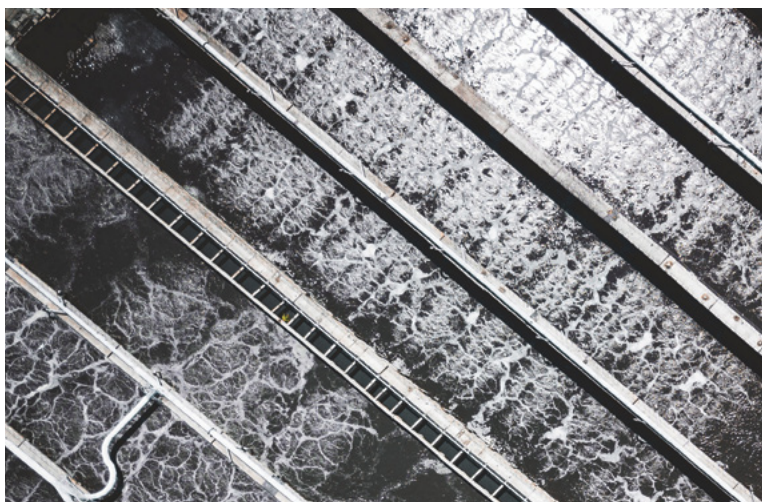




Youth Action for SDG 6

IWA & Grundfos
Fellowship Outcomes



GRUNDFOS 

IWA
the international
water association



Youth Action for SDG 6

IWA & Grundfos
Fellowship Outcomes

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List of Abbreviations

3I's – Innovation, Integration, and Implementation
CI – Conservation International
CLD – Causal Loop Diagrams
CRC – Convention on the Rights of the Child
CSR – Corporate Social Responsibility
DRR – Disaster Risk Reduction
EWS – Early Warning System
GIS – Geographic Information System
GWP – Global Water Partnership
HLPF – High-Level Political Forum
ICT – Information and Communication Technology
ICIWaRM – International Centre for Integrated Water Resources Management
IWA – International Water Association
IWRM – Integrated Water Resources Management
NWP – National Water Policy
NGO – Non-Governmental Organisation
SDG – Sustainable Development Goals
SDG 6 – Sustainable Development Goal 6 on water and sanitation
SWM – Solid Waste Management
UN – United Nations
UNICEF – United Nations Children's Fund
WASH – Water, Sanitation, and Hygiene
WFD – Water Framework Directive
WHO – World Health Organization
WRM – Water Resources Management
WUE – Water Use Efficiency
WWTP – Wastewater Treatment Plant
YWPs – Young Water Professionals

ACTION

NEW YORK
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MARCH
2023

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IWA foreword



In 2022, the International Water Association (IWA) and Grundfos forged a visionary partnership, giving birth to the Youth Action for SDG 6 Fellowship. This alliance bore testament to their shared commitment to nurturing and empowering the Young Water Professionals (YWPs) who serve as catalysts for change within the water sector. The Fellowship brought together 13 exceptional YWPs from diverse corners of the world, transcending geographical and cultural boundaries to create a transformative journey. Their voyage led them to the United Nations (UN) 2023 Water Conference in New York, where they engaged in a symphony of activities and discussions.

This Fellowship was not merely an initiative: it became a catalyst for progress, uniting ideals, empowering aspirations, and shaping a water sector characterised by dynamism, diversity, and transformative energy. The YWPs, selected to represent different regions and uphold gender parity, embodied the essence of this initiative.

Leading up to the UN 2023 Water Conference, the YWPs embarked on a journey of intellectual enrichment through meticulously curated online training sessions. These sessions delved into the complexities of the Sustainable Development Goals (SDGs), covering themes such as intergenerational dialogues, water cooperation, science communication, and climate change. At the Conference itself, the YWPs took centre stage, participating in panels, workshops, and roundtables, engaging with global leaders.

The momentum continued beyond New York, with the YWPs participating in online engagements designed by the IWA Secretariat. These platforms allowed them to disseminate their insights and spotlight pivotal decisions and commitments made during the UN 2023 Water Conference. The gathering in Denmark at Grundfos Headquarters in September 2023 was a highlight of the Fellowship. Here, the YWPs presented their projects and shared key takeaways from the Conference. It was a collaborative event that emphasised the pressing need for young professionals to shape the water sector's future.

The culmination of this journey is this publication, where the chosen YWPs share the results of their projects. These chapters resonate with the themes of the Conference, rooted in the SDG 6 Global Acceleration Framework's accelerators.

The IWA & Grundfos Youth Action for SDG 6 Fellowship was a unique odyssey where YWPs found themselves at the heart of sustainable development. Their contributions are woven into this publication, a testament to their commitment to crafting a future that thrives on diversity, equity, and inclusion. As these pages unfold, they call upon us to recognise the unbreakable link between youthful passion, unwavering determination, and the path to a more sustainable world. The journey continues, and the voices of these YWPs will echo in the waters of progress for years to come.

Kalanithy Vairavamoorthy

Executive Director of the International Water Association

Grundfos foreword



In the face of the unprecedented challenges posed by the climate crisis, the significance of sustainable water management, as outlined in the United Nations Sustainable Development Goal 6 (SDG 6), cannot be overstated - it is a goal that resonates deeply with Grundfos values. Access to clean water and sanitation is a basic human right, and it is the basis for people, communities, and ecosystems thrive.

One of the key solutions to help solve the world's water challenges is capacity building and partnerships across geographies and generations. The International Water Association and Grundfos's "Youth Action for SDG 6" Fellowship is about just that: a pioneering initiative that empowers Young Water Professionals (YWPs) from all around the globe.

The fellowship programme is not just a collaboration; it is a shared commitment to shaping a sustainable future and a testament to our collective determination. Through active participation in the UN 2023 Water Conference and IWA Water and Development Congress & Exhibition 2023, the YWPs have gained and shared valuable insights in the water sector. Their engagement transcends geographical boundaries, embodying the spirit of SDG6, and amplifies the shared responsibility we bear for the planet's future.

Grundfos's dedication to this cause goes beyond mere support. We see the YWPs not just as future leaders but as current change-makers. Their experiences serve as inspiration, and their new perspectives challenge the status quo, leading us toward more sustainable water management. In the face of the interconnected challenges posed by the climate crisis and water crisis, these 13 talented YWPs represent hope, resilience, and determination.

As we move forward, Grundfos is excited about the solutions these young minds will engineer, the policies they will influence, and the world they will shape. Grundfos stands firmly behind these champions of water, providing mentorship, resources, and belief in their ability to create ripples of change that will resonate far beyond the confines of this partnership.

Grundfos extends a heartfelt gratitude towards the YWPs, IWA, and everyone involved in this collaboration. Together, let us continue our journey toward a sustainable, water-wise world, where there is a possibility in every drop.

Poul Due Jensen

Group President and CEO of Grundfos Holdings A/S





Introduction –

The IWA and Grundfos Youth Action for SDG 6 Fellowship

In 2022, the International Water Association (IWA) and Grundfos joined forces in a partnership focused on Young Water Professionals (YWPs) which resulted in the Youth Action for SDG 6 Fellowship. This Fellowship recognised 13 high-flying YWPs who were selected to represent the Youth Action for SDG 6 Fellowship during the 2023 United Nations (UN) Water Conference, a historic congregation for the water sector that assembled in New York, USA, in March 2023. The YWPs were selected to represent different geographical standpoints, and came from Africa, Asia, Europe, Latin America and the Caribbean, North America, and Oceania.

Leading up to the monumental UN 2023 Water Conference, the YWPs underwent a series of meticulously curated online training sessions, hosted by the IWA Secretariat with the support of Grundfos. The training was scrupulously calibrated to focus on the current challenges of achieving Sustainable Development Goals (SDGs) while also addressing the Conference's key themes: intergenerational dialogues, water cooperation, science communication, water, sanitation, and hygiene (WASH), and climate change. During the Conference, the Youth Fellows appeared on the centre stage of panels, workshops, round tables, and the Interactive Dialogues. Their presence extended to the Global Youth Movement for Water daily meetings where young people gathered to brainstorm ideas and discuss the main processes happening during the day as well as to the events of the New York Water Week where they witnessed game-changing water actions and solutions from around the world.



Figure 1.1-1 – IWA & Grundfos Youth Fellows

Source – IWA's portfolio. From upper left to lower right: Chelsea Hayward (Australia), Pabel Cervantes (Mexico), Sudipti Arora (India), Jacob Amengor (Ghana), Krithika Iyer Shivakumar (India), Farokh Ishaq Kakar (Canada), Marina Batalini de Macedo (Brazil), Hadi Toure Guindo (Mali), Yang Villa (Philippines), Muhammad Anique Azam (Pakistan), Inês Breda (Denmark), Charles Shachinda (United Kingdom), and Krisztian Mark Balla (Denmark).



Figure 1.1-2 – Youth fellows during the UN 2023 Water Conference
Source – IWA's portfolio

Continuing the momentum from New York, the Youth Fellows also engaged in online engagements hosted by IWA and designed with a geographical focus:

- *YWP Get-Together | UN Water Conference: perspectives from Latin America & the Caribbean*
- *YWP Get-Together | Importância da atuação do jovem profissional no setor da água: perspectivas da Conferência da Água da ONU*
- *YWP Get-Together | African and European youth perspectives for a water-wise future*
- *YWP Get-Together | Perspectives from Asia-Pacific youth on the UN 2023 Water Conference*

These platforms allowed the Fellows to present the knowledge acquired during the UN 2023 Water Conference as well as their take-home messages from the event.

In September 2023, six months after the UN 2023 Water Conference, the YWPs met in Denmark, at the Grundfos Headquarters in Bjerringbro. The gathering was an illuminating and collaborative event for the Fellows who discussed the pressing need for young professionals to actively engage in shaping the future, underlining their significance as the next generation of water professionals. During the meeting, they presented the results of their projects, as well as the key outcomes and biggest surprises from the UN 2023 Water Conference.

The culmination of this exciting journey is via this publication which aims to highlight the important role young people play in the UN 2030 SDG Agenda, focusing on how the water sector can be transformed by their energy and brilliance. Each chapter of this anthology is a mosaic of the Youth Fellows' projects, carefully chosen to reflect their unique contributions toward achieving the SDGs, with a focus on SDG 6:

- **Empowering Young Water Professionals: Innovations and Insights for SDG 6 and WASH Sustainability**

This chapter highlights the critical role of YWPs in advancing SDG 6 and WASH sustainability amidst global challenges and the need for a skilled and competent workforce.

- **Enhancing funding, engagement, and innovative practices to explore sustainable water solutions via YWPs contributions**

This chapter explores ways to enhance funding, engagement, and innovation support for YWPs, focusing on addressing challenges faced by WASH entrepreneurs, showcasing practical technological solutions, and examining YWPs' perspectives on water resource reusability.

- **Empowering Sustainable Progress: Water Skills Development and Citizen Science for Climate Adaptation**

This chapter explores the synergy between water skills development and citizen science, highlighting their significance in addressing climate adaptation and sustainable progress.

- **Water Collaboration Across Boundaries: Navigating Transboundary Cooperation, Cross-Sectoral Engagement, and Scientific Partnerships within the 2030 Agenda**

This chapter underscores the critical importance of cooperation and collaboration among diverse stakeholders and sectors to accelerate progress toward achieving SDG 6.



Figure 1.1-3 – IWA & Grundfos Youth Fellows during the gathering in Denmark Source – IWA’s portfolio

- Fostering youth empowerment to leverage the Water Action Decade

This chapter explores the transformative role of youth engagement in advancing water security and sustainability, emphasising their significance in accelerating progress toward water-related SDGs by comprising two diverse, yet complementary narratives.

The publication will be presented at the upcoming IWA World Development Congress & Exhibition in Kigali, Rwanda (10-14 December 2023).

The IWA & Grundfos Youth Action for SDG 6 Fellowship positioned the YWPs at the centre of the discussion about sustainable development: this publication reflects their commitment to crafting a future that thrives on diversity, equity, and inclusion. As such, these pages invite us to see the strong link between youthful passion, resolute determination, and the path to a more sustainable world.



¹ The Global Youth Movement for Water (GYMW) was launched during the 9th World Water Forum, bringing together youth-led organisations and allies to influence decision-makers, increase our youth’s negotiating power and encourage action around the globe. More information can be found here: <https://filluptheglass.org/>.

² For a deeper exploration of the New York Water Week, its significance, and the profound connections it forged, delve further at <https://nywaterweek.com/>.

YBFOSS



Chapter 1 –

Empowering Young Water Professionals: innovations and insights for SDG 6 and WASH sustainability

There are many challenges and opportunities related to achieving Sustainable Development. Water, Sanitation & Hygiene (WASH) stands as the backbone of human health and environmental sustainability, representing interconnected pillars crucial for the world's well-being. Amidst global challenges like population growth, climate change, and urbanisation, the WASH sector plays a pivotal role in fostering sustainable development. Since the recognition of water and sanitation as a fundamental human right by the United Nations in 2010 (UN, 2010) and its incorporation in the Agenda 2030 for Sustainable Development, under SDG 6, actions have been put in place to achieve them. Yet, problems of access to safe drinking water and sanitation remains a critical concern, exacerbated by the COVID-19 pandemic. The lack of access to this basic human right is directly related to aspects of the well-being and public health of the population, as well as environmental problems of contamination of water resources and social problems of conflicts over water and inequalities (WHO, 2014).

Universal access to water and sanitation has great cross-connections with other themes included in the SDGs so that the public policies adopted to achieve its different goals and targets can generate synergies or trade-offs (Parikh et al., 2021). Meeting SDG 6 targets necessitates a six-fold acceleration of efforts at various intervention levels, including governance and community engagement, with an emphasis on involving young professionals. The importance of addressing water-related issues as cross-sectoral and interconnected has already been incorporated and highlighted in different approaches, such as the water-energy-food nexus and the extreme events-sanitation-public health nexus (Macedo et al., 2022). However, there is an open field when it comes to its intergenerational aspects and the role that young people can play in achieving SDG 6 and the wider Agenda 2030.

This chapter focuses on the role played by Young Water Professionals (YWPs) when it comes to SDG 6 and WASH Sustainability, underscoring the importance of young professionals in advancing the water sector. The first sub-chapter discusses how YWPs can assist in an evidence-based and risk-oriented decision-making process. Discussion groups were conducted with YWPs from different contexts (undergraduate students, professional master students, and women professionals). Different perspectives were brought to the table from the different groups regarding the main synergies and trade-offs between the universalisation of water supply and sanitation with the other SDG 6 targets. From this, it was possible to construct a Causal Loop Diagram to help model the impact of different public policies on the sector.

The second sub-chapter explains how the indicators for the main targets of WASH: 6.1 water access and 6.2. sanitation work. Both targets include a series of indicators that have tracked the progress of population in gaining access to water and sanitation services over time. These indicators have changed over time and although more details have been added, e.g., amount of water, quality, disaggregation of several factors is still needed.

The final sub-chapter discusses how the development of a skilled and competent workforce is essential for addressing present and future water sector needs. To this end, the integration of innovation, implementation, and integration (3 I's) is considered crucial for building resilience. The text outlines a comprehensive approach, culminating in a national conference that aimed to raise awareness and mobilise youth action for SDG 6, and serving as a significant step toward implementation.

1.1. YWPs assisting an evidence-based and risk-oriented decision-making process to universalise basic sanitation in Global South Countries

Marina Batalini de Macedo

The paradigm of addressing water-related challenges from a cross-sectoral perspective, exemplified by approaches like the water-energy-food-environment nexus, has gained recognition in recent years. Innovative frameworks, such as the extreme events-sanitation-public health nexus, are emerging to incorporate dimensions of climate change and public health into water management (Macedo et al., 2022). These approaches aim to holistically assess the impacts of decisions made in isolated sectors, enabling the identification of synergistic actions that enhance positive outcomes while mitigating trade-offs (Kurian et al., 2016). They highlight that a paradigm shift in the decision-making process is imperative. By adopting these new methods, an evidence-based and risk-oriented decision-making process can be strengthened.

Despite the availability of scientific insights regarding these novel frameworks, their application in decision-making, particularly in Global South countries, remains limited. Consequently, a critical mandate for YWPs in the upcoming decade is to promote evidence-based and cross-sectoral decision-making. Besides their key role in addressing current water challenges, YWPs have a unique opportunity to harness emerging technologies that enhance analytical capabilities and decision-making processes. Innovative tools like digital multicriteria and systems analysis can provide invaluable insights for informed policy formulation and implementation.

Additionally, actions necessary for the universalisation of water supply and sanitation systems may have connections with other sectoral policies, therefore it is increasingly necessary to recognise intersectoral collaborations to tackle persistent siloes in local government that hinder collective efforts to meet the SDGs (Fox and Macleod, 2021; Kurian et al., 2019). While synergies refer to two-way positive connections with SDG 6 for each other SDG target, trade-offs refer to two-way negative connections with water supply and sanitation for each target (Carbonell et al., 2023). Examples of synergies and trade-offs between actions for the provision of water supply and sanitation obtained by the literature review are synthetised in Figure 1.1-1. However, synergies

and trade-offs have been identified only for direct impacts, with no information gained about the weight of the impact or connection, nor about the processes involved.

The merger of these synergies and trade-offs can be incorporated into evidence-based decision support tools for the implementation of cross-sectoral public policies related to the universalisation of sanitation (SDG 6) and the other SDGs. Options include from Causal Loop Diagrams and Fuzzy Cognitive Mapping, among others, for creation of a conceptual model for cross-sectoral analysis between SDG 6 and other priority SDGs. To verify the applicability of this conceptual model, three discussion groups were held with YWPs in Brazil. The discussion groups took place in June and August 2023. In total, 25 YWPs participated in these activities, ranging from the ages of 25 to 35 years old and with gender equality (12 women and 13 men).

Aimed at bringing different perspectives to the process, the three discussion groups were held in different contexts. The first group took place face-to-face, with fourth year Water Engineering students at the Federal University of Itajubá, who are already doing internships in the water sector (Figure 1.1-2). The second was held online, with a focus on female professionals working in the water resources regulation sector (such as the National Agency on Water and Basic Sanitation) and in research and education. The third was also online, with students from the professional master's degree in Water Engineering at the Federal University of Itajubá, which includes young professionals working in different sectors of water resources, such as sanitation companies in Minas Gerais and Maranhão, consultancy for sanitation companies in the southeast, mining companies in Minas Gerais, municipalities' environmental secretariat, and consultancy for the preparation of planning instruments (municipal master plans, macro drainage plans and sanitation plan).

