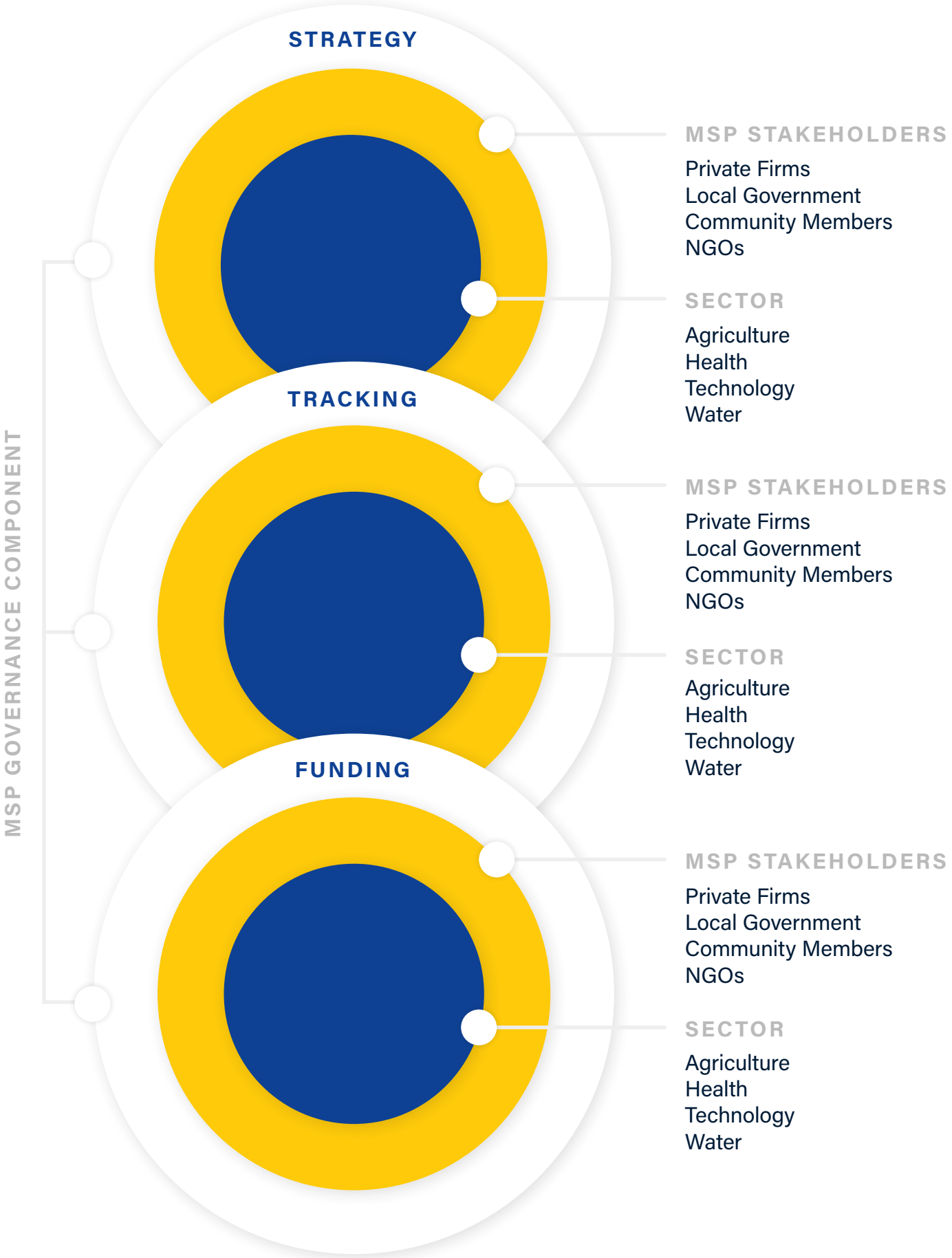


FIGURE 3: DISTRICT-LEVEL LAYERED APPROACH TO BUILDING RESILIENCE THROUGH MULTI-STAKEHOLDER PARTNERSHIPS (SURESH ET AL. 2018)

Multi-stakeholder: Establish partnerships/collaborations between government and non-governmental organisations/institutions for planning and implementation of resilient water systems. The transboundary nature of water supply and the impact of disasters, pandemics, etc., requires SADC countries to strengthen existing transboundary/ Cross border collaborations and programmes and focus on River Basin Commissions/organisations for planning and implementation of national water, sanitation and hygiene programmes.