These activities aimed to create a conceptual model (Causal Loop Diagram – CLD) to support the decision-making process, focusing on evaluating cross-sectoral policy impacts, between SDG 6 and the other SDGs, in both directions. The participants were first instructed to study the political, social, and economic challenges in achieving universalisation of water supply and sanitation in the Global South. They used this content as a basis for the initial discussion within the groups, with the most relevant synergies and trade-offs being listed (to reduce the analysis variables). Moreover, other links of synergies and trade-offs not listed by their initial review but identified as relevant by the group were incorporated. The final CLD obtained from a compilation of information from all the groups is presented in Figure 1.1-3 and the main connections are discussed here. Using the CLD, it was possible for the YWPs to create equations that

		SDG 1	SDG 2	SDG 3	SDG 4	SDG 5	SDG 7	SDG 8	SDG 9	SDG 10	SDG 11	SDG 12	SDG 13	SDG 14	SDG 15	SDG 16	SDG 17
6 CLEAN WATER AND SANITATION	Synergies	100%	50%	69%	90%	89%	100%	83%	100%	60%	100%	64%	120%	60%	67%	50%	79%
	Trade-offs	57%	13%	8%	10%	33%	0%	17%	25%	40%	10%	9%	20%	0%	0%	0%	11%

Figure 1.1-1 – Synthesis of main synergies and trade-offs found between the different goals of SDG 6 and the other SDGs found in literature review
Source – The author

quantify the impacts of the synergies and trade-offs, for each causal relationship identified, enabling further numerical quantification of the synergies and trade-offs on the chain of impacts.

During the discussion groups, it was observed that SDG 6 has direct impacts on the other SDGs (either as synergy or trade-offs), as well as chains of actions that cause indirect impacts, often disregarded or underestimated during the decision-making process, with unforeseen consequences. Thus, the groups opted to assess the entire chain of impacts, including the indirect. It was even observed that within the chain, it

is possible to have a closed loop, generating consequences back to SDG 6 itself. The main points discussed in the groups are presented in the figure 1.1-3.

SDG 6 can bring indirect synergies to SDG 1 (no poverty), since with the improvement in public health, individuals may have more access to work and, consequently, increase in income. In addition, SDG 6 also provides greater access to uncontaminated food (both by irrigation with safe water and access to food hygiene), improving their work capacity and increasing income, leading to economic growth (SDG 8). To close the loop, from the point of view of synergies, the

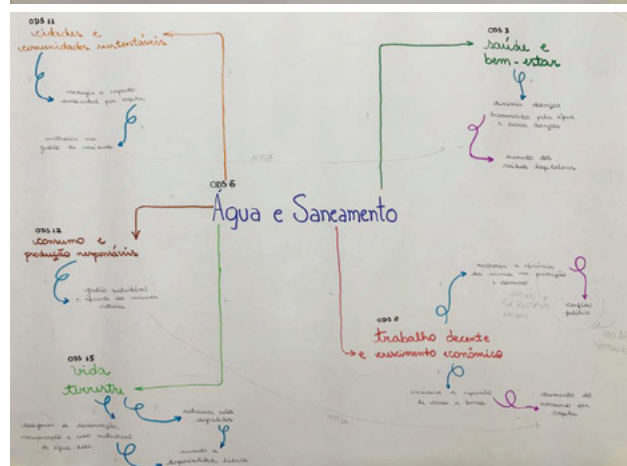
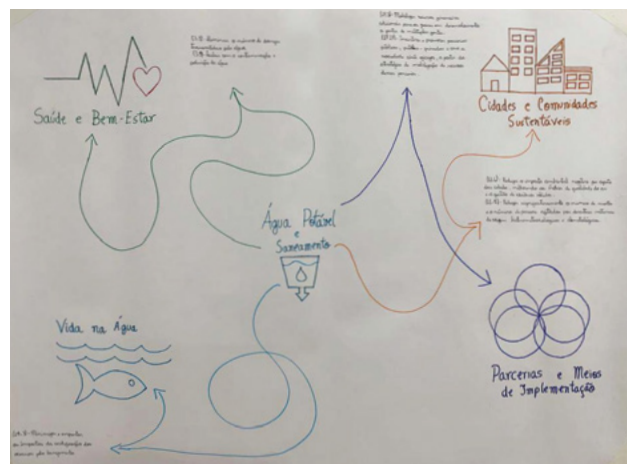


Figure 1.1-2 – Discussion group with students in the fourth year of Water Engineering at the Federal University of Itajubá
Source – The author

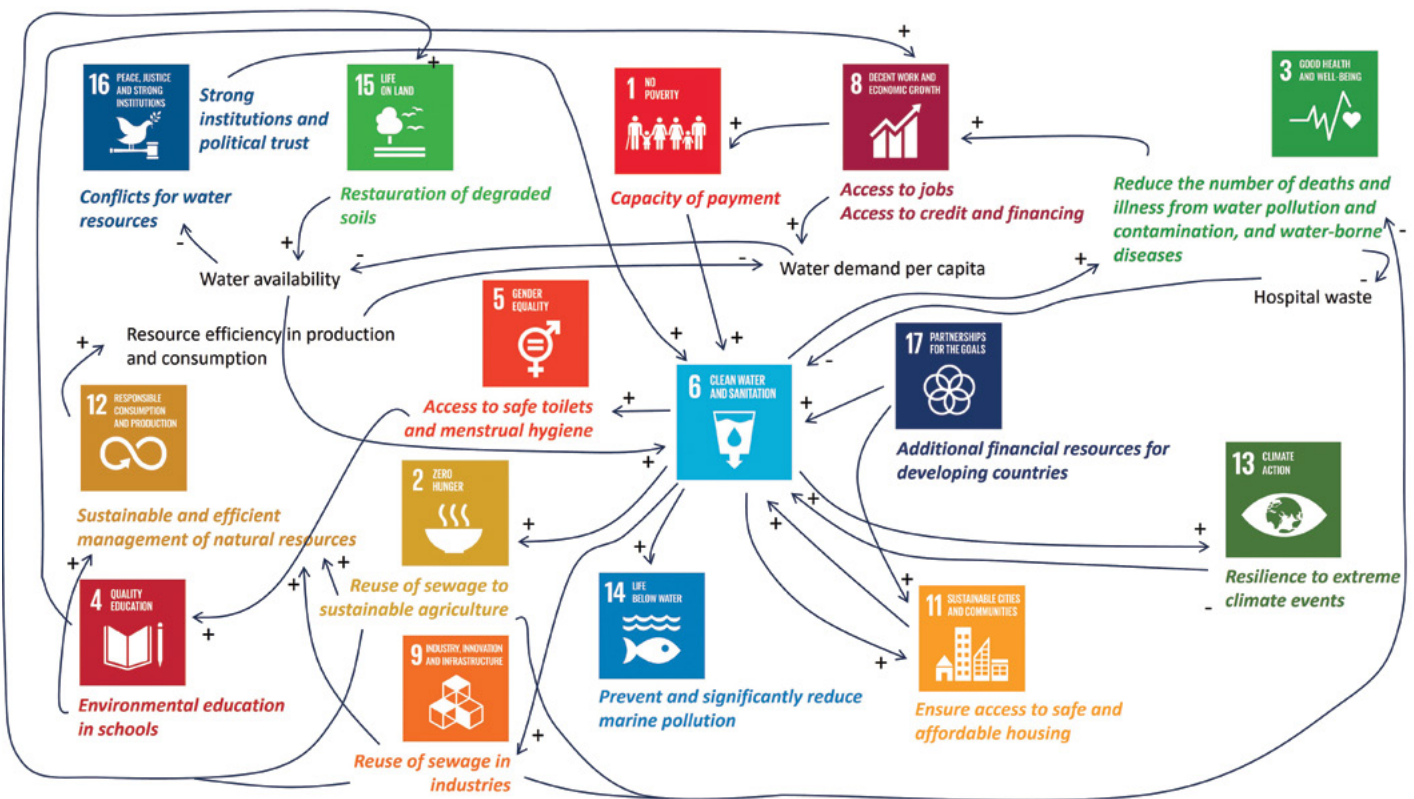


Figure 1.1-3 – CLD for linkages between SDG 6 and other SDG for a Brazilian case study. Positive sign indicates reinforcement paths and negative signs represent inhibition paths

Source – The author.

increase in income can also bring synergy with SDG 6 itself, so that it increases the payment capacity and, consequently, the ability to adhere to the system and finance new water and sanitation infrastructure.

However, improving economic conditions also close the loop with SDG 6 through a path of trade-offs, since the increase in economic productivity can lead to an increase in the consumption by the population (in terms of daily water consumption per capita and general consumption of products). The increase in consumption can lead to trade-offs with water resources management, at watershed scales since it can decrease water availability and increase water conflicts.

Direct synergy was also observed between SDG 6 and SDG 5 (gender equality), mainly related to increased menstrual hygiene in collective spaces, including schools. Thus, indirectly there is also synergy with quality education. There is also a connection to quality education (SDG 4), as including environmental education in school curricula contributes to inducing rational consumption, reducing waste, wastewater and reducing total tap water demand, therefore showing synergy with SDG 6.

Additionally, in the Brazilian context, it is an extremely important collaboration in terms of housing policies and universalisation of sanitation, since around 8% of Brazilians live in favelas (slums) (Instituto Locomotiva, 2021). Thus, improvement in SDG 11 is an a priori necessity in relation to the universalisation of sanitation. The lack of adequate and regularised housing is still part of the main sanitation gap in favelas as well as rural communities. However, trade-offs were also identified. The increase in urbanisation leads to an increase in surface runoff, with a consequent increase in flood events, which can damage sanitation infrastructure as well as cause overflow of the systems, exposing the population to contaminated water. Therefore, city planning policies should encourage the use of flood mitigation structures, such as sustainable urban drainage systems and stormwater harvesting.

Synergies between SDG 6, SDG 2 (zero hunger), and SDG 9 (industry, innovation and infrastructure) were also pointed out, regarding the reuse of sewage sludge for sustainable agriculture (actions that are already practiced in Brazilian companies such as SANEAGO, SANEPAR, CAGECE, and regulated by CONAMA 498/2020) and the reuse of sludges in industries, such as incorporation into concrete (still in the experimental and research phase). Despite the interesting

perspective of synergy, if there is no strict regulation, it is possible to have trade-offs with SDG 3 (good health and well-being), due to the risk of exposure to contaminants.

Another important synergy observed in the discussion groups for the Global South countries was between SDG 6 and SDG 16 (peace, justice, and strong institutions). The lack of trust in institutions often leads to resistance from the population to acceptance of the expansion of water supply and sanitation systems, since this expansion entails new tariffs. Due to the generalised feeling of corruption, new tariffs are always usually associated with embezzling money and enriching the political class. Examples like this were presented to several municipalities in Brazil during the discussions. Another point of discussion brought up in the groups was the need for regulatory agencies to guarantee equity in access to water for low-income and socially fragile populations, such as differentiated tariffs that do not threaten their human right to water.

Still, regarding the synergies between SDG 6 and SDG 16, it was suggested that reducing bureaucracy in water grants may increase access to water for small population centres, mainly small rural communities, which still represent a major gap of universalisation in water supply and sanitation in Brazil. However, a possible trade-off between reducing bureaucracy and greater indiscriminate water consumption was also raised, which could lead to conflicts and contamination of water resources.

The discussion groups brought different perspectives not previously presented in the literature review, allowing the elaboration of a more complete and more fine-tuned CLD for the countries of the Global South. From the CLD, it was possible to identify points of attention for the organisation and elaboration of public policies, to avoid unwanted effects with the universalisation of sanitation for the integrated management of water resources and for other sectors. Its instrumentation allows quantification of the impacts of policies projected in the water sector on to other sectors. However, there are still challenges to incorporating CLD in the decision-making process, mainly related to technical barriers (little knowledge is available about the method) and increased digitalisation, since modelling needs digital tools for its operation. These challenges can be addressed through greater YWP participation in decision-making, as new undergraduate and training courses in water resources increasingly incorporate new methodological approaches, based on conceptual models (such as the CLD). Also, the use of digital tools, including programming and the use of artificial intelligence, is encouraged in YWP training, which can help operationalise conceptual models for evidence-based decision-making.

Participants reported positive learning gains from focus groups due to three main points. The first was due to greater contact with the SDGs and their targets and indicators since had to read and carry out an initial study as a basis for discussions. The second was due to thinking about the chain of impacts as a whole, expanding the assessment to other sectors, making it even possible to close the loop back to sanitation itself. The participants reported that it was interesting to observe that actions to universalise sanitation can bring negative effects to the sanitation sector itself, and actions to mitigate and prevent such impacts should be considered in advance.

Third, the diversity of professional backgrounds, genders, and ages allowed thinking in a more integrated and intersectoral way. Different professional examples were addressed during the discussion, enriching the perspectives. Finally, during the discussions, participants were also able to identify the main challenges to universalise the water supply and sanitation in Brazil, from their experience:

- There is a need for more investment in the sector (the cities with better infrastructure coverage invest about fivefold more than the others). Many water companies in Brazil do not have financial sustainability, due to low tariffs and low efficiency.
- Tariffs need to be increased, however, many populations that still do not have access to water and sanitation infrastructure do not have payment capacity. Therefore, there is a need for tariffs proportional to consumption and social tariffs to be regulated.
- Technological innovation is necessary, to decrease costs and increase efficiency (e.g., reduce water losses, reduce energy demands).
- There is a need for well defined regulatory framework. The regulatory framework should define a basis for efficiency, coverage, and social tariffs, among others.
- The political barrier still plays an important role, due to the lack of trust in the political institutions, divergent interests between the politicians, and the lack of continuity between different governments.

1.2. Co-creation of next generation of indicators for an inclusive evaluation of WASH in the scope of SDG 6

Pabel Cervantes-Avilés

The United Nations had established a set of eleven specific indicators to track and evaluate progress towards SDG 6. These indicators are aligned with the SDG 6 targets and cover various aspects of water and sanitation access, water quality, water use efficiency, and integrated water resources management (Table 1.1). The indicators are used to monitor progress at the global, regional, and national levels and to identify areas that require further attention and intervention to achieve SDG 6 targets. Among all targets, drinking water (6.1) and sanitation and hygiene access (6.2) form the main axis of SDG 6, and actions involved in these targets have direct implications over the other targets, making this highly important for WASH. Therefore, the highly detailed analysis of their indicators can result in more suitable actions from different parties.

According to the resolution of the General Assembly 68/261, SDG's indicators should be disaggregated, where relevant, by income, sex, age, race, ethnicity, migratory status, geographic location, and other non-inclusive characteristics (UN, 2014). In 2016, some indicators of the SDG 6 were amended to enhance and promote more relevant actions. For example, 6.1.1. the indicator was "By 2030, achieve universal and equitable access to safe and affordable drinking water for all", and it has now changed to "Proportion of population using safely managed drinking water services". Although this new indicator has a quantitative output, its scope could be inclusive by disaggregating relevant characteristics such as geographical location, income, access to education, and race, among others.

Hence, it is important to know the perspectives and efforts made globally: and the UN Water could be a suitable forum to compile and study the perspectives of a new generation of indicators. This will make a synergy to determine the main characteristics and influencing factors that the new generation of indicators can include on a global basis to evaluate WASH inclusively in the SDG 6 context.

Methodology

Characteristics and influencing factors of the new generation of indicators were determined by crisscrossing the features of the key elements for inclusion by UNESCO, and the current indicators 6.1.1. and 6.2.1. of SDG 6. Current data about the progress of the indicators were retrieved from the Joint Monitoring Programme for Water Supply and Sanitation

(JMP) (WHO/UNICEF, 2023). Four interviews were conducted with key global actors to know learn about their experiences, current initiatives, and future challenges in WASH indicators: the interviewees were representatives of academia, regional banks, NGOs, and the national government. Since the UN Water Conference brings together whole actors, it was a suitable scenario to develop efforts facing the need to update and co-create more inclusive indicators.

Current indicators: description and progress

SDG 6 target 6.1 sets forth a compelling vision: by 2030, we strive to achieve universal and equitable access to safe and affordable drinking water for all. At the heart of tracking progress towards this ambitious target lies Indicator 6.1.1, a critical tool that monitors the proportion of the population utilising safely managed drinking water services.

"Safely managed" drinking water services encompass a spectrum of essential criteria. The water source itself must be classified as "improved", which includes reliable options such as piped water, boreholes or tubewells, protected dug wells, protected springs, rainwater, water kiosks, and packaged or delivered water. In addition, access to this improved water source is a key consideration; it must be located on the premises of the users, ensuring convenience and ease of use. Equally vital is the service's availability, a measure that encompasses a minimum threshold of 12 hours per day or 4 days per week, ensuring a continuous and reliable water supply. Such dependability bolsters communities' resilience and facilitates economic and social activities, underlining the importance of secure water access.

Yet, the core essence of safely managed drinking water extends even further. It hinges on adherence to international standards for microbiological and chemical water quality, as specified in the WHO Guidelines for Drinking Water Quality (WHO, 2017). Meeting these stringent standards guarantees that the water is not only accessible but also free from contaminants, thus safeguarding public health and well-being.

As we chart our course toward universal access to safe and affordable drinking water, Indicator 6.1.1 serves as a beacon, guiding our collective efforts and inspiring transformative action. By monitoring and understanding the proportion of the population benefiting from these comprehensive drinking water services (Figure 1.2-1), we can observe that our progress is regionalised. Regions of the globe economically underdeveloped are called to urgent action to increase the proportion of the population using safely managed drinking water. Importantly, two out of five regions of the globe are below the world mean value, making Sub-Saharan Africa and Central and Southern Asia the core of several actions to be implemented (Dang et al., 2023).

Table 1.1 – Subdivision of SDG 6 targets and their current indicators

SDG TARGET IN SHORT	INDICATOR	DESCRIPTION
6.1. Drinking water	6.1.1. Proportion of the population using safely managed drinking water services.	This indicator assesses the percentage of the population with access to drinking water that is safely managed, which means it is available on premises, accessible when needed, and free from contamination.
6.2. Sanitation and hygiene	6.2.1. Proportion of the population using safely managed sanitation services, including a handwashing facility with soap and water.	Evaluation of the percentage of the population with access to sanitation facilities that are safely managed and include a handwashing facility with soap and water.
6.3. Wastewater treatment and safe reuse	6.3.1. Proportion of wastewater safely treated.	Measurement of the percentage of generated wastewater that undergoes proper treatment to reduce pollution and protect the environment.
	6.3.2. Proportion of bodies of water with good ambient water quality.	This indicator assesses the quality of water in various bodies of water, such as rivers, lakes, and coastal areas, by evaluating factors like chemical and biological pollution.
6.4. Efficient water use	6.4.1. Change in water use efficiency over time.	Determination of changes in water use efficiency in different sectors, including agriculture, industry, and domestic use, to promote sustainable water consumption practices.
	6.4.2. Level of water stress	Measurements on the ratio of total freshwater withdrawals to total renewable freshwater resources in a given region, indicate the level of water stress and potential water scarcity.
6.5. Integrated water management	6.5.1. Degree of integrated water resources management implementation	Evaluation of the extent to which countries implement integrated water resources management practices to ensure the sustainable and equitable use of water resources.
	6.5.2. Proportion of transboundary basin area with an operational arrangement for water cooperation.	Assessment of the extent of operational arrangements and agreements between countries sharing transboundary water resources, promoting cooperative management.
6.6. Healthier ecosystems	6.6.1. Change in the extent of water-related ecosystems over time.	Monitoring the changes in the extent and condition of water-related ecosystems, such as wetlands and lakes, to ensure their protection and restoration.
6.a. International cooperation	6.a.1. Amount of water- and sanitation-related official development assistance (ODA) that is part of a government-coordinated spending plan.	Measurements of the amount of financial assistance provided by developed countries to support water and sanitation projects in developing countries.
6.b. Local participation	6.b.1. Proportion of local governments that adopt and implement local disaster risk reduction strategies in line with national disaster risk reduction strategies.	This indicator assesses the adoption and implementation of disaster risk reduction strategies at the local government level to address water-related risks and vulnerabilities.

In the same way, Indicator 6.2.1 stands as a pivotal measure, diligently tracking progress towards the target of providing universal access to safely managed sanitation services, complemented by handwashing facilities equipped with soap and water. Safely managed sanitation services, a key facet of this indicator, encapsulate a comprehensive approach. It involves access to improved sanitation facilities, which encompass a range of improved options such as flush or pour-flush toilets, ventilated improved pit latrines, composting toilets, and various other advanced systems. The emphasis on improved facilities ensures the dignity and well-being of individuals, promoting better health outcomes and an enhanced quality of life.

Beyond the availability of improved sanitation, safely managed services extend to equity and accessibility. It prioritises the need for adequate and equitable sanitation access for every individual, including those in vulnerable and marginalised communities. Leaving no one behind is not merely an aspiration but a core principle of this endeavour. Moreover, an essential dimension of Indicator 6.2.1 revolves around promoting proper hygiene practices. To this end, it advocates for the incorporation of handwashing facilities equipped with soap and water. This simple yet powerful addition fosters good hygiene behaviours, which are instrumental in preventing the spread of diseases and safeguarding public health.

Progress of this indicator shows that more regions of the globe (four out of seven) are below the mean globe value (UN Water, 2023), making sanitation and hygiene access issues more accurate in the globe (Figure 1.2-2). The regions of the globe with more advancements are Australia and New Zealand, Europe, and Northern America, and Eastern -South Eastern Asia, although their progress ranges between 64 and 95% of coverage, which is still perfectible. By weaving together, the elements of improved sanitation access, equity, and handwashing facilities, we lay the foundation for a future that champions dignity, health, and inclusivity. The vision of Indicator 6.2.1 resonates profoundly, as it underscores the importance of recognising sanitation as an essential human right.

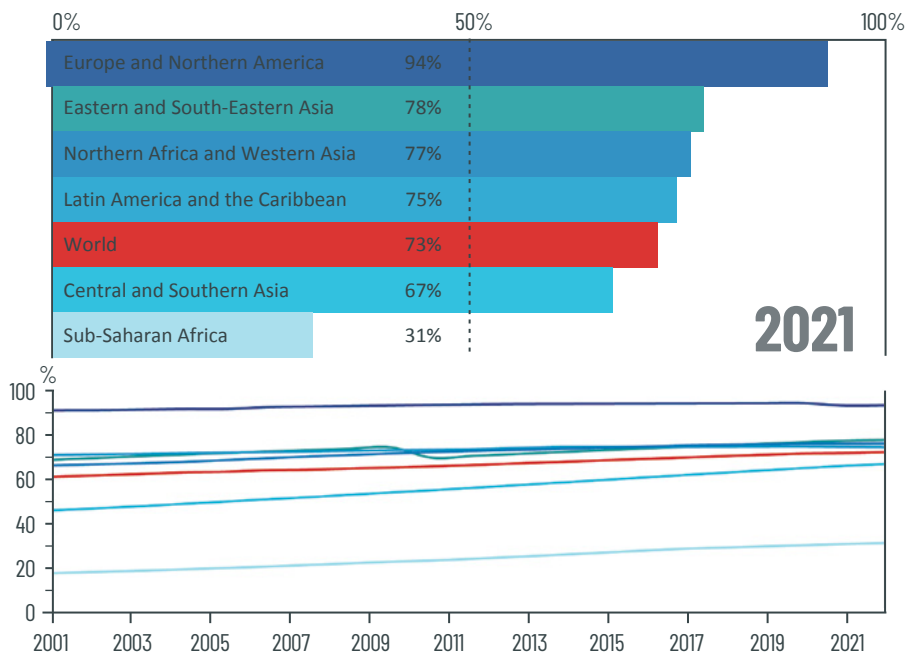


Figure 1.2-1 – Advancements of target 6.1. by 2022 under the tracking with the indicator 6.1.1 about the population using safely managed drinking water
Data retrieved from UN Water (UN Water, 2023)

Behind the indicators 6.1.1 and 6.2.1: disaggregated by location

The geographical location, whether rural or urban, exerts a profound influence on advancements towards SDG Targets 6.1 and 6.2 (Figure 1.2-3 and 1.2-4), which respectively aim to achieve universal and equitable access to safe and affordable drinking water, as well as access to sanitation and hygiene services for all by 2030. Understanding the unique challenges and opportunities in each setting is crucial in forging an inclusive path toward success. Current indicators 6.1.1 and 6.2.1 should consider, at least, five factors in order to promote more assertive actions in those regions where needed: *Rural Realities, Urban Challenges, Sustainability and Resilience, Community Participation and Empowerment, Inclusivity and Equity.*

Rural realities

In rural areas, achieving SDG 6.1 and 6.2 can be particularly demanding. Remote communities often grapple with limited access to improved water sources, necessitating long and arduous journeys to fetch water. The lack of centralised sanitation infrastructure leads to open defecation and poor hygiene practices, contributing to the spread of diseases. Overcoming these challenges requires tailored solutions that account for geographical barriers, resource constraints,

and the cultural context. Leveraging innovations, such as decentralised water systems and community-led sanitation initiatives, empowers rural communities to create sustainable and locally relevant solutions.

Urban challenges

In contrast, urban areas present their own set of challenges on the path towards SDG 6.1 and 6.2. Urbanisation places immense pressure on water and sanitation services as population density surges. Rapid migration to cities strains existing infrastructure and demands immediate attention to ensure equitable access. Informal settlements in urban areas are often deprived of basic services, perpetuating inequity and exacerbating health risks. Addressing the unique urban challenges requires investments in robust water supply networks, innovative wastewater management, and inclusive policies that prioritise the most vulnerable urban residents.

Sustainability and resilience

Both urban and rural areas benefit from incorporating sustainable and resilient practices. For SDG 6.1, embracing water conservation measures, rainwater harvesting, and judicious water use in agriculture contributes to safeguarding water resources. Similarly, SDG 6.2 necessitates promoting environmentally friendly sanitation technologies and proper waste treatment to protect ecosystems and public health. Emphasising sustainable solutions fosters long-term progress and ensures the endurance of these critical services.

Community participation and empowerment

In both settings, community engagement is pivotal. In rural areas, empowering local communities to actively participate in water management and hygiene programmes fosters ownership and ensures the sustainability of initiatives. In urban settings, engaging residents and stakeholders in decision-making processes enhances accountability and enables the formulation of relevant and effective strategies.

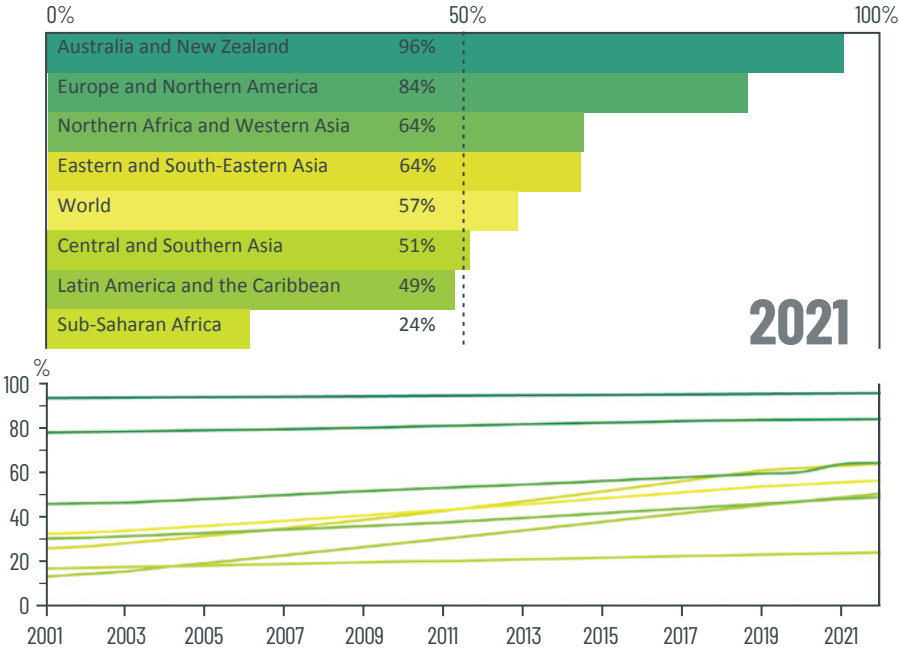


Figure 1.2-2 – Progress of target 6.2. by 2022 under the tracking with the indicator 6.2.1 about the population using safely managed sanitation services
Data retrieved from UN Water (UN Water, 2023)

Inclusivity and equity

Lastly, addressing disparities in access to water and sanitation services is paramount. Ensuring that no one is left behind necessitates targeted interventions to uplift marginalised communities, be they in rural or urban areas. Prioritising equity in planning and resource allocation helps bridge the gap and moves us closer to the vision of SDG 6.1 and 6.2.

In conclusion, recognising the influence of location is instrumental in shaping a comprehensive approach to achieving SDG 6.1 and 6.2. Tailored solutions that acknowledge the uniqueness of rural and urban contexts, embrace sustainability, and prioritise community empowerment will pave the way for a future where all individuals, regardless of where they reside, enjoy access to safe drinking water and sanitation services that promote health, dignity, and prosperity for all.

Forecasting by 2030 the targets 6.1 and 6.2 and the disaggregation by location

Progress data from 2000 to 2022 have been used to forecast the level of progress for several countries towards the SDG 6.1 and 6.2 (Figure 1.2-5). These data were disaggregated by location for both targets (WHO/UNICEF, 2023). In the case of target 6.1, the majority of countries maintain less than a 2% annual rate of change to provide access to drinking

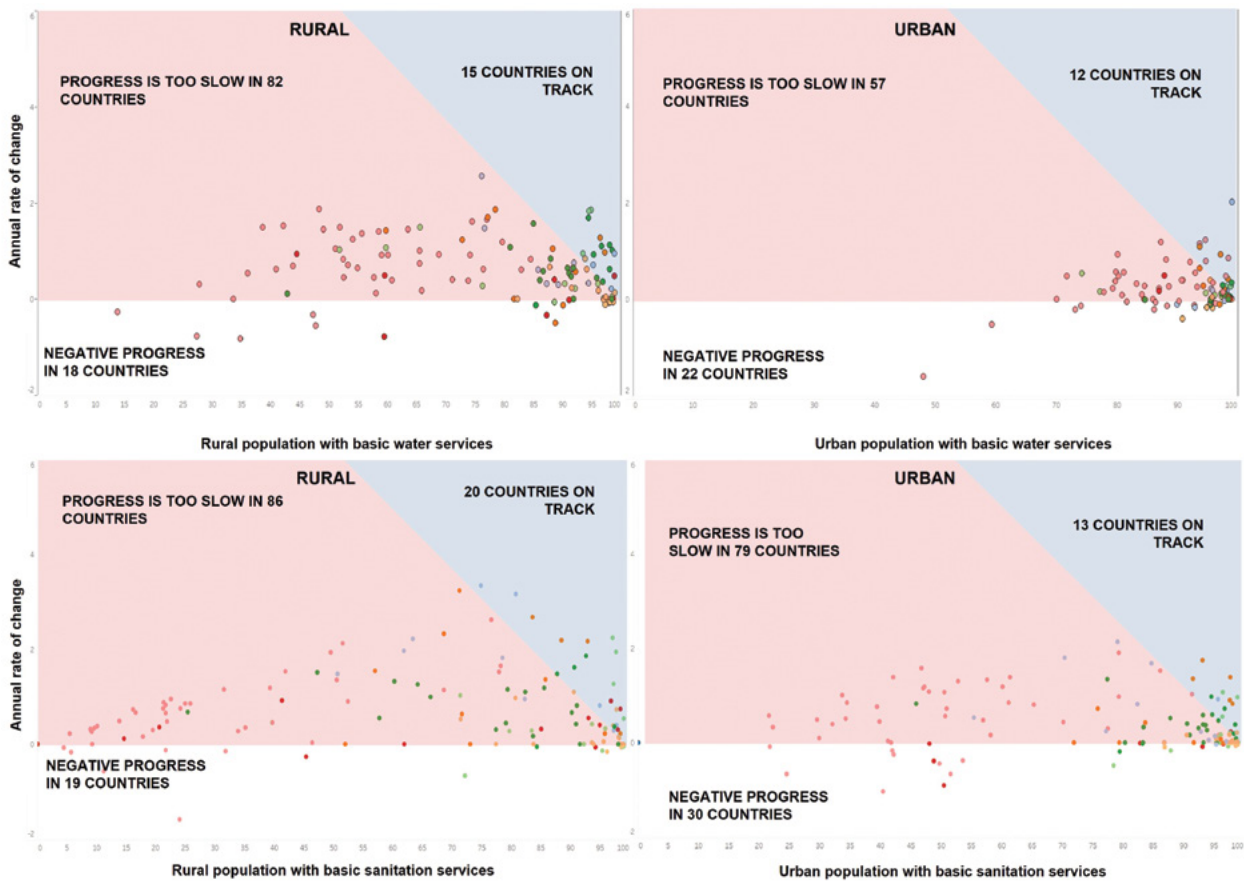


Figure 1.2-3 – Forecasting the achievement of targets 6.1 and 6.2 for rural and urban areas in the globe to 2030 based on annual progress from 2000 to 2022. Note: Dots are forecast for countries with available data
 Source: Data retrieved from WHO/UNICEF (WHO/UNICEF, 2023).

water in both rural and urban areas. At this rate, access to drinking water in urban areas will reach more than 90%, while for rural areas the majority of countries will continue at between 25 and 80%. Results also demonstrate that only 16% of the countries are on track to reach at least 90% access to drinking water in rural areas. A similar percentage (15.2%) is found for urban areas. Considering the difficulties in rural areas discussed above, current and future actions should be focused on overcoming the particular conditions of rural areas in those regions that need it.

The forecast for reaching target 6.2 is more worrying than that for 6.1. Considering current annual rates, the population with universal access to sanitation services will vary depending on where they live. By 2030 a wide range of people (up to 95%) living in rural areas may not have access to sanitation services, while for urban areas the percentage of people without access to sanitation may be more than 70% (Figure 1.2-3). This is expected due to the annual rate of change, on average, is below 1.5 and 2% for rural and urban

areas, respectively, which compromises the achievement of the goal. The forecast is different for the urban and rural areas, and it gives rise to greater concern for rural areas. There are several particular characteristics of the populations in these areas, such as ethnicity, age, and gender that must be considered when renewing actions and accelerating the annual rate of change.

The pursuit of SDG 6, encompassing Target 6.1 on universal access to safe drinking water and Target 6.2 on sanitation and hygiene services, requires dynamic and contextually relevant indicators to effectively monitor progress. Ongoing research endeavours to focus on exploring disaggregated items within existing indicators, offering valuable insights for stakeholders and decision-makers to generate new, tailored metrics. Notably, such disaggregation by geographic location and socioeconomic characteristics has gained prominence in an increasing number of countries, showing disparities and enabling targeted interventions to bridge access gaps.

Critical to the success of these endeavours is the recognition that disaggregation by individual characteristics, including age, sex, disability, and other relevant demographics, holds tremendous significance. These refined indicators reveal nuanced dimensions of inequality, ensuring that vulnerable and marginalised populations are not overlooked in the pursuit of inclusive development. By discerning the distinct needs and challenges faced by diverse groups, stakeholders can craft responsive policies and interventions that elevate societal equity and well-being.

In the context of developing countries, where disparities in access to water and sanitation services are often pronounced, the significance of these disaggregated indicators cannot be overstated. Fostering data-driven decision-making, they equip governments and organisations with granular insights to channel resources effectively, drive transformative change, and prioritise the most pressing needs.

Furthermore, as we envision a future of sustainable progress, it is imperative to proactively forecast new indicators that align with evolving global challenges and ambitions. By envisioning the impact of potential metrics, we fortify our ability to measure progress accurately and mobilise resources strategically. This proactive approach fosters anticipatory policy development and enhances the overall effectiveness of SDG 6 initiatives.