Multi-sectoral: Cooperation between public and private sectors addressing the water, agriculture, health, technology and economy is crucial to building the resilience of water and related systems.

Multi-layered: It is crucial to apply the multi-sectoral and multi-stakeholder plans considering the layers, i.e. regional (SADC) level, country, province/district, city/town/village, to manage the monitoring, evaluation and improvement.

The multi-layered approach is crucial to effective management and good governance because regional challenges cannot be addressed at the national and/or provincial levels. For example, a major challenge in transboundary cooperation and joint monitoring is the harmonisation of systems, methods and data formats across aquifer boundaries" (Nijsten et al., 2018), while local challenges might be limited to finances and maintenance of water supply systems and/or wastewater treatment systems. The situation is further confounded by participation in RBOs outside the main development community. For example, because of the geographic location, Angola, Tanzania, and the Democratic Republic of Congo (DRC) also have a footprint in the RBOs whose administrations are largely outside the SADC. These include the Nile Basin Initiative (NBI) for Tanzania and the DRC; and the Commission Internationale du Bassin Congo-Oubangui-Sangha (CICOS) – Angola and the DRC.

6.1.3 MONITOR, EVALUATE AND IMPROVE THE WASH SECTOR

The following recommendations based on the United Nations (nd.) could help to strengthen and/ improve WASH programmes in SADC countries:

- Develop and utilize evidence to support programme adaptation and integration of climate change adaptation (CCA) and disaster risk reduction (DRR) elements into WASH programme design and implementation.
- Conduct inclusive and gender-sensitive risk assessments to strengthen WASH programme design and implementation and inform other sectoral programming and planning.
- Develop key advocacy messaging and communication, informed by evidence and risk assessment to support WASH sector investment and strategic action.
- Develop a comprehensive WASH resilience model, including developing tools and approaches for implementation, informed by experiences and consultations with the primary managers and users of WASH.
- Scale-up climate-resilient WASH services to urban and rural populations, including through the use of rapid response teams and using existing coordination mechanisms, and enhance community capacity, including supporting local health clubs and school health clubs.
- Support the use of renewable energy and innovative approaches such as solarized boreholes and water kiosks.

6.1.4 BUILD RESILIENCE CAPACITY FOR POST-COVID-19 WATER SECURITY

Building resilience (ability to avoid, cope with and recover from disruption) capacity has proven to assist countries' preparedness and responsiveness in withstanding crises (Hamouda, 2021). Therefore, planning at the regional and national levels should operationalise resilient policies amongst SADC countries under the framework of Agenda 2063 and Sustainable Development Goals (SDGs). This has been identified as a critical endeavour for the contextualisation and localisation of SDGs (Hamouda, 2021) and related regional plans.

Components of resilience capacity building for the SADC should take a systems approach to policy, sustainable water supply, funding support, and cross-border monitoring and evaluation (Table 6). This will require adherence to good governance practices for all stakeholders.

TABLE 6: GOOD GOVERNANCE & RESILIENCE CAPACITY FOR POST-COVID-19 WATER SECURITY

Principle	Policy System, Water Supply System
Transparency	Policy system: should allow transparency, openness, participation, and institutional systems.
Equality	The policy system: should consider economic diversity, decentralised decision making, and social safety nets.
Accountability	Policy system: Policy environment and processes, transparency and participation
Effectiveness & Efficiency	Policy system: Emphasise monitoring and evaluation Institutional system: early warning systems, data/information system Production system: Research and innovation, research-agriculture/ food-energy linkages, WASH programmes, Water supply infrastructure,
Strategic Vision	Policy system: Land and natural resource rights, institutional systems (e.g. transboundary water commissions), joint (transboundary) decision making
Responsiveness	Policy system: democracy, transparency and participation Production system: should focus on research linkages and capacity

The shift from planning to mitigate specific risks to managing cross-cutting resilience requires a more integrated approach to planning, strengthening networks of services and functions, and enabling effective monitoring of resilience across the board (Ofwat, nd.).