In conclusion, the journey towards achieving SDG 6.1 and 6.2 is significantly enhanced by the pursuit of refined, disaggregated indicators. By empowering stakeholders and decision-makers with nuanced insights through geographic, socioeconomic, and individual characteristic disaggregation, we can steer development efforts towards inclusivity, resilience, and sustainable impact. As we continue to explore novel measurement approaches, the forecast of new indicators becomes a linchpin in our pursuit of a more equitable and water-secure world for all.

1.3. Exploring perceptions of young professionals in the WASH sector paradigm and understanding the 3 I's – innovation, integration and implementation for SDG 6

Sudipti Arora

The Sustainable Development Goal 6 (SDG 6), which envisions universal access to clean water and sanitation by 2030, is at the heart of the agenda 2030. Its ability to underpin other SDGs reinforces that clean water and improved sanitation facilities are fundamental for healthy lives, breaking the cycle of waterborne diseases and easing burdensome tasks related to water collection. While the 2030 Agenda aims to ensure water and sanitation for all, progress towards SDG 6 targets lags as we approach the mid-point of the SDG period. As per Goal 6 updates at UN SDGs, achieving universal coverage by 2030 will require a sixfold increase in current rates of progress for safely managed drinking water, a fivefold increase for safely managed sanitation, and a threefold increase for basic hygiene services (sdgs.un.org). With only seven years remaining until the completion of the 2030 Agenda, urgent action is needed to accelerate progress in SDG 6.

Within this area, a pivotal but often overlooked aspect of SDG 6 should be discussed: the perceptions of young professionals in the WASH sector paradigm. By amplifying the voices of young professionals, their potential to inject fresh perspectives, innovative ideas, and unwavering enthusiasm into the pursuit of SDG 6 can be promoted. This text presents a comprehensive analysis of the unique insights held by YWPs on the 3 I's towards the realisation of SDG 6.

By aiding understanding YWPs' perspectives, the present chapter supports us in establishing a more inclusive and effective approach towards achieving SDG 6. Also, it helps to identify both the opportunities and barriers that YWPs encounter as they strive to make a lasting impact within the WASH domain. It provides an intricate understanding of how YWPs can shape the WASH sector's trajectory and drive progress towards the ambitious goal of universal access to WASH, contributing to the global endeavour of realising a more sustainable, equitable, and healthier world by harnessing the transformative potential of the WASH sector and the dedication of its emerging leaders.

To delve into the perceptions and viewpoints of YWPs in the WASH sector, three actions were taken. First, a structured survey was designed and conducted to collect quantitative and qualitative data, allowing YWPs from

diverse backgrounds and regions to share their insights. The data collected was solely used for research purposes. Any personal information (such as designation, contact no., email, etc.) was only used to categorise the responses and never be publicised. By filling out the form, respondents gave consent to receive a couple of follow-up emails. The form was comprised of four sections as described below (Figure 1.3-1) to expand on understanding of perceptions of youth for SDG 6. Questions revolved around their experiences, aspirations, and challenges in the WASH sector, as well as their perspectives on the WASH Sector and their awareness of SDG 6. The survey was distributed through online platforms and professional networks to ensure a diverse and representative sample of young professionals in the WASH domain.

Section 1 Personal information & demographic details	Name / Age / E-mail ID / Contact details / Designation / Address for communication / Profession / Institution of affiliation
Section 2 Understanding water access & usage	Source & accessibility of water / Proportion of usage of water / Quality of drinking water / Water shortages / Water-borne illness data / Price & affordability data
Section 3 Understanding WASH sector	Accessibility of toilets / Sanitation facility / Community WWTPs / Open defecation data / Access to menstrual hygiene
Section 4 Awareness about SDG 6	Awareness on SDG 6 goals & targets / Awareness on water conservation / Youth role & motivation for SDG 6

Figure 1.3-1 – Survey questionnaire description
 Source – Autor

The survey was structured to concentrate on six primary focal areas, namely:

- Demographic and intellectual analysis
- Water availability and usage
- Accessibility and quality of potable water
- Water availability for Sanitation and Hygiene
- Awareness levels, particularly among the youth

Additionally, two in-person events were organised to stimulate innovative thinking and develop solutions related to the WASH Sector and SDG 6. The inaugural event, named 'Water-A-Thon,' was launched on World Environment Day, which fell on 5th June, 2023. This event took place during a one-day National Conference called "EcoSDG Summit:

Navigating a Greener Future Through Waste and Water Management." It convened a diverse array of participants, including young professionals, experts, stakeholders, and organisations from the WASH sector. The primary goal was to facilitate intensive and interactive brainstorming sessions to generate fresh perspectives and impactful ideas that could address current challenges and contribute to the achievement of SDG 6 targets. It encouraged participants to think innovatively, challenge conventional approaches, and propose creative solutions to complex water and sanitation issues.

The second event, titled 'WAVE- Water, Alternatives & the Environment for Implementation & Integration of SDG 6,' was a collaborative effort with the Dr. B. Lal Institute of Biotechnology (Jaipur, India) and the Centre for Conservation of Natural Resources, Environmental Protection, and Climate Change (CCoNREPC) under the auspices of The Rajasthan Forestry & Wildlife Training Institute (RFWTI). This event, which took place on 26th July, 2023, at the RFWTI campus, aimed to assemble all stakeholders to raise awareness about SDG 6 and promote youth engagement in advancing SDG 6. In total, the survey attracted 189 Young Water Professionals (YWPs), with 122 participants attending the first in-person event and 100 attending the second event.

Survey findings

1. DEMOGRAPHIC AND INTELLECTUAL ANALYSIS

As described in Figure 1.3.2, a significant proportion of the survey respondents were female, accounting for 69.3% of the total participants, and nearly three-quarters of the survey's participants fell within the youth age bracket, ranging from 16 to 35 years old. While the survey saw participation from individuals across the nation, it's worth noting that there was a slight bias towards respondents from Rajasthan, which can be attributed to the survey's origin in this state. Interestingly, close to 60% of the participants were students, representing various educational levels, including schools, colleges, and institutions. This high student participation underscores the active engagement of young people in the survey, highlighting their enthusiasm and interest in the subject matter. The roles or designations of the respondents are clearly outlined in Figure 1.3-2.

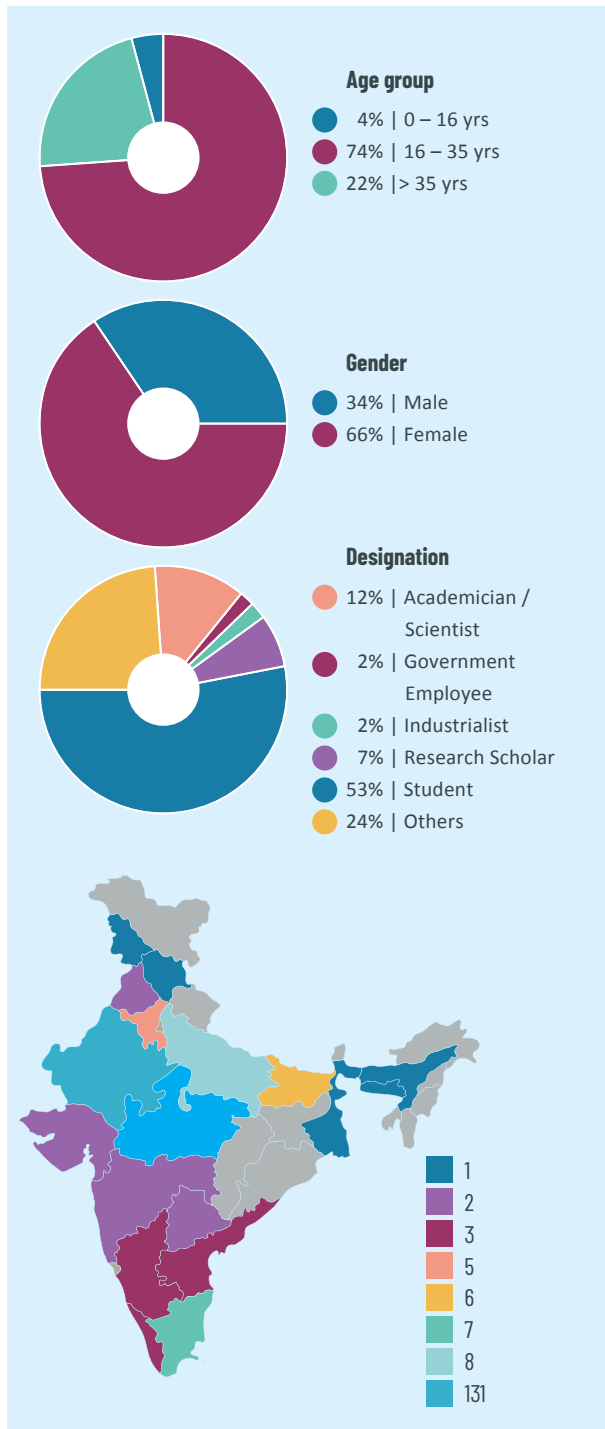


Figure 1.3-2 – Demographical analysis

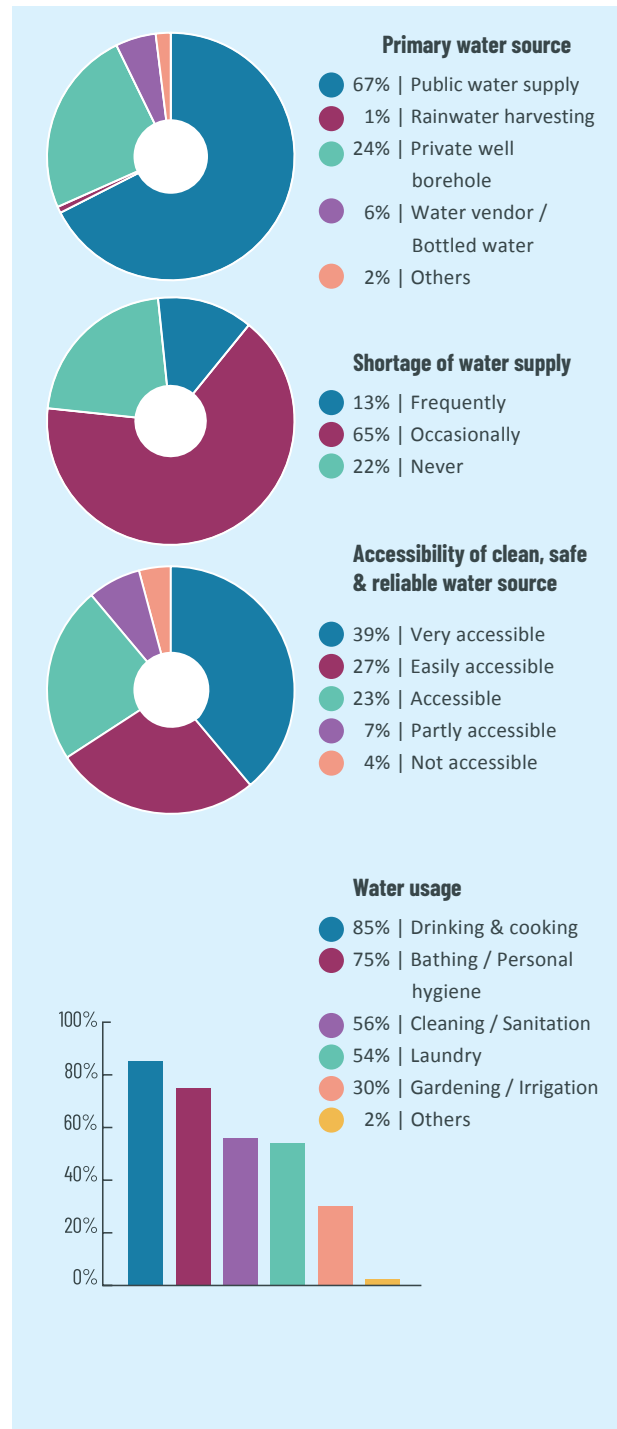


Figure 1.3-3 – Accessibility of Water data

2. WATER AVAILABILITY AND USAGE

Regarding access to water, a significant majority of the survey participants, specifically 90%, reported that they obtain their water supply from either public water sources, which accounted for 67.2%, or private wells and boreholes, making up 24.3% of the respondents' sources. These findings indicate that, for the population surveyed, access to water supply is not a major area of concern. Furthermore, an

analysis of water usage patterns revealed that a substantial portion, around 85.2% of the respondents, identified drinking and cooking as the primary activities requiring maximum water usage, while 74.8% considered bathing and laundry to be the next significant water-consuming activities.

Interestingly, despite the presence of multiple sources of water, approximately 65% of the survey recipients reported encountering occasional water shortages at some point.

Simultaneously, it's important to note that there exists significant variability in the accessibility of clean, safe, and reliable water sources among the survey participants, highlighting disparities in water access within the surveyed population.

3. ACCESSIBILITY AND QUALITY OF POTABLE WATER

In terms of access to potable water, it's evident that only approximately 50% of individuals have access to water of reasonably good quality, while approximately 15.9% of the population still grapple with poor-quality potable water. Interestingly, a substantial 62.4% of respondents reported not having experienced waterborne illnesses (Figure 1.3-4).

However, it's noteworthy that around 63% of people believe that the cost of potable water is affordable for them. Despite this, 40% of respondents disagree with this perspective, emphasising the need for specific measures to ensure that every individual's right to clean and safe drinking water is upheld.

It's essential to exercise caution when interpreting the data that suggests 88% have access to clean potable water, as there may be biases present in the survey that could influence these results.

4. WATER AVAILABILITY FOR SANITATION AND HYGIENE

Another aspect explored in the survey pertained to the WASH Sector and the findings indicated that 75% of the participants reported having toilets in their homes (Figure 1.3-5). However, this proportion declined to 56% when assessing the availability of proper sanitation facilities. Notably, a significant 90% of respondents stated that their households were equipped with toilets connected to sewer systems, highlighting a relatively high level of sanitation infrastructure. Additionally, 60% of participants affirmed that their immediate surroundings were free from open defecation practices.

Concerning the access to water for menstrual hygiene, 75% of the survey respondents reported having access to water for this purpose. However, it's important to note that a significant majority, more than 60%, indicated that they were aware of others who did not have access to such facilities (Figure 1.3-5).

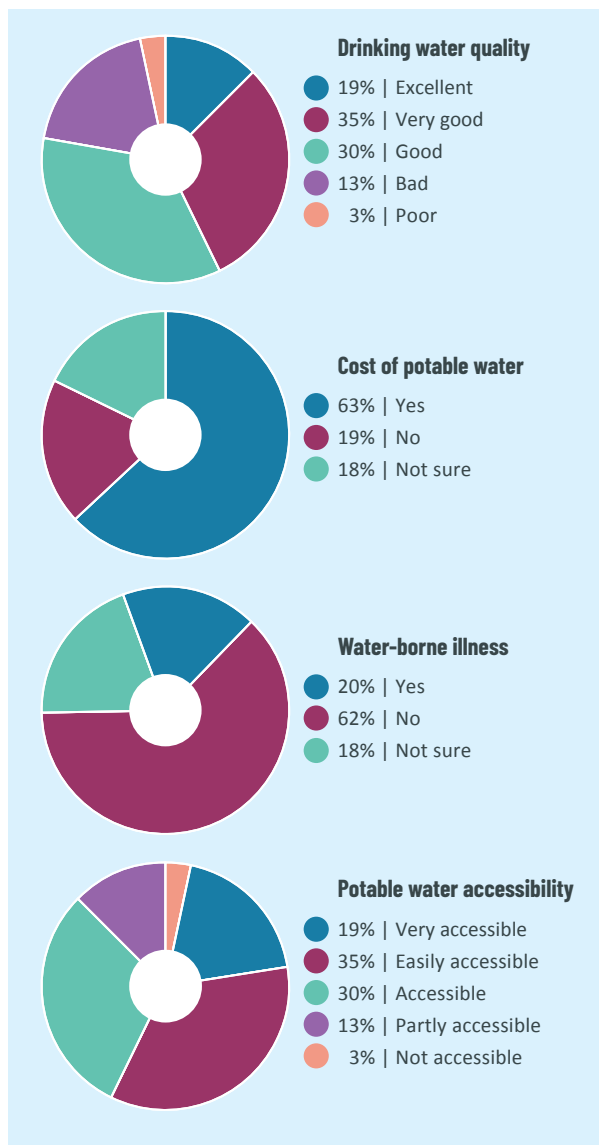


Figure 1.3-4 – Accessibility of potable water

5. AWARENESS LEVELS, PARTICULARLY AMONG THE YOUTH

Among those who engage in water conservation efforts, 50% prioritise water reuse, while 40% are actively involved in rainwater harvesting. Conversely, the primary reason why a majority of people do not participate in water conservation activities is due to a combination of insufficient awareness and inadequate infrastructure (Figure 1.3-6).

The significance of awareness programmes becomes apparent when considering that exactly half of the respondents, are unaware of the initiatives undertaken by WASH in this regard. This underscores the need for increased awareness campaigns and educational efforts in the realm of water conservation.

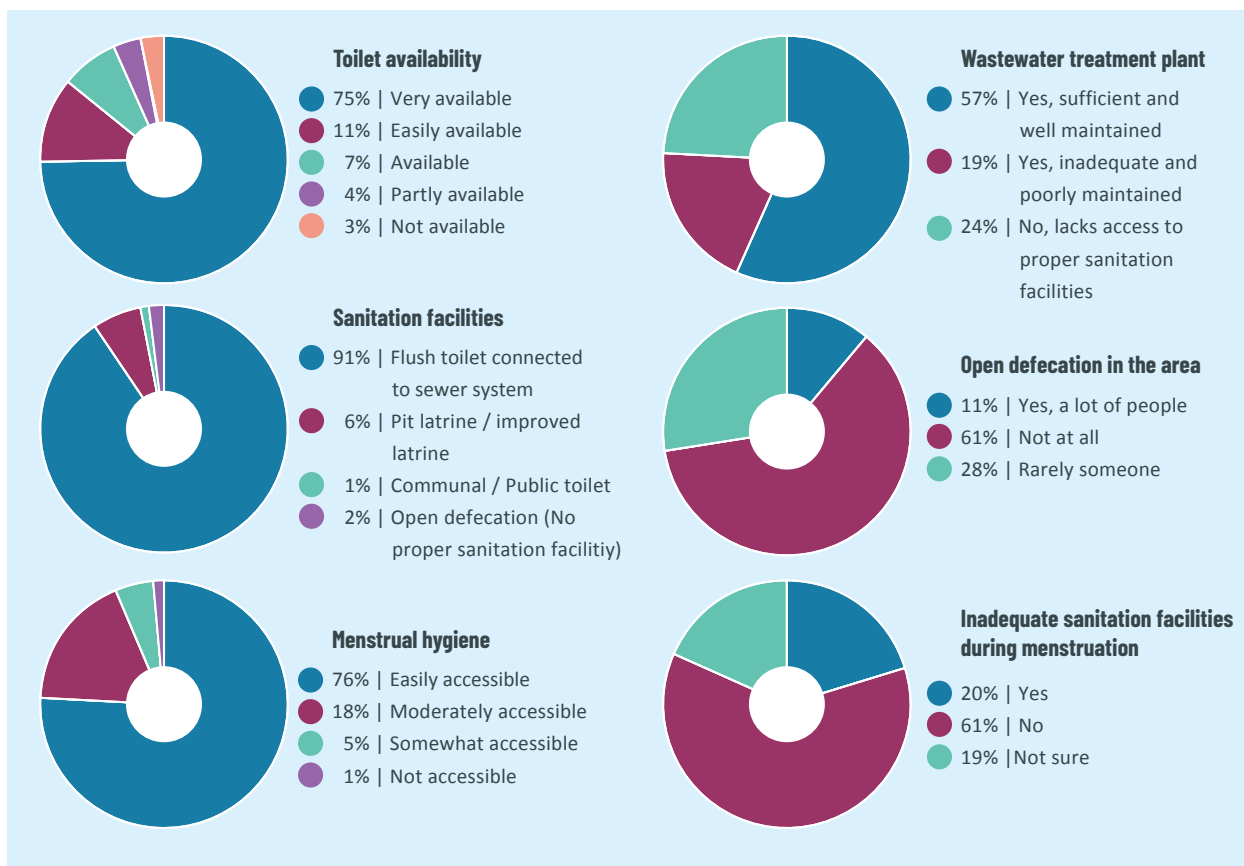


Figure 1.3-5 – Water Accessibility for WASH and Menstrual Hygiene

Implications of events: Water-A-Thon & Wave Conference to raise awareness among youth

During the initial in-person event, known as the 'Water-A-Thon', participants were invited to submit comprehensive ideas aimed at making a tangible impact in the WASH sector. These ideas were expected to be practical, scalable, and sustainable, ensuring that they could be effectively implemented in real-world contexts. Figure 1.3-7 shows the summary of the water-a-thon and a clear visual representation of the nationwide participation, highlighting that ideas were received from various regions across the country. A total of 60 ideas were submitted during Phase I of the event, with 30 of them advancing to compete in Phase II and Phase III. In addition to this, a hybrid idea exposition event was organised on the 11 and 12 of August. This event aimed to select the top ideas for potential funding and was conducted in collaboration with the Biotechnology Innovation and Incubation Center at the Dr. B. Lal Institute of Biotechnology. The 40+ ideas are now published in a compendium which can be found at <https://bit.ly/3MCDFXh>.

Table 1.2 gives a summary of the ideas generated during this event, categorising them into four distinct categories: (a) water treatment, (b) water conservation, (c) water audit and measures, and (d) wastewater treatment. Subject matter experts and mentors were invited to offer guidance and support throughout this event. Their wealth of knowledge and experience proved invaluable in helping participants refine their ideas, anticipate potential challenges, and develop actionable plans for implementation. Out of the 30 ideas that competed during the event, a total of 15 were recognised and awarded across five distinct categories, which included Best Social Impact Idea, Best Digital Transformation, Water Sustainability, Champions of Change, and Young Innovator.

The culminating event, titled WAVE (Water, Alternatives, and Vision for Environment), aimed to elevate awareness and motivate action in response to the challenges presented

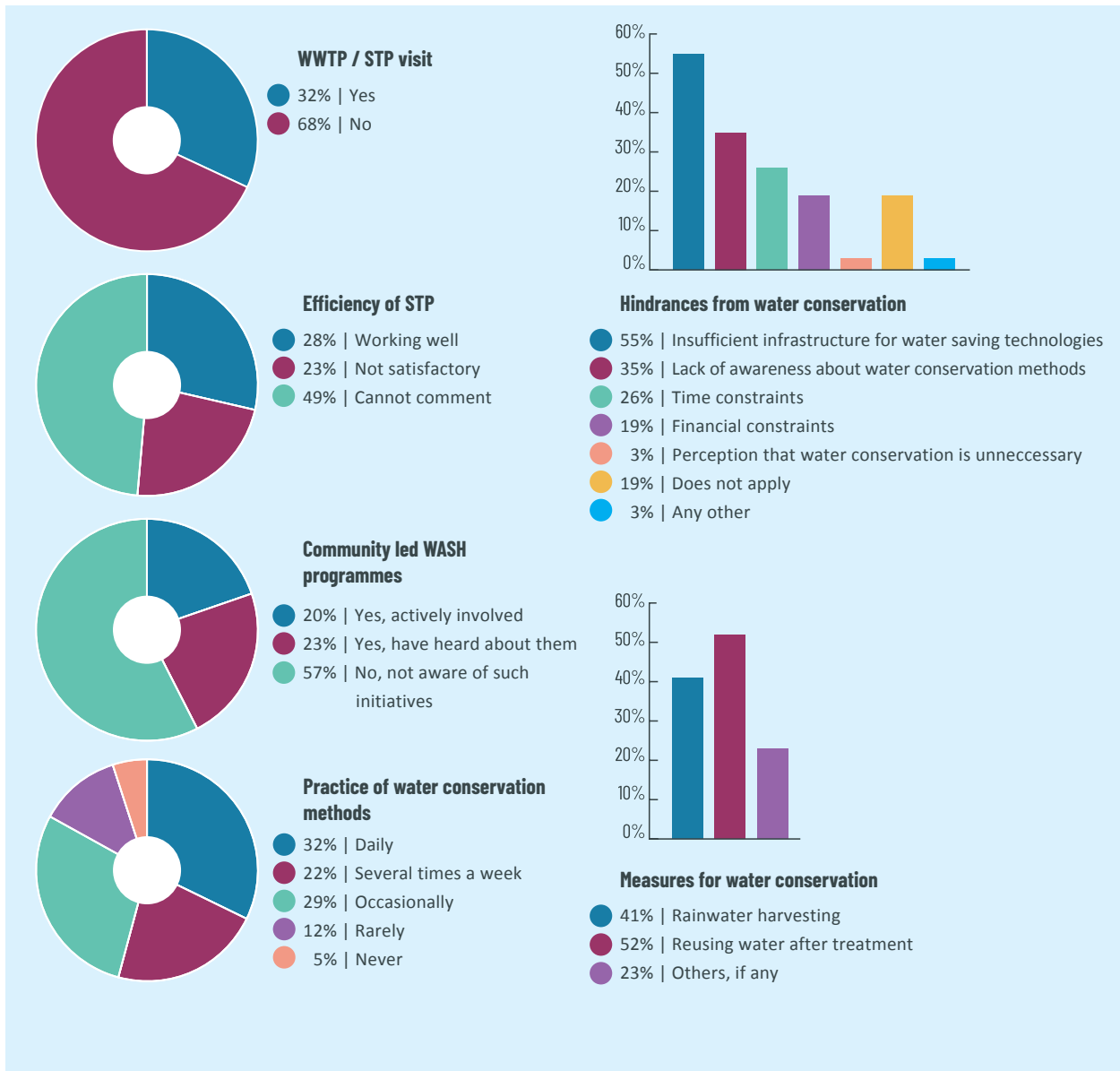


Figure 1.3-6 – Awareness levels among youth

by climate change. It also sought to promote water conservation and advocate for a zero-waste approach rooted in the principles of a circular economy.

During this event, a unique and innovative activity called the 'Water Innovators' Expo' was conducted. This activity encouraged participants to collaborate, engage in critical thinking, and propose innovative solutions to various challenges associated with SDG 6. It served as a platform for participants to unleash their creative thinking, foster teamwork, and gain a deeper understanding of the intricacies, challenges, and opportunities surrounding SDG 6.

These two flagship events stand as transformative moments, and in today's world, where social impact and youth mobilisation are paramount, these events have assumed profound relevance. The Water-A-Thon galvanised innovation

and collaboration, uniting a diverse group of participants in a collective effort to tackle WASH sector challenges. It not only unleashed fresh perspectives but also ignited the passion of our youth, driving them to address the pressing issues of clean water and sanitation. Meanwhile, the WAVE event raised the clarion call for climate action, water conservation, and a circular economy, aligning seamlessly with the aspirations of socially conscious youth. Its "Water Innovators' Expo" not only nurtured critical thinking but also showcased the power of young minds coming together for a sustainable future. These events, in their entirety, exemplify how youth mobilisation and social impact are pivotal in the context of our project, shaping the path toward achieving SDG 6 while harnessing the dynamism of our young professionals.

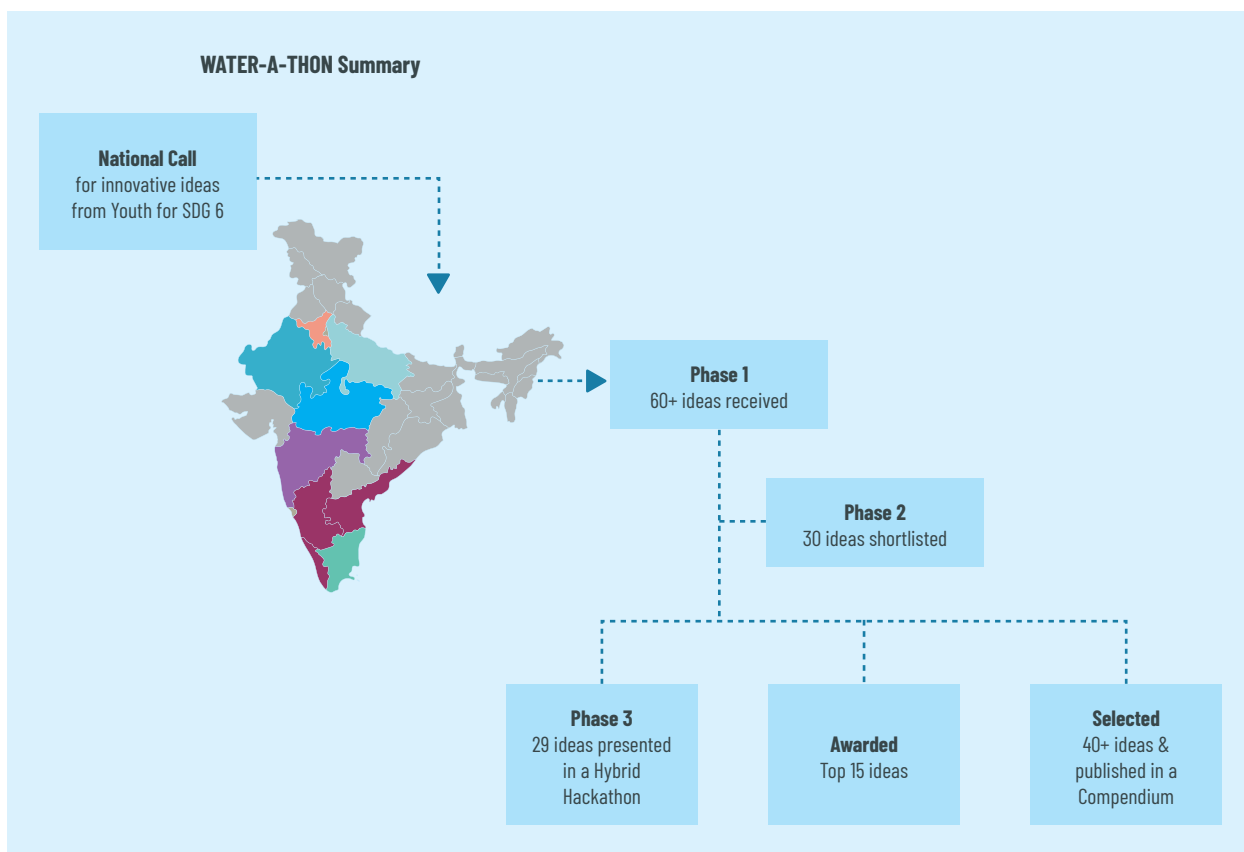


Figure 1.3-7 – Summary of Idea exposition event

Conclusions

This review offers valuable insights into the perspectives of young professionals within the WASH sector, with a particular focus on the 3 I's: Innovation, Integration, and Implementation. Drawing from a wide array of sources, including academic and grey literature, this comprehensive review provides a multifaceted understanding of the subject matter. It serves as a foundation for pinpointing knowledge gaps, areas necessitating further investigation, and potential pathways for fostering innovation, collaboration, and effective strategies in WASH sector implementation.

The 3 I's emerge as central components in the pursuit of SDG 6's ambitious objectives. These interrelated elements are indispensable for addressing the intricate challenges inherent in the WASH sector. They empower the development of sustainable solutions and amplify the impact of interventions.

This scoping review unveils a spectrum of viewpoints held by young professionals actively engaged in the Water, Sanitation & Hygiene sector. Their perspectives encompass a broad spectrum, encompassing their assessments of the current state of the sector, the hurdles they encounter in their work, their aspirations for the future, and their awareness of SDG6.

The primary takeaway from this chapter underscores the importance of actionable plans, and one such plan is encapsulated in the acronym SAVE water:

- S: Solving Water Challenges**
- A: Advancing Opportunities**
- V: Visionary Innovations**
- E: Effective Integration**

These elements collectively represent a blueprint for driving progress in the WASH sector, aligning with the overarching goal of ensuring equitable access to clean water and sanitation while minimising environmental impact. Through concerted efforts in solving challenges, seizing opportunities, fostering innovation, and promoting effective integration, young professionals can contribute significantly to the realisation of a more sustainable and inclusive WASH sector.

Table 1.2 – Innovative ideas from youth during the water-a-thon idea exposition

INNOVATIVE IDEAS FOR SDG 6			
WATER CONSERVATION MEASURES	WATER TREATMENT	WATER AUDIT AND MANAGEMENT	WASTEWATER TREATMENT
Harvesting of excess rainwater for the generation of hydroelectricity	Reducing water pollution via Eco soaps	Aquaaudit-Auditing of water availability, supply, usage, water conservation, etc.	Combinatorial strategies to purify household wastewater via physical, biological, and chemical methods
Enhancement of collection and storage efficiency for harvesting rainwater	Aquaxylem – Use of xylem tissues for water filtration	Ni-The Water Saviour-IoT based live water availability, usage, leakage alerts in real time on mobile based apps and web dashboards	Use of Green Nanomembranes to treat wastewater for reuse
Nurturing liquid lifelines – salinity reduction in water to increase usable water, watersheds to prevent water loss and phytoremediation to prevent water contamination		IoT based smart water management systems for different types of users such as residential, commercial, and industrial, agricultural, educational, etc.	Solar distillation – Use of UV light for treatment of wastewater
Conservify – Gaming app for engaging water conservation	Thermal desalination of ocean water to increase the amount of reusable water	Awareness of smart water management via mobile apps, social media platforms, smart home devices, etc.	Wastewater treatment via biofilm formation
AquaPave – Advancements in rainwater harvesting		Integrated approach for water pollution mitigation via bioremediation, filtration, and AI driven awareness	
GreenOps™ – AI based data collection in real-time for potential water leakages and predictive analysis -	Reusing the Water generated by Technological Advancements	Real time river water quality monitoring and bioremediation system	
Aquanets – Collection of rainwater in specialised nets for harvesting	Revolutionising Water Purification and Resource Recovery: A Novel Device for Ammonia Extraction and Urea Production	Mitigating water wastages and breakages – community driven app	Removal of heavy metal from industrial wastewater with a combination of constructed wetland and biochar immobilised with bacteria
TinyML – Leak detection using Machine Learning		Water quality analysis by algae-based biosensor and bioremediation of wastewater by activated charcoal	

WATER CONSERVATION MEASURES
Inclusion of SDGs knowledge at school levels to involve youth
Promoting Water Conservation for Sustainable Agriculture through Education: A Comprehensive Approach
Hydroponic Technology: Revolutionising Crop Irrigation for Sustainable Water Conservation
"Conserve Water with Smart Toilets: A Paradigm Shift in Sustainable Water Management
Envirogreen water bottle

WATER AUDIT AND MANAGEMENT	WASTEWATER TREATMENT
City Water Bodies Database for Repair, Renovation, and Restoration to manage the hydrological challenges posed by urban flooding, waterlogging, and droughts	Waste Utilisation System (WUS) based on Vermitechnology for domestic wastewater, solid sludge, and fecal sludge in a unified system
Water weekenders in the city to create awareness	Nano adsorbents to treat wastewater
Integration of Bioremediation, Filtration, and Nanoparticles – Future AI- driven Awareness for Water Body Restoration and Wastewater Management	Combination of constructed wetlands and vermifiltration for the treatment of industrial wastewater
Innovative Fusion of Indian and Tang Dynasty Drainage Systems for Sustainable Rainwater Management	Use of vermifiltration technology to treat clinical wastewater and reduce ARBs
A comprehensive database of all water bodies in the city, to promote repair, renovation, and restoration	Solar Disinfection: Innovative Decentralisation technique for wastewater treatment
Practices and Tradition keeping the Rivers Alive - Cases of Public Participation in Water Governance	The Influence of Vermifiltration on Antibiotic-Resistant Bacteria and Genes: Earthworms in Wastewater Treatment for Clinical Applications
"Nurturing Water Consciousness: Daily Tips for Sustainable Living through smart water management"	"ReWater: A Solution for Water Scarcity through Graywater Reuse"
	Nanoparticles – Future of wastewater treatment
	Treatment of Textile Wastewater with the combination of two technologies at a pilot scale
	ReBloom: Transforming Sewage Wastewater into Green Gardens and Sustainable Growth



Chapter 2 –

Enhancing funding, engagement and innovative practices to explore sustainable water solutions via YWP contributions

Young Water Professionals (YWPs) bring a unique set of strengths that are vital to modern water management and governance. They are typically more familiar with cutting-edge technologies and more comfortable with rapid adaptation, two traits that are increasingly relevant in an era of swift technological advancement (*Savenije & van der Zaag, 2008*). Additionally, YWPs often demonstrate a strong commitment to holistic, interdisciplinary approaches and a keen awareness of the socio-political dimensions of water management.