6.2 RECOMMENDATIONS FOR THE EU AND UK WATER SECTOR

The quick reaction and immediate research into the detection and fate of the virus from the European water sector were key to providing decision-makers with crucial information to make rapid assessments and implement virus-related protocols. The urgent and immediate response to the pandemic by the water sector should now be followed up by medium-term measures to increase water security as we look to overcome the current and future pandemics. It is vital that the water sector is recognized as an essential service that will help the sector respond, recover and rebuild post-COVID-19. Additionally, the technological advancement undertaken by the European water sector should not die with the virus. A new research path in proven digitalisation and a new efficient and flexible way of working has provided an opportunity for the water sector to change old, outdated working habits and policies and build a new path for a resilient future.

As an outcome of this research, the EU expert sees the need for an interlinked approach between all sectors that enhance the approaches and improves the engagement in the water sector discourse with specific relevance to water governance. This will allow for increased collaboration among stakeholders to provide improved risk management alternatives, water conservation and treatment measures and policy interventions that will be more transparent, thus facilitating the buy-in from society and industry to implement sustainable sector changes.

There is a need to develop citizens' water-related skills and knowledge, particularly for young professionals, precisely as there are fears that achieving the SDGs may fall behind due to the refocused pandemic attention and investment. Thus, there is a call for better use of the economic resources to tackle the related SDG issues, including mainstreaming environment and climate action into policies. It is essential to recognise that "we are in this together", and thus to build a water-smart society post-COVID-19 is not limited to Europe. As proposed by Water Europe, this objective must be extended to all European neighbours, including Africa, through strong collaboration to build a resilient water future together.

The specific recommendations are listed below:

6.2.1 DETECTION AND MONITORING

- To implement a standardised and harmonised method of sampling, storage, concentration, isolation, and detection of SARS-CoV-2.
- To further investigate the survival/infection of SARS-CoV-2 in the whole water cycle under different field conditions. Specific focus should be placed on rural areas.
- A standardised protocol should be implemented for water-based epidemiology (WBE) for tracking COVID-19 in water systems.

6.2.2 TECHNOLOGICAL

- Continue to support the digital revolution in the water sector to ensure future resilience.
- Strive to incorporate water-digital-human systems into platforms that enhance water management.
- Incorporate artificial intelligence (AI) technology to enhance planning and build resilience in the sector.

6.2.3 SOCIAL ASPECTS AND CAPACITY DEVELOPMENT

- Investigate across Europe how water utilities communicated water conservation and quality measures to consumers during the period of the COVID-19 pandemic. Build a database of lessons learnt.
- Continue to develop co-sectorial partnerships and collaborations (e.g. build long term collaborations between the water sector and the health, business and education sectors)
- Develop citizens' water-related skills and knowledge regarding all aspects related to transmission, particularly for young water professionals
- Create water-related communities (for instance: living labs, competency groups, water observatories etc.).
- With the advent of new technology and monitoring protocols, develop training campaigns for staff to use specialised equipment for SARS-CoV-2 detection.
- Investigate the change in water use habits instigated by the pandemic.

6.2.4 GOVERNANCE

- Create long-term working groups that have an increased involvement of all the water relevant stakeholders to improve the governance of the water systems, specifically in relation to the management of COVID-19.
- Implement joint programmes and results frameworks that enhance water governance.
- Enhance synergies between water-related investments, implementing cross-border projects
- Analyse how funding for COVI-19 was applied in the water sector with a specific focus on new policies that have emerged from this as a result.

7. POSITION PAPER ON "BUILDING CAPACITY FOR POST COVID-19 RESILIENCE OF THE SADC WATER SECTOR."

7.1 CONTEXT

One of the challenges Southern African countries face is the restricted access to water and the proper maintenance of good hygiene and sanitation. The lack of access to safe and clean water and sanitation facilities exposes inhabitants to the fatalities of COVID-19 if no action is taken to ensure improved Water, Sanitation and Hygiene (WASH) services.[20] Also, institutions play a critical role in strengthening the systems to monitor, operate and maintain WASH facilities through community participation and hygiene promotion. [3, 4]. Moreover, transboundary shared watercourses (mainly river basins) and watercourse commissions are at the core of water and wastewater management and service delivery in the SADC region. If managed properly, the river basins form a natural system that underpins the resilience of the water sector in the Region. In this case, the shared water sources are seen as a key enabler of post-pandemic long-term resilience.