In a 2019 report from Water Youth Network, a global organisation connecting YWPs, many of the highlighted projects indicated a broad, systems-based understanding of water issues, reflecting a willingness to cross traditional disciplinary boundaries (*Water Youth Network, 2019*). This propensity for cross-disciplinary collaboration and systems thinking is increasingly recognised as vital for addressing the complex challenges of the water sector.

Despite these strengths, YWPs often face substantial barriers to entry and progress in the water sector. In the same manner, WASH entrepreneurs face barriers embedded in funding conditions that limit their optimum performance. These obstacles primarily stem from conservative industry attitudes, a lack of opportunities for meaningful leadership and participatory roles, and the often slow pace of institutional change. Issues related to funding are also considered a setback to absorbing the contributions of YWPs in the water sector, and so does the perception of practices acceptable to YWPs. Considering this scenario, this chapter will focus on ways to enhance funding and engagement and brings innovative practices to showcase and support YWPs to implement sustainable water solutions.

The first sub-chapter discusses issues related to challenges that WASH entrepreneurs face with regard to funding conditions established by donors/financial agencies.

Certain funding conditions limit WASH entrepreneurs in the implementation of WASH interventions. Such funding conditions include; short funding proposal/application timelines, capping of overhead costs, advance funding of project activities and extortion of money from project funds of WASH entrepreneurs. Also, the study explains the recommendations to enhance funding conditions, which were made by the WASH entrepreneurs interviewed.

The second one sub-chapter shifts the focus to two case studies showcasing practical implementations of technological solutions. These solutions primarily stem from academic research and thereby exemplify how YWPs are enabled to be the key stakeholders and drivers of "proof of concept" projects in a) a wastewater and climate adaptation project, and b) a project focusing on drinking water distribution with the help of renewables. The key focus of both projects is the swift transition of research into practice, to show how low-cost solutions can make an impact without substantial investment, and as a result list the benefits of YWP involvement.

The final sub-chapter reflect on the young professionals' acceptance of the reusability of water resources. It was evident at the UN Water Conference that YWPs have taken charge of future water decisions and made a plausible statement of the water conservation strategies required. These strategies are usually compounded with unconventional practices and even uncommon water resources tapped from across the cycle. The section reports the YWPs' perception of various water resources and the reusability of water resources. It also attempts to correlate their responses with their geographical locations and professions while giving the responders flexibility to vocalise reasons for their respective responses.

2.1. Improving funding conditions for WASH entrepreneurs: smart acceleration of access to clean water and safe sanitation

Jacob Kwasi Amengor

Entrepreneurship is used to describe the process of starting and developing a new business with the aim of delivering a new or improved product or service to a target market. Entrepreneurs manage this process with their innovations at their own personal and financial risk. A kind of entrepreneurship that is widely practiced in the water and sanitation sector is social entrepreneurship. Social entrepreneurs have the goal of developing solutions to societal problems, with limited focus on the magnitude of monetary returns. The extensive practice of social entrepreneurship in the water and sanitation sector is driven by the recognition that access to clean water and safe sanitation is primarily a matter of human rights, and it's the marginalised in society who bear the brunt of the sector's challenges.



Figure 2.1-1 – People in Abutia Amesianyako in Ghana who are benefiting from a Drinking Water System Constructed by the WASH Advancement Centre

This underlines a promising trend that has emerged in recent times with regard to Water, Sanitation, and Hygiene (WASH) entrepreneurship. Entrepreneurs are taking the lead in deploying research outcomes and innovations, which leads them to play a vital role in bridging the gap between research and practice. They are striving to deliver WASH services more efficiently and effectively by providing a structure that incorporates the latest research findings that used to be contained within scholarly publications into their operations

for optimum impact. Their actions tend to solve the challenge and recurring hurdle that emerges in translating research and scientific discoveries into practical action. Their pivotal contributions and efforts have the potential to accelerate progress towards achieving Sustainable Development Goal 6 (SDG 6).

Despite the commendable contributions of WASH entrepreneurs, one major hindrance faced by them lies with the lack of adequate attention and support in terms of funding conditions (Christopher et al., 2021). Insufficient financial backing poses a significant setback to the execution of their work and hampers their ability to scale up impactful solutions. This has contributed to the slowing pace of progress towards meeting SDG 6 targets that are currently being experienced (UN-Water, 2020).

Acknowledging the pivotal contribution made by these entrepreneurs and tending to their financial requirements becomes imperative in sparking a favourable transformation and substantial progress within the water and sanitation sector. Effectively dealing with the challenges associated with funding will cultivate enhanced partnerships among research entities, industries, policymakers, and WASH entrepreneurs.

This collaborative synergy can facilitate a more comprehensive strategy that merges innovative research with pragmatic execution, ultimately propelling the achievement of SDG 6 objectives. The primary objective of this study is to shed light on the challenges faced by WASH entrepreneurs in their endeavours to secure sufficient funding and deal with growth-inhibiting funding conditions. It offers insights and actionable strategies that can serve as a practical guide for policymakers, donor agencies, and stakeholders. By doing so, it aims to enhance comprehension and resolution of the restricting financial conditions and funding requisites encountered by WASH entrepreneurs. Ultimately, the goal is to cultivate an environment conducive to their expansion and lasting influence

in their crucial role of providing enhanced WASH services to underserved communities.

To achieve this goal, WASH Entrepreneurs hailing from diverse regions across Africa, Europe, and North and Latin America were interviewed. They were selected due to their impressive work in providing water and sanitation services to their target groups and their fundraising activities. In total, five WASH entrepreneurs were interviewed, with three

having identified themselves as males, and two as females. They offered valuable perspectives on the challenges faced, their innovative solutions and recommendations, and their experiences in navigating the complexities of funding conditions. Through their contributions, a deeper understanding of the WASH entrepreneurship landscape is gained that helps to uncover key strategies to support and empower water changemakers and other WASH entrepreneurs.

Funding landscape: challenges and recommendations

The participants indicated various barriers that challenge the expansion of their work. First, 75% indicated that the timeline for submitting the funding proposal and its application submission is not enough. It is important to note that the timeline is usually determined by donors and financial institutions, often without taking into account the specific requirements and nature of work undertaken by the applicants. As a result, WASH entrepreneurs might have insufficient time to develop detailed proposals, align their teams, provide documents, and clearly outline the activities associated with the funding proposal.

An example of this issue can be found with venture capitals. According to Eisenmann (2021), venture capitals tend to support established entrepreneurs rather than just any attractive business model. This underscores the importance of adequate time for WASH entrepreneurs to submit well-crafted proposals that demonstrate their industry expertise, team strength, and leadership capabilities.

Without such comprehensive documents that showcase the tenacity of WASH entrepreneurs and the feasibility of their business ventures, they may find it difficult to access reasonable funding, despite having highly viable WASH enterprises. Addressing this time constraint and allowing entrepreneurs the opportunity to present their cases thoroughly can unlock the potential for a significant positive impact in the WASH sector, ensuring deserving ventures receive the funding they need to make a substantial difference in addressing water and sanitation challenges globally. As part of the interviews, participants were asked to share their recommendations, which are explained in the ensuing paragraphs.

According to the interviewees, donor agencies and financial institutions should engage their target award applicants to understand the nature of their work and the extent of work that goes into the development of essential documents needed for a convincing application or project proposal. In addition, feedback on submitted applications and proposals should be provided to help the applicants recognise the areas of the application to focus on in subsequent calls for applications.

To enhance the funding process, donor agencies and financial institutions should actively engage with their target award applicants, seeking to understand the details of their work and the effort needed to prepare compelling applications or project proposals. By going through this engagement process, donors/financial institutions can gain valuable insights that will guide their decisions on timelines, which will support the ability of the applicants to produce convincing submissions.

Providing feedback to applicants, especially when their proposals are not successful, will empower them to refine and strengthen their future submissions, reducing the application/proposal development time and fostering a culture of continuous improvement. As a result, the overall quality of applications will likely rise, leading to more effective and impactful projects being funded and contributing to meaningful progress. This proactive approach to dealing with timeline challenges through engagement and giving of feedback fosters a mutually beneficial relationship between funding entities and the applicants, leading to more informed and effective application submissions and funding decisions.

The second challenge identified pertains to donor-funded project overhead cost restrictions, where many such projects impose fixed percentage limitations (e.g., 10%, 15%, 20%) on overhead expenses relative to the total project funds (U.S. Department of Labor, 2023). While this approach aims to manage expenses, it can pose obstacles to project success in several ways. Entrepreneurs often grapple with unforeseen or additional overhead expenditures during project execution, compelling them to seek extra funding sources beyond the project's budget, thereby straining their financial resources and constraining their ability to ensure project success. These ramifications unfold on two fronts: firstly, entrepreneurs may deplete their enterprise funds to cover project overhead costs, hindering business expansion and sometimes causing financial collapse; secondly, certain donor agencies restrict service charges paid to entrepreneurs for project implementation, often offering rates below actual costs. Consequently, entrepreneurs may secure project bids that leave them in worse financial straits, impairing long-term sustainability and the delivery of high-quality services. This stringent overhead cost capping has been recognised as a barrier to innovation and entrepreneurial ingenuity in addressing critical water, sanitation, and hygiene challenges.

The WASH entrepreneurs interviewed firmly advocate for the adoption of flexible and realistic approaches to overhead cost allocation in donor-funded projects, as it directly impacts both project success and the long-term viability of their enterprises. Urging donor agencies to take into account the unique requirements of each project and allowing for reasonable overhead expenses, while also

ensuring fair compensation for the entrepreneurs' services, will empower them to deliver projects with greater impact while maintaining their financial stability and fostering growth opportunities. Embracing such an environment, which recognises the true cost of project implementation and actively supports entrepreneurial initiatives, holds the potential to significantly advance the work and impact delivered by WASH entrepreneurs.

The third challenge that was identified was the difficulty of pre-financing projects and initiatives by WASH entrepreneurs prior to the donor disbursement. Certain donors and financial institutions impose a requirement on WASH entrepreneurs to pre-finance projects they've bid for, with reimbursement only provided for completed project activities. This practice presents substantial challenges, particularly for WASH startups and enterprises with limited financial resources, who are often unable to front the necessary funds, thereby disqualifying them from potentially growth-boosting projects. Even when entrepreneurs secure the pre-financing, donors' project fund disbursements are plagued by significant delays, adversely impacting these enterprises' operations, and sometimes interest on loans depletes the received project funds, further hindering their growth. This funding approach can stifle innovation and hinder the translation of research findings into impactful WASH solutions, deterring entrepreneurs from pursuing projects that could drive positive community change. A recommended solution is for donor agencies and financial institutions, upon selecting awardees, to actively assess entrepreneurs' financial status and release project funds incrementally. This approach would provide vital support, enabling prompt and efficient project execution, reducing delays, and alleviating financial stress. By tailoring funding to entrepreneurs' needs and releasing it strategically as projects progress, donors can create a more conducive and effective environment for implementing impactful WASH projects.

The fourth challenge is related to corruption. Certain individuals within donor agencies, financial institutions, and intermediary entrepreneurship support groups, including incubators and accelerators, engage in the practice of retaining a portion of project funds in the name of facilitation fees, lack of appreciation, depreciation, etc. The unauthorised withholding of these funds can have severe repercussions, hindering the progress of the entrepreneurs' initiatives and disrupting the intended impact of the financial support. As project funds are specifically allocated to project activities, any retention of these monies not only undermines the trust and transparency within the funding process but also creates significant obstacles for entrepreneurs striving to achieve their goals.

The adverse effects of such unlawful retention can be profound. Entrepreneurs may face financial hardships and encounter challenges in securing vital resources, leading to project delays or even cancellations. Additionally, the loss of project funds can stifle innovation and limit the scalability of ventures, preventing entrepreneurs from fully realising their potential impact. Moreover, this unethical practice undermines the credibility of donor agencies, financial institutions, and support groups, eroding the confidence of aspiring entrepreneurs in seeking funding and support for their projects. Addressing this issue is crucial for fostering an environment of trust, accountability, and equitable opportunity, where entrepreneurs can access the resources, they need to thrive and contribute to solving the WASH challenge.

Based on the interviews, the main recommendations that were identified are: to safeguard the interests of entrepreneurs, donor agencies and financial institutions must proactively adopt strategies that involve independent reviews of their funding processes. This is vital to prevent any potential extortion schemes that may be devised by internal personnel within the agency or institution to rip off entrepreneurs.

In addition, it is necessary to carefully assess and discourage the practice of providing financial support through third-party organisations such as incubators and accelerators. A critical review of such arrangements ensures that entrepreneurs receive much-needed financial assistance without being exploited or treated as mere cash cows in the process. Prioritising the protection and fair treatment of entrepreneurs should be at the core of these institutions' initiatives and policies.

Supporting and improving the funding conditions for WASH entrepreneurs is vital for achieving sustainable water management and access to clean water and safe sanitation. WASH entrepreneurs bridge the gap between research and practice, striving to deliver WASH services efficiently, and contribute significantly to SDG 6 targets. However, the lack of adequate funding attention poses a significant setback, hindering their ability to scale up impactful solutions. To address these challenges, donor agencies and financial institutions should engage applicants, provide timely feedback, adopt flexible overhead cost allocation, and offer advance funding for projects. Additionally, addressing corruption through independent reviews is crucial to ensure fair treatment and protection for entrepreneurs. By implementing these strategies, we can empower WASH entrepreneurs to make a substantial positive impact in delivering improved drinking water, safe sanitation, and hygiene services to communities in need, fostering meaningful advancements in the water and sanitation sector.

2.2. Water utility of the future: the role of YWPs in bringing vision to practice

Krisztian Mark Balla

In an era of increasing complexity, characterised by environmental, social, and economic challenges, YWPs can play a bigger role when it comes to the digitalisation of water and the adoption of technology in the sector. As we continue to navigate the digital era, there is exponential potential to advance water resource management through the application of progressive technologies, data science, and innovative digital tools. Youth engagement in technology and scientific advancements can bring about a transformative shift in the water sector and facilitate the transition to more sustainable and resilient water management practices. This text, thus, pivots around the idea of the 'Water Utility of the Future' focusing on how YWPs can influence the digitalisation of the water industry and what key roles they can play to accelerate this transformation. The text brings some practical implementation examples in the form of case studies, showcasing the impact of research built into practice.

The discussed case studies light on the synergy between technology and research, demonstrating their collaborative role in effecting substantial enhancements in water management practices. These instances underscore the significant potential offered by digital solutions, highlighting the importance of nurturing and channelling the abilities of YWPs. While each case study maintains its unique attributes, their collective insights offer a valuable perspective on the capacity of the water sector to leverage technology and the proficiency of YWPs to effectively tackle prevailing and emerging challenges.

The role of technology in water management

Digital water technologies, such as smart meters, Internet of things devices, and advanced analytics, have the potential to drastically increase the efficiency of water management systems. They enable real-time monitoring and control of water supply and distribution, allowing for the identification and resolution of issues like leaks and system inefficiencies. As a result, they can lead to significant cost savings and improved water conservation (*Sarni, 2021*). Additionally, digital platforms can serve as a catalyst for knowledge sharing, collaboration, and stakeholder engagement in water management. Platforms like the Water Information System for Europe (WISE) facilitate informed decision-making by

providing comprehensive, accessible information and serve as platforms for stakeholder engagement in water resource management (*European Environment Agency, 2020*).

Furthermore, digital water technologies can provide crucial resilience against climate change impacts. Predictive analytics and modelling tools can help in forecasting water supply and demand under different climate scenarios, informing long-term water management strategies. Remote sensing technologies can also aid in monitoring the effects of climate change on water resources, such as changes in water availability due to changes in rainfall patterns or glacier melt (*McCabe et al., 2017*).

However, the transformation towards digital water is not without its challenges. Conservative attitudes within the water sector, coupled with a lack of understanding about what digital water entails, often hinder the adoption of new technologies (*Hering et al., 2013*). The fear of cyber threats and concerns about data privacy and security are also significant obstacles, as the implementation of digital water technologies involves handling a considerable amount of data, some of which may be sensitive (*Li & Liu, 2021*).

Moreover, transitioning to digital water requires substantial capital investment. Many water utilities, especially in low-income countries, struggle with financial constraints that impede the procurement and maintenance of advanced digital technologies. Another significant impediment to the full realisation of the potential of digital water is the dichotomy between research and practice in water management. It is essential that the wealth of knowledge produced by academic research is effectively translated into tangible, implementable practices on the ground. YWPs, given their novel perspective and digital adeptness, are ideally suited to bridge this gap and instigate the fusion of research and practice in the sector (*Roux et al., 2008*).

YWPs can act as critical change agents in this context, thanks to their ability to navigate the digital realm with ease and their inherent inclination towards innovation (*Bodin et al., 2017*). By occupying roles within both the research and practitioner communities, they can bridge the gap between these groups, ensuring that research findings are effectively communicated to those who can implement them, and practitioner needs and experiences are adequately addressed within research. However, for young professionals to effectively bridge this gap, they need support from both the academic and professional communities. There is a pressing need for mentoring and capacity building programmes, along with opportunities for YWPs to take on leadership roles in research and practice.

Case study 1: empowering decision-making in wastewater networks through a level-based, data-driven approach

This case study revolves around a novel concept where automated decision-making is enabled by the deployment of water level sensors and utilisation of weather forecast data in wastewater systems (Balla et al., 2022). This approach was trailed in a pilot project in Ishøj, Denmark, where an efficient data-driven model was developed and implemented. The toolchain integrated system knowledge with parameter uncertainty, which was handled by Gaussian Processes. Through this methodology, a decision support system was created to manage the operation of storage elements optimally (Balla et al., 2022).

Experimental evaluation of the approach has been carried out in a pilot project, where five level sensors have been deployed in the network for a period spanning five months, while the rain data was obtained from the Danish Meteorological Institute's (DMI) service. The area and the sensor placements are shown in Figure 2.2-1.



Figure 2.2-1 – Stormwater network in Ishøj, where red dots denote the placement of water level sensors (M1-3.)

Source – The Author

The network is a stormwater system transporting the water from the city of Ishøj to the sea. There is a main transport line, along which there are stormwater basins with high volume capacity. The main focus of the utility is to carry out climate adaptation on their system. Conducting a survey with the operators of the water utility, the following issues have been identified and generalised for a network-scale storm water management solution:

1. 'Water volumes accumulate downstream in our network, increasing the risk of flooding in case of high intensity rain events. Moreover, high sea level at the downstream just intensifies this issue, making the downstream part of the network unable to release water'

2. 'Without any sort of control, the capacity of the upstream basin is not utilised, therefore all the water volumes are bypassing and propagate downstream'

In relation to the above issues, two more Danish wastewater utilities have been involved in the surveys. Both utilities are operating combined networks, facing additional issues, that is,

3. 'Climate adaptation is crucial because we cannot discharge rainwater when sea levels are high. Our operators spend a lot of time analysing pump data.'

4. 'Early-mitigation and warning of the treatment plant overload is needed due to the long transport times in our networks.'

5. 'Unintended water needs to be handled in our system. Optimisation of the pumping policies regarding unintended water and energy would be a start.'

To solve the above problems, better information about the behaviour of the system is needed. For this reason, we deployed level sensors in the two basins and three sensors

between the basins to learn how rain infiltrates into the network, and most importantly: how the upstream level variations affect the levels downstream.

The advantages of IoT and digital approaches as this one can be generalised in the following way:

1. Real-time Optimisation: It allows for a real-time response to high-intensity rainfall events, aiding in the prevention or at least attenuation of water surges in the sewer system.

2. Predictive Control: The use of water level sensors and weather forecast data for predictive control reduces the reliance on reactive techniques, improving efficiency.

3. Practical Feasibility: This cost-effective, plug-and-play solution is economically viable for even smaller operators who may not have the means for high-fidelity physical network models.

For this case study, a visualisation interface has been developed on top of the Grafana time series visualisation package shown in Figure 2.2-2.

From the collected dataset, 12 rain periods were chosen, which we used to evaluate the predicting capabilities of the proposed approach. An example of the training and validation results is shown in Figure 2.2-3.



Figure 2.2-2 – Grafana visualisation interface developed for the case study

As shown, the water levels are trained and validated on approximately half of the collected data, respectively. Moreover, 1-hour predictions are shown in Figure 2.2-4.

The results show that such a solution is capable of predicting reasonable levels and uncertainty measures solely using water level and historical rain gauge measurements as forecasts.

With the increased frequency and intensity of rainfall events due to climate change, the solution presented in this case study could be widely applicable in a variety of urban contexts. The use of sensors and data-driven models for decision-making could be deployed in many wastewater networks worldwide to optimise their operations in real time.

Furthermore, such solutions are designed for scalability. The model's ability to incorporate additional parameters and sensors allows it to adapt to larger networks. For instance, sensors could be installed at more locations within a network to increase the granularity of data and improve the model's predictive capabilities. Additionally, it can be integrated with other digital tools for holistic urban water management, extending its usability beyond just wastewater networks.

In conclusion, this case study underscores the transformative potential of digital technology and data-driven solutions in wastewater management. It emphasises the necessity of adopting innovative practices, particularly predictive control methods. This project stands as a testament to the pivotal role YWPs can play in bridging the gap between

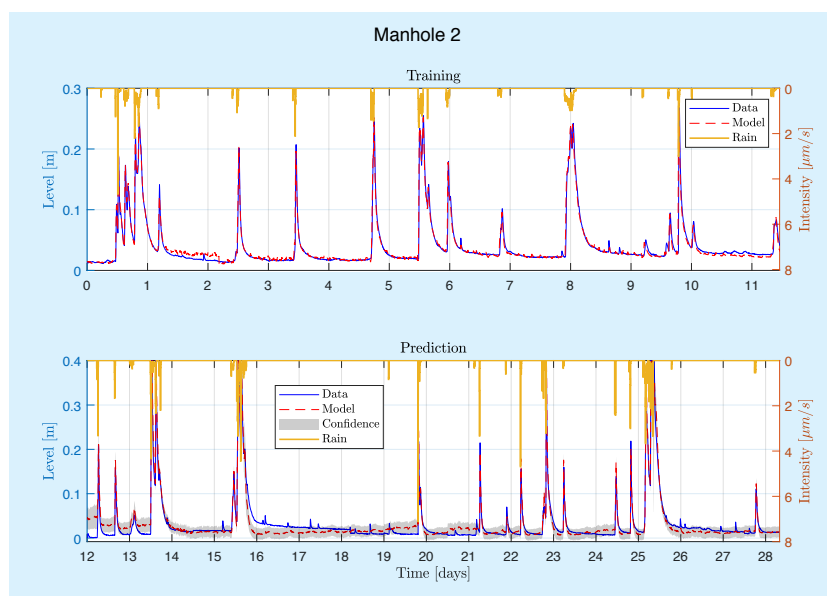


Figure 2.2-3 – Example of model training and predicted water level response with characterisation of the uncertainty based on the 12 rain events over a five-month test period from 16 June 2020 to 27 October 2020

academic research and field application. By harnessing their technological acumen and commitment to sustainable practices, practical solutions for pilot projects are possible to develop with a fairly low financial budget, improving operational efficiency and resilience against climate change impacts on water utilities.

The collaborative efforts of YWPs with established water utilities illuminate the path for effective knowledge exchange and swift translation of research into tangible solutions. Such symbiotic partnerships are essential for innovation, highlighting the importance of continuous learning, adaptation, and openness to new technologies within the water sector.

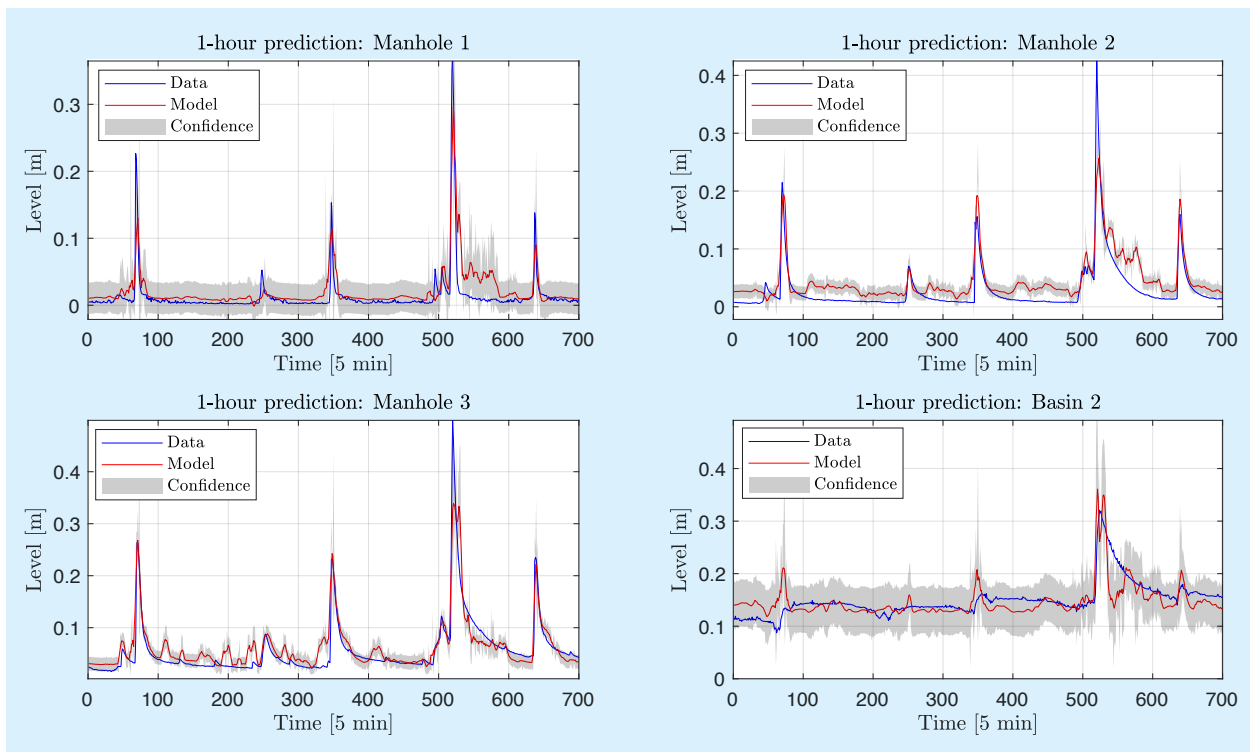


Figure 2.2-4 – 1-hour predictions verified over the validation set for the rain event between Day 13 and 14

Case study 2: achieving water-energy neutrality through intelligent optimisation of water distribution systems

This case study explores a progressive approach that utilises automated decision-making tools to boost the sustainability and affordability of water distribution systems, particularly in financially constrained countries. This strategy embodies the digital transformation movement within the water sector, aiming for a water-energy neutral outcome, efficient water supply system, and significant cost savings.

The proposed strategy employs water towers in distribution networks as storage units, with the intelligent manipulation of the timing and amount of water pumped into these towers ensuring a steady water supply. By shifting electricity consumption to periods of high renewable energy production (e.g., wind and solar), the solution offers environmental benefits and substantial cost savings through load shifting (WEF, 2022).

Between 2006 and 2030, the developing world will progressively account for an estimated 87% of growth in the world’s primary needs for energy (Sarkar, Ashok and Jas Singh., 2010), (IEA, 2008). This is mainly engendered by a combination of urban sprawl, population growth, and especially climate change. As such, there is a crucial need to help developing countries to build energy and cost-efficient systems across sectors and industries to ensure socioeconomic growth and development. In this regard, the

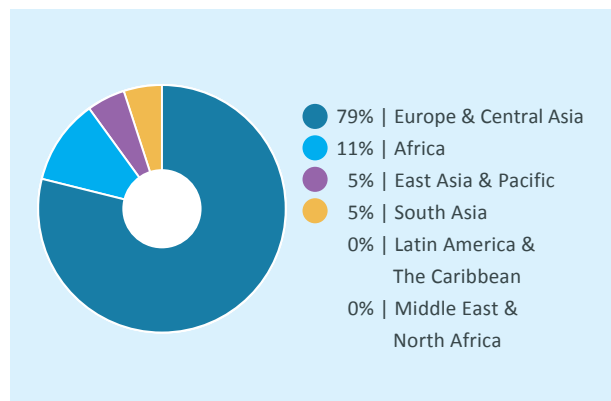


Figure 2.2-5 Regional breakdown of projects with explicit EE indicators

water sector plays a pivotal role in devising low-cost, low-carbon, and efficient water systems to reduce CO₂ emissions and increase access to water.

Two common and generalised issues collected, specifically for this case study are:

1. 'Water utilities often struggle with high operational expenditure, largely due to the significant energy costs associated with water distribution.'
2. 'Water distribution systems in many income-constrained regions are highly inefficient, leading to energy wastage and unsustainable operational costs.'



Figure 2.2-6 – Cloud-based solution visualised on an open-source IoT platform (Thingsboard, Inc., 2016). The dashboard shows demand and level predictions along with the flow scheduling of the pumps

Liu, Feng Ying, et al., (2012) assert that 'improving energy efficiency in water utilities is a basic means for controlling operational costs'. A study that was carried out under the Energy Sector Management Assistance Program of the WBG on urban water and wastewater operations revealed that, in general, energy efficiency incorporation in systems design and implementation is explicitly infrequent, particularly in the developing world. Figure 2.2-5 displays the sheer lack of energy efficiency in urban water and wastewater utilities across income-constrained regions.

Taking inspiration from the aforementioned, our main objective was to verify the proposed technology's efficacy and demonstrate its plug-and-play capability for scalability. To achieve this goal, we tested the algorithm on a laboratory setup, utilising an easily accessible edge platform and Microsoft Azure's cloud computing services. The test setup emulates the diurnal demand pattern of a city with a population of approximately 10,000. Day-ahead electricity prices were obtained through the Nord Pool Spot market system (Nord pool).

The proposed solution has been integrated with an open-source IoT platform, as depicted in Figure 2.2-6. The dashboard below displays the demand and level predictions, as well as the flow scheduling of the pumps. The algorithm updates on an hourly basis and strives to operate the system based on future electricity prices. As a result, it fills the water tower when prices are low and utilises the volume (emptying) when electricity prices are high. Our simulation study spanned 7 years, from 2016 to 2022, and focused

on historical electricity prices. The study's findings suggest that operating the network using the proposed solution, as compared to a simple on/off policy, could potentially reduce operational costs by approximately 15%. (The prices considered here exclude tax and commissioning costs.)

The algorithm learns from nominal operations and can function with any pumps and locally deployed hardware that satisfy the system's basic requirements. In conclusion, this case study highlights the profound impact of digital transformation and data-driven methods in the domain of water distribution and energy management. It underscores the urgent need to integrate innovative, low-cost solutions, particularly predictive control technologies in water utilities, especially within resource-constrained settings of the Global South.

The collaborative endeavour between YWPs and established water utilities sheds light on the path for efficient knowledge transfer and rapid conversion of research outcomes into implementable solutions. These mutually beneficial partnerships are crucial for driving innovation, underlining the importance of lifelong learning, flexibility, and receptiveness to emerging technologies within the water industry. As we move forward, such collaborations will play a key role in the transformation of the water sector, leading to a more sustainable, equitable, and energy-efficient future.

2.3. Youth acceptance of unconventional water for resilient natural rehabilitation

Muhammad Anique Azam

Young Water Professionals (YWPs) have their own narrative and perceptions when it comes to water resources in social, regulatory, and technical contexts. Their priorities are different, and this affects their consideration of the whole water cycle. These unique points of view are not easily incorporated into high-level decisions arenas, or even in regional and local decision-making processes. This text presents the results of a survey carried out from April 20th, 2023, to May 13th, 2023, that aimed to shed light on the following questions:

1. Do the respondents prioritise one water resource over the others?
2. Are the youth more welcoming of reusability and to what extent?
3. Given the trends of acceptance of specific forms of water in specific reuse, do geographical locations play a role?
4. Does being connected to a certain profession shape the way we reuse water?

Eight-three individuals from 38 different countries participated in the survey. The greatest number of participants came from Pakistan (12), India (11), and Brazil

(4). A healthy balance of genders participated in the survey, of which 87.8% were aged between 18 and 35. These were tagged as YWPs for the purpose of the survey, in line with IWA's description of YWP and 26% of the YWPs stated that they had attended the United Nations Water Conference 2023 in person. The top three categories of responder were from Academia (39%), Consultants (17%), and International Non-Governmental Organisations (NGOs) (13%).

From the geographical representation perspective, the responses from South Asia are most in number, comparable to the rest of the world. Responses were sparse from across Africa, but common from Europe although dominantly single from every country. Americas showed better response numbers per state but lesser country-wise participation overall.

Prioritising water resources

The diverse perspectives emerging from the survey results shed light on varying viewpoints regarding the prioritisation of water resources. The findings reveal a spectrum of opinions, with some participants emphasising the urgency of food security, depleting groundwater aquifers, and drawing upon practices in their local context, while others technically supporting the hydrological cycle, the historical importance of surface water, and the unique geography of every region. Additionally, the survey highlights the importance of region-based sampling for any techno-political decision revolving around water utilisation. This array of insights underscores

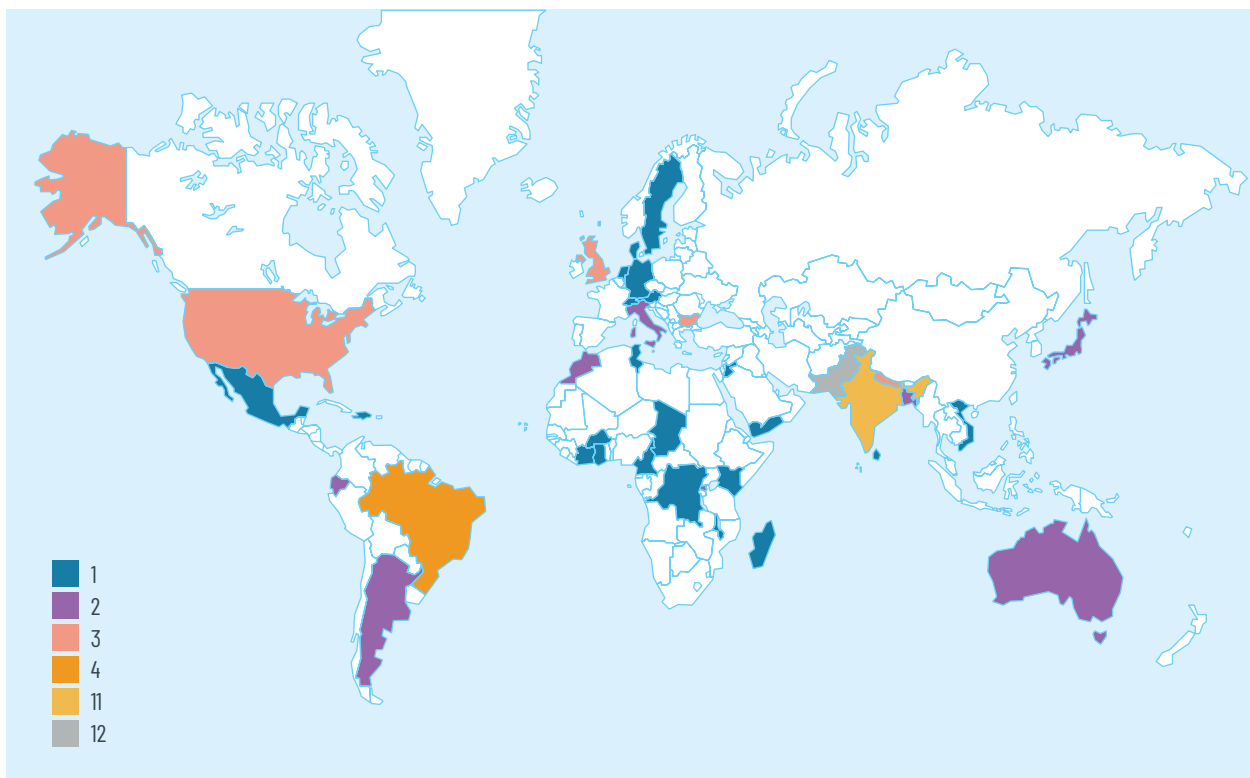


Figure 2.3-1 – Colour intensity map of the respondent's geographical location.