On the strategic and governance level, the Southern African Development Community (SADC) has a suite of policy, planning and implementation tools, including the SADC Water Research Agenda and SADC Regional Strategic Action Plan on Integrated Water Resources Development and Management Phase. The strategic objective of the SADC Water Research Agenda is to promote the evidence-based implementation of SADC water programmes and projects through multi- and inter-disciplinary research and synthesis of existing and new information, which will lead to a realisation of SADC developmental goals. However, SADC countries have experienced positive and negative impacts of the COVID-19 pandemic on the planning and implementation of the SADC Water Research Agenda and WASH Research Development and Innovation (RDI) and the research, innovation and technological capacity of the Region.

A desktop study on the "Impact of COVID-19 on the EU and SADC Water Research Agendas and Capacity Building Activities - prospects for increased resilience and effective post-COVID-19 recovery" found the following regarding the SADC water sector: (1) low preparedness/response to the COVID-19 pandemic, (2) weak institutional architecture, (3) low water-COVID-19 research, innovation and technological capacity, (4) low water system governance, and the fact that (5) little has been done to investigate institutional, communal and societal responses to WASH facilities about COVID- 19.[21]

If not addressed, the impact of the COVID-19 pandemic will translate to delayed or non-achievement of sustainable development goal 6 (SDG6) – "Ensure availability and sustainable management of water and sanitation for all", particularly the two targets directly related to water and environmental management, i.e., 6.2 – "achieve access to adequate and equitable sanitation and hygiene for all, paying special attention to the needs of women and girls and those in vulnerable situations"; and 6.3 – "improve water quality by reducing pollution, eliminating dumping and minimising release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally".

Based on the findings, recommendations were derived for the SADC countries, focusing on research and technical capacity, collaborations/partnerships, monitoring and evaluation of the WASH sector, and building resilience capacity for post-COVID-19 water security.

[20] Howard et al., 2020
[21] Matai & Chirisa, 2020

7.2 BUILDING RESILIENCE CAPACITY FOR POST-COVID-19 WATER SECURITY

Building resilience (ability to avoid, cope with and recover from disruption) capacity has proven to assist countries' preparedness and responsiveness in withstanding crises. Therefore, planning at the regional and national level should operationalise resilient policies amongst SADC countries under the framework of Agenda 2063 and Sustainable Development Goals (SDGs) and the SADC Research Agenda.

The components of resilience capacity building for the SADC should take a systems approach to policy, sustainable water and WASH services, funding support, and cross-border monitoring and evaluation. This will require adherence to good governance practices for all stakeholders.
The shift from planning to mitigate specific risks to managing cross-cutting resilience requires a more integrated approach to planning, to strengthen networks of services and functions, and to enable effective monitoring of resilience across the board.

7.3 VISION

Building capacity for co-creation and uptake of research, knowledge generation, and technology and innovation solutions for post-COVID-19 resilience of the SADC water sector

7.4 IMPLEMENTATION APPROACH

The SADC water sector recognises its responsibility to contribute to the UN 2030 Sustainable Development Agenda and the Sustainable Development Goals (SDGs). Though focusing on SDG6 – Clean Water and Sanitation, the water sector acknowledges the direct and indirect linkages to SDG3 – Good health and wellbeing, SDG4 – Quality Education, SDG5 – Gender Equality, SDG7 – Affordable and Clean Energy, SDG12 – Responsible production and consumption, and, SDG13 – Climate Action. Moreover, the SADC recognises the multi-sectoral implications of the SDGs, hence the adoption and use of multi-stakeholder, multi-sectoral and multi-layered approach to form new (or improve/strengthen existing) partnerships and build capacity for planning, resource mobilisation and implementation (including procurement) of the water infrastructure, research, and technology development programmes.