Figure 2.3-2 – Professional affiliation of the respondents

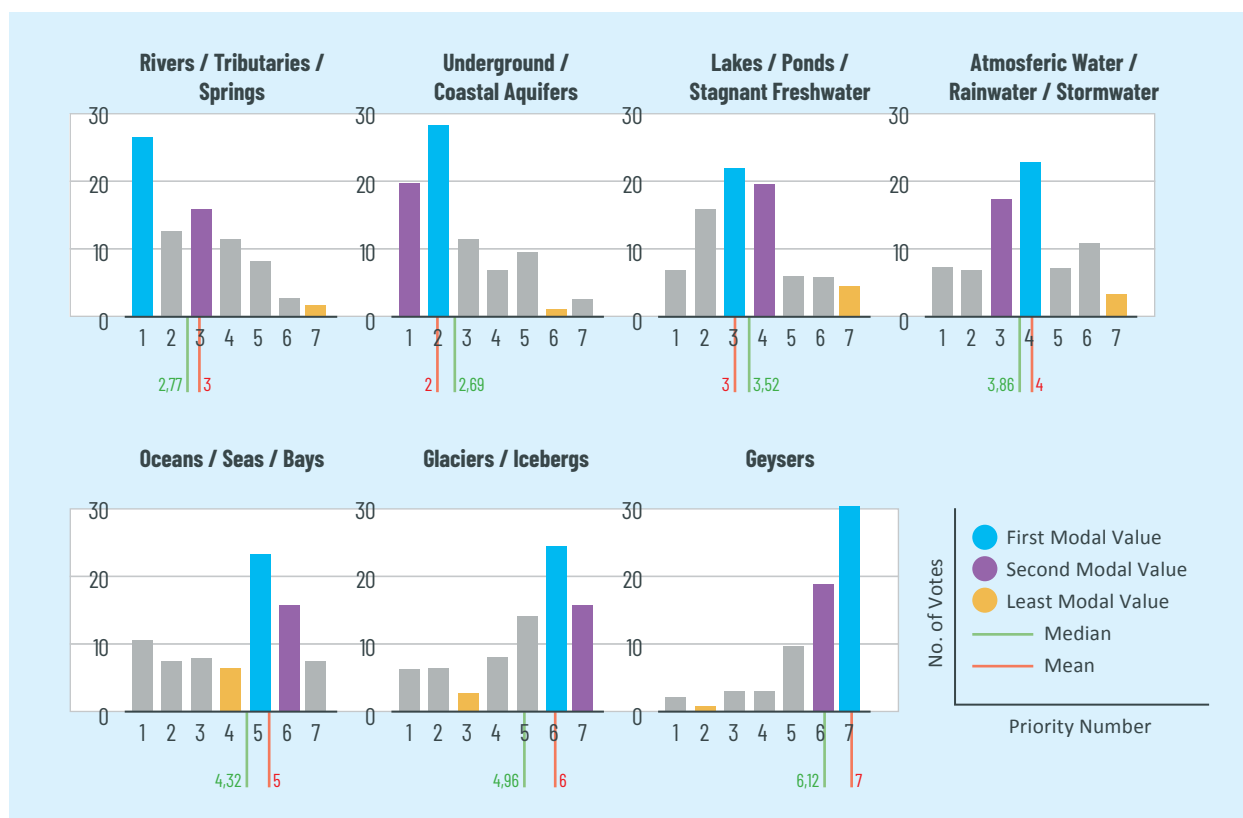


Figure 2.3-3 – A column chart of counts of priority numbers for each water resources

the complex considerations involved in prioritising water resources and the necessity of crafting comprehensive strategies that harmonise these differing viewpoints for the collective benefit of present and future generations. Some common features of the responses are:

- Some respondents replied that they wanted to place every resource as either first or second priority only, others criticised that the question was biased.
- The scientific literature plays an important role in shaping our understanding and thus prioritising some resources of water over others.
- Priority was also assigned to the resource’s usability, energy production, and abundance.

- Some drew upon their personal experiences to prioritise the water resource.
- Extreme events also shaped some responses as groundwater and rivers can be easily polluted and potability becomes an issue.

Prioritising water resources reveals an interesting pattern. This question harmonised the respondents from various regions, belonging to different professions, who collectively had chosen one unique value for every water resource (corresponding to the first modal value from the charts). The proximity of the first and second modal values is important because if a certain subset of the population held stronger views on prioritising one resource different from another subgroup, they would appear at a distance. Similarly, the

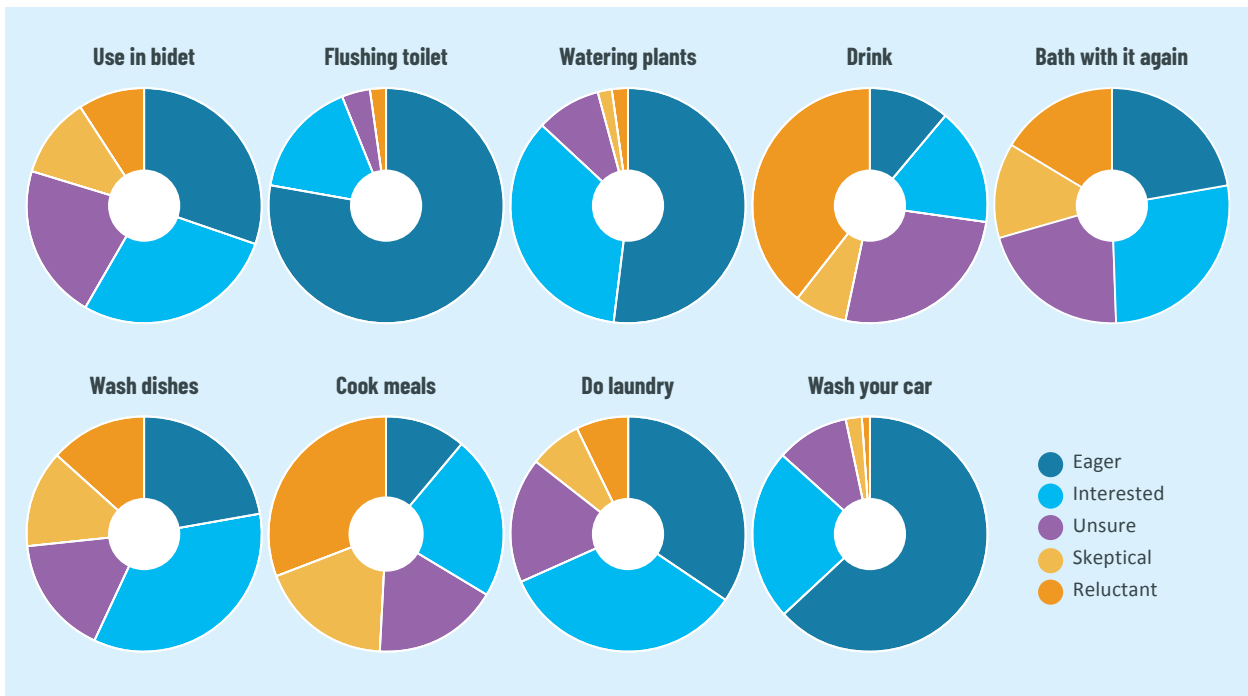


Figure 2.3-4 – Pie-charts for bath water reuse against common uses

farther the least voted value is from both the first and second modes, adds to the homogeneity in thinking of the sample. The first and second modes for all the water resources except the rivers are adjacent. This result may be attributed to the South Asian population accounting for almost one-third of the sample size. The rivers have played a vital role in the subcontinent symbolising religious virtues (Oestigaard, 2021), as well as relating to strong transboundary politics since the independence of the states from the British Raj. (Wirsing and Jasparro, 2007). Economically, the region is primarily an agrarian economy that mostly thrives on the tributaries of the Indo-Gangetic plain. (Desai et al, 1984). Technically, being the most evident source of surface water with energy to harness, and biodiversity, rivers are valuable for the world at large. (Evans et al, 1998)

Another interesting pattern can be seen for oceans. This resource falls between strong opinions as the least voted value is located right beside the first modal value. Expected reasons for this behaviour are the responses from the landlocked countries where respondents could not relate to the role of the sea in their daily life. A similar yet subtle trend is seen for glaciers for the same reason.

The mean and median values help identify the dispersion of the votes as they serve as additional measures of the central tendency. Statistically, if the mean, median, and mode coincide, the distribution is balanced for any given random variable. Here, we see the stagnant freshwater resource/lakes and rainwater, attaining a somewhat balanced (or

normal) trend, compared to other resources which are skewed. The respondents tend to keep them at moderate priority and without many conflicts in their responses.

It is important to understand why the various respondents chose to answer in the way they did. The survey form offered respondents the opportunity to submit additional comments to explain their choices. Some verbatim quotes are:

1. A technical consultant from Germany wrote: *The answer is solely based on current practice in a water-rich country. With groundwater sources dwindling and droughts increasing in future scenarios, harvesting rainwater to recharge aquifers and maintain stable flows in rivers will increase in importance. In water-scarce countries, desalinated ocean water is already a major water source and will grow larger in years to come.*
2. An academic from Bangladesh wrote: *It was a tough decision to make. However, after considering today's scenario where the main source of water for some countries around the world (river) is being polluted, I choose river water sources as the main Priority right now. If the river around us can be restored to its original forms and maintained, the other hydrological cycle will also come to its original forms.*
3. A researcher from Nepal wrote: *Coming from a landlocked country – the sea does not directly hold value, but I don't deny its importance. Lakes/wetlands also support carbon sequestration, communities and civilisation are formed around wetlands - having a larger connection to people.*

Reusing water

A crucial concern revolving around reusing water is the safety of it being reused. The respondents were asked would they use the water, if it was completely reusable and safe. This assesses only the cultural objections to reusing water. The water they had to use was the one they had bathed with.

It is noteworthy that the survey had modules of capacity building where the respondents were educated about the water cycle and unconventional water resources. By the water reuse pie charts on figure 2.3-4, some interesting inferences can be made. Respondents were very welcoming to the idea of washing cars and flushing toilets with the water they had bathed with, while they were distributed on all levels of satisfaction when it came to taking a bath with it again or washing dishes. Drinking and cooking meals were still not accepted. It is also interesting that for the responses not showing a high eagerness, around a quarter of the responses expressed their lack of acceptance including cooking, drinking, doing laundry, and washing dishes. These individuals tend to be nudged to take interest with proper awareness and trust building coupled with the need of conservation in local contexts.

Like the previous question, the respondents were asked for reasons for their choices. Some verbatim quotes are:

1. A technical consultant from Switzerland wrote: *The knowledge and trust I can have in my collection and treatment system, I guess.*

2. An academic from Bulgaria wrote: *It will be not economically and resource-wise effective to recycle water for those purposes in my opinion.* An IGO worker from the USA wrote: *Would love the option of reusing bath water - even if not treated to drinking water standards for toilet flushing and watering plants. Would want to know more about the treatment process to be 'eager' with regards to reuse for drinking but certainly open to it.* A practitioner from Australia wrote: *Knowing that if regulation is in place, quality will be suitable.*

Conclusion

The survey aimed to understand socio-technical barriers that halt water reuse practices. An attempt to educate the audience was made by introducing multimedia related to the water cycle and unconventional water resources. The responses spanned across Asia (dominantly South Asia), Africa (sparsely), the Americas, and Europe. The sample size of 83 random respondents assigned a unique priority number to every water resource, with the most common resources (rivers and oceans) showing subtle dispersion of the population voting behaviour. On the prompt to reuse water (from bathing) for certain common household uses, given that the water was fit for the said purpose and all under their usual living conditions, the responses showed exceptional satisfaction and eagerness to reuse the water for applications that didn't contact their bodies such as washing cars, or flushing toilets. Strong dissatisfaction was seen with using such water for drinking and cooking meals. A fourth of the respondents were unsure about many uses. Despite geographically weighted responses towards South Asia, effective awareness, marketing of economical technologies, and stringent reuse policies can make people interested in reusing water. Water seems to unite the multiple geographical regions on reuse, coupled with the mostly young sample size for the survey who are both interested in and aware of the water reuse.



Chapter 3 –

Empowering sustainable progress: water skills development and citizen science for climate adaptation

This chapter explores the intersecting realms of water skills development and citizen science as powerful tools for climate adaptation and sustainable progress. It showcases the structural manifestations of barriers to skills development and provides examples from around the world where citizen science initiatives have contributed to addressing skills development and water-related challenges.

In an era marked by the need for climate-resilient development, water skills development and citizen science emerge as key strategies for improving public health, livelihoods, poverty reduction, clean energy, and environmental sustainability. The integration of capacity development, citizen-generated data, and traditional knowledge into decision-making processes fosters holistic solutions that mitigate water management, land degradation, climate change, and biodiversity loss.

Youth engagement holds a pivotal role in expediting progress toward SDG 6 and the broader SDG agenda, particularly in the context of the escalating climate-induced water crisis. Thus, understanding the multifaceted barriers to water skills development between generations is paramount. This understanding forms the basis for robust initiatives and programmes aimed at attracting, nurturing, and harnessing youth's skills and talents for climate action and sustainable development, thereby addressing human capital investment needs in the global water sector.

As demonstrated in case studies from Ethiopia, Ghana, Mexico, and South Asia, citizen science has the potential to empower communities, enhance social dimensions of scientific knowledge, and enable inclusive and sustainable water and climate solutions. By adopting a human rights-based approach, citizen science can also address structural inequalities and empower marginalised populations in their pursuit of access to safe water and sanitation services.

In summary, this chapter delves into the critical intersections of water skills development and citizen science, emphasising the vital role they play in achieving sustainable progress and climate adaptation. Through practical examples and case studies, it becomes evident that harnessing the power of youth, traditional knowledge, and community engagement is essential for addressing the multifaceted challenges posed by water and climate crises. The subsequent sections of this document will delve deeper into these themes, providing insights and recommendations for empowering sustainable progress through water skills development and citizen science.

3.1. Water skills development: a cross-cutting accelerator for progress towards sustainable development

Charles Shachinda

Water is an indispensable part of life. It is an integral and cross-cutting enabler of virtually all critical aspects of social, economic, cultural, and political development. Today, the global water sector is increasingly being seen as a frontliner and a key accelerator for engendering a green global economy and ensuring the attainment of net-zero targets and the overarching SDGs. In the backdrop of the centrality that the water sector plays, however, the delivery of adequate, equitable, and quality WASH to vast populations, requires a set of systems, processes, and resources that must work interrelatedly to ensure good and sustainable service delivery.

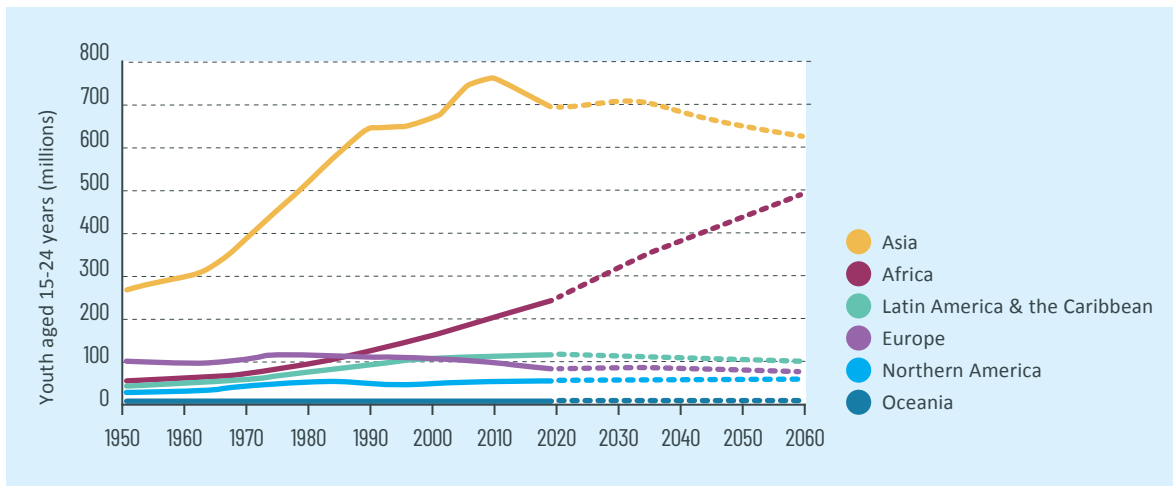


Figure 3.1-1 – Population trends for youth aged 15-24 years by region from 1950-2060
 Source – United Nations (2013) World Population Prospects: The 2012 Revision

At the heart of this interplay is the need for an adequate and qualified human resource that possesses the necessary technical and vocational skills and abilities to ensure the efficient delivery of WASH infrastructure and services for the attainment of SDG 6 and the broader SDG agenda by 2030 and beyond. Water industries, both in the developed and developing world, are experiencing a rising shortage of water skills. This challenge is comparably severe in developing countries, as urbanisation and population growth are also rising rapidly. Generally, the WASH skills gap challenge manifests itself in two ways.

On the one hand, there is the challenge of developing skills for new entrants to the sector, and on the other hand, there is the challenge of upskilling or strengthening the capacity of those who have already been working in the sector, as the sector's needs significantly evolve. According to the UN-Water's (2020) report on the SDG 6 Global Acceleration Framework, the onus now largely lies on local governments and WASH service providers, especially in developing countries, to strengthen their capacity in areas such as planning, financing, implementation, and monitoring.

The challenges that hinder water skills development, as well as young people's active and efficient participation and contribution towards managing and governing water resources, whether at the local, national, or global level, are multidimensional