Multi-stakeholder: Establish partnerships/collaborations between government and non-governmental organisations/institutions for planning and implementation of resilient systems.
Multi-sectoral: Cooperation between public and private sectors addressing the water and related aspects such as agriculture, energy, health, technology and economy is crucial to building the resilience of the water and related systems.
Multi-layered: It is crucial to apply the multi-sectoral and multi-stakeholder plans considering the layers, i.e., regional (SADC) level, country, province/district, city/town/village, to manage the monitoring, evaluation and improvement. Interventions will need to be delivered at the scale of administrative areas, with programmes covering entire districts, municipalities, cities and provinces.

7.5 CAPACITY INTERVENTIONS

7.5.1 RESEARCH AND TECHNICAL CAPACITY

While the SADC water research agenda acknowledges that many research efforts are undertaken in the region, a need has been identified at the SADC Water Division level to consolidate, streamline and institutionalise research to ensure that the research stays relevant to the needs of the region.[22] Therefore, the following interventions should help to develop the research and technical capacity of institutions in the Region:

- Leverage the services of the existing regional and international capacity development networks (e.g. WaterNet) to build research and technical capacity.
- Use the existing networks to share best practices and improve institutional water research and management profiles.

[22] Elema, 2019

- Incorporate/strengthen research and technical skills into the existing programmes, e.g. IWRM-related masters and doctoral programmes in selected universities.
- Incorporate training on artificial intelligence (AI) technology in water professional training programmes to enhance planning and build resilience capacity in the sector.
- Develop and implement "Train the Trainer" and mentorship programmes on water and sanitation research and innovation to improve the capacity of research institutions.
- Conduct training on remote data collection and monitoring techniques.
- Plan and implement professional training on research and innovation analysis and modelling methods.
- Fund and facilitate water and sanitation research internship programmes in collaboration with universities and research institutes.
- Promote and facilitate joint water and sanitation research with the academia, private sector, civil society organisations and international institutions.

7.5.2 CAPACITY FOR KNOWLEDGE CREATION

The current lack of research and innovation human capital and inadequate institutional infrastructures weaken the ability of most SADC countries to create knowledge on water security and resilient systems. With proper planning, the following interventions should help to improve knowledge creation in the region.

- Use existing expertise from local universities/institutions to package and disseminate the existing "unpublished" information, which is still relevant and may lead to solutions. Attach young/emerging researchers to "shadow" the experienced researchers to enable learning by doing.
- Use existing expertise from local universities/institutions to translate existing published findings (articles/conference proceedings/book chapters) into policy briefs, policymakers' booklets and planning manuals. Attach young/emerging researchers from the public and private water sector to "shadow" the experienced writers/researchers.
- Develop and implement training programmes on:
- Formulating and establishing policies, laws, systems, plans, and measures based on scientific knowledge and data;
- Establishing the organisational frameworks of governments and strengthening individual capacity to help developing countries implement policies, plans, and measures formulated and established based on scientific knowledge and data;
- Interpretation and communication of science to communities and decision-makers; and,
- Setting up and maintaining large databases and ensuring data integrity.
- Support the development of national innovation systems essential for linking various actors in public and private sectors together to enable sharing of knowledge and exchanging of ideas through joint projects involving R&D.
- Establish joint academy-industry water and sanitation Research/Professorial Chairs to stimulate and balance research, innovation and technology transfer in most SADC institutions of higher learning.
- Promote non-technical methods of communication that would help establish knowledge creation platforms that work even in a rural setting.

7.5.3 CO-CREATION AND UPTAKE OF WATER AND WASTE WATER TECHNOLOGY AND INNOVATION SOLUTIONS

The overall state of knowledge readiness remains inadequate to promote innovation and speed up the process of rapid transformation. The following interventions are put forward to promote co-creation and uptake of technology.

- Support the digital revolution in the water sector to ensure future resilience.
- Create awareness of the need for appropriate public participation and intervention in the co-creation and uptake of technology solutions.
- Define the roles of various stakeholders, including governments, businesses, and citizens, in facility planning, development, maintenance and management.
- Develop policies and guiding instruments to facilitate sharing/co-ownership of infrastructure/technology
- Establish technology user networks and platforms for sharing knowledge and best practices (including operation, maintenance, and management of facilities/technologies).
- Build capacity for the development of technical plans, including wastewater treatment plans.
- Strengthen policy-making functions through technical cooperation and other schemes.
- Develop government supervisory, regulatory, and supporting systems to keep performing necessary functions.
- Facilitate cooperation focused on infrastructure development according to country-specific economic development stages.
- Support basin-level collective action and innovations (including water efficiency technologies).
- Incorporate water-digital-human systems into platforms that enhance water management.
- Developing countries seek infrastructure development through Public-Private Partnerships (PPP), including Private Finance Initiatives (PFI), primarily to minimise public spending on infrastructure development. Therefore, assist developing countries in developing PPP infrastructure through various schemes, such as feasibility study assistance in preparatory surveys (for PPP infrastructure projects), private-sector investment finance, etc.

7.5.4 MONITOR, EVALUATE AND IMPROVE THE WASH SECTOR

WASH programmes need to include greater investment in the systems of governance for leadership, policy, planning, financing, market development, capacity development and monitoring for improvement at both national and local levels. Building capacity to implement the following interventions[23] could help to strengthen and/or improve WASH programmes in SADC countries.

- Revise and adapt WASH indicators to make provisions for pandemics.
- Conduct inclusive and gender-sensitive risk assessments to strengthen WASH programme design and implementation and inform other sectoral programming and planning.
- Develop key advocacy messaging and communication, informed by evidence and risk assessment to support WASH sector investment and strategic action.
- Develop a comprehensive WASH resilience model, including developing tools and approaches for implementation, informed by experiences and consultations with the primary managers and users of WASH.
- Create WASH online database and data gathering systems so that monitoring data is available near-real-time to aid in planning and reaction to future pandemics.
- Scale-up climate-resilient WASH services to urban and rural populations, including through the use of rapid response teams and using existing coordination mechanisms, and enhance community capacity, including supporting local water committees and health clubs.
- Support the use of renewable energy and innovative approaches such as solarised boreholes and water kiosks.
- Establish innovation hubs in the region for promoting water and sanitation technologies that can be implemented across the region. The hub would bring all players together to share knowledge and experiences and showcase solutions designed to solve specific problems

[23] Based on United Nations (nd.)

APPENDIX A

Project Title: "The impact of COVID-19 on the EU and SADC Water Research Agendas and Capacity Building Activities - prospects for increased resilience and effective post- COVID- 19 recovery."

Questionnaire for Stakeholders
The purpose of this questionnaire is to learn from the water sector (stakeholder) how the COVID-19 pandemic has affected households and the water sector in selected countries within the SADC and to ascertain whether the sector anticipates lasting challenges resulting from the pandemic.

1. DEMOGRAPHIC INFORMATION

Country: _____

Province/District: _____

City/Town/Village: _____

Organisation: _____

Gender: _____

Job Title: _____

Description of Organisation/Sector (e.g. Academic, Water Service operator, Water Regulator, Public authority, Civil society organization, etc.): _____

_____

Years of experience in the water sector: _____

2. WATER-RELATED SECTOR/ORGANISATIONS

2.1 Which of the following options best describe the role (and extent of contribution) of your organisation/department within the water sector?

(USE THE NUMBERS 1 TO 5 TO RANK THE ROLES FROM LOW TO HIGH PRIORITY, WHERE 1 = LOWEST, 2 = LOW, 3 = MEDIUM, 4 = HIGH, 5 = HIGHEST)

	1	2	3	4	5
Water supply					
Water and wastewater treatment					
Water research					
Water Regulator					
Capacity development					
Planning					
Governance					
Water quality					

2.2 Which of the following options best describe your organisation's relevance and capacity to contribute to the improvement of the water sector resilience?

(TICK ALL APPLICABLE TO YOUR ORGANISATION; AND USE THE NUMBERS 1 TO 5 TO RANK THE EXTENT/LEVEL OF RELEVANCE AND CAPACITY FROM LOW TO HIGH, WHERE 1 = LOWEST, 2 = LOW, 3 = MEDIUM, 4 = HIGH, 5 = HIGHEST)

	1	2	3	4	5
Relevance in the sector					
Potential capacity to act and deliver services during the COVID-19 pandemic					
Capacity to mobilise resources					
Capacity to plan and implement resilience programmes after the pandemic					
Potential to influence national and regional policy					

3. WATER SUPPLY SERVICES

3.1 Which of the following water supply systems and/or supplemental structures were added to the normal water sources to provide sufficient water to urban and rural areas during the COVID-19 pandemic?

(TICK ALL APPLICABLE SOURCES AND/OR GIVE DETAILS IF YOUR OPTION IS "OTHER")

	Rural Areas	Urban Ares
Water Tanks		
Tanker Trucks		
None		
Other (Specify)		

3.2 Was your normal water supply interrupted/reduced during the pandemic? (Tick one option)

	Rural Areas
Yes	
No	
Other (Explain)	

4. PAYMENT OF WATER BILLS

4.1 Were you provided with alternative options for payment of your water bills during the pandemic?

(IF YES, DESCRIBE THE OPTIONS; IF NO, GIVE REASON FOR YOUR ANSWER)

	Reason/ Explanation
Yes	
No	

4.2 Did you benefit from some form of water payment waiver/relief system during the pandemic?

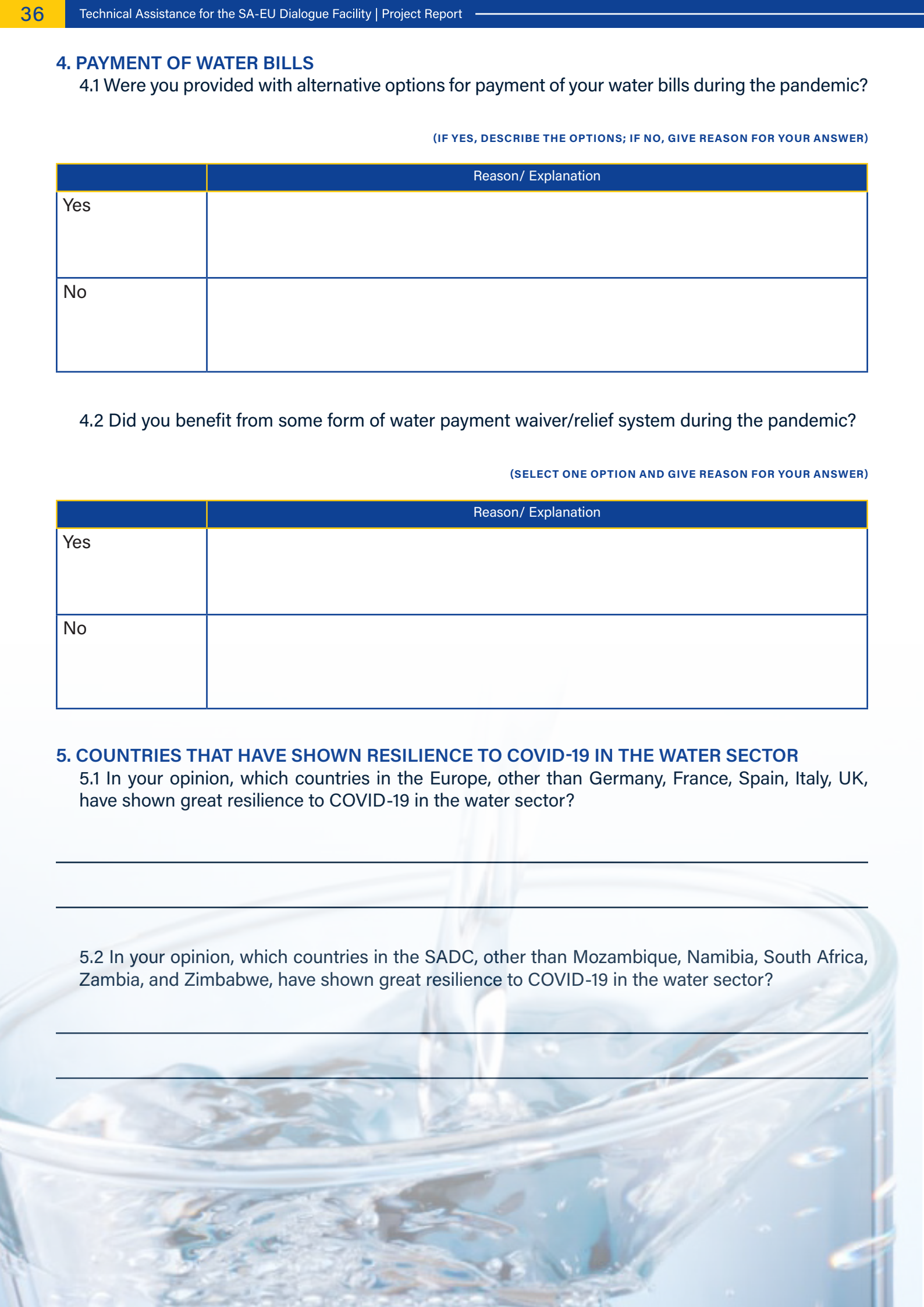
(SELECT ONE OPTION AND GIVE REASON FOR YOUR ANSWER)

	Reason/ Explanation
Yes	
No	

5. COUNTRIES THAT HAVE SHOWN RESILIENCE TO COVID-19 IN THE WATER SECTOR

5.1 In your opinion, which countries in the Europe, other than Germany, France, Spain, Italy, UK, have shown great resilience to COVID-19 in the water sector?

5.2 In your opinion, which countries in the SADC, other than Mozambique, Namibia, South Africa, Zambia, and Zimbabwe, have shown great resilience to COVID-19 in the water sector?



6. THE RESEARCH HAS SHOWN THAT THERE ARE CAPACITY DEFICIENCIES IN THE WATER SECTOR RELATED TO:

- Developing citizens' water-related skills and knowledge, particularly for young water professionals
- There is still a need for society to recognise that water is an essential service
- There is a greater need for the water sector to be transparent for society
- Technical capacity deficiency in trained staff and specialised equipment for SARS-CoV-2 detection.

What other capacity deficiencies have you identified during the pandemic?

7. THERE HAS BEEN SIGNIFICANT RESEARCH IN THE MONITORING AND DETECTION OF SARS-COV-2, DIGITALIZATION RESEARCH, AND PUBLIC POLICY IN THE EU AND THE UK. ARE YOU AWARE OF ANY OTHER COVID-19 RESEARCH TRENDS IN THE EU, UK OR SADC IN RELATION TO THE WATER SECTOR?

8. WHAT, IN YOUR OPINION, WOULD CONSTITUTE A RESILIENT WATER SECTOR WITH REGARD TO THE CURRENT PANDEMIC?

THANK YOU FOR RESPONDING TO THE QUESTIONS

SA-EU Strategic Partnership

South Africa has enjoyed a successful, productive and mutually beneficial relationship since the European Commission's Special Programme for Victims of Apartheid was created in 1985, and subsequently with the advent of the first democratically elected Government in 1994. South Africa and the EU signed a Trade, Development and Cooperation Agreement (TDCA) in 1999, which came into force in 2004 and was amended in 2009.

In 2007 SA and the EU established a Strategic Partnership (SP), and following the acceptance of a Joint Action Plan (JAP) in 2007, that facilitates co-operation between South Africa and the EU. South Africa has become one of the European Union's 10 Strategic Partners and the only one in Africa. The JAP promotes a programme of "dialogues" by means of which experience is shared in areas of common interest and strategies are developed to overcome shared challenges across a wide range of fields (social, economic, cultural, etc.).

The Dialogue Facility project is an instrument supporting the Strategic Partnership by giving it a human face through people-to-people dialogues and other related interventions, including communication, visibility and awareness-raising activities.

The Dialogue Facility (DF) has since 2011 to date, facilitated more than 80 dialogues in sectors such as: trade, economics, education, health, science and technology culture, etc.

The Dialogue Facility will provide support such as technical assistance, logistics (conferences, workshops, seminars, and events), support to study tours, research, mentoring, Twinning, etc.

The Dialogue Facility is strategically guided in a partnership between European Union and the government of South Africa. A Programme Management Unit deals with day-to-day administration.

For further information refer to www.dialoguefacility.org

water & sanitation
Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

WATER RESEARCH COMMISSION

WATERnet
Building Capacity for Water Resources Management in Southern Africa

The project is funded by the European Union and implemented by a consortium led by the Water Research Commission of South Africa and WaterNet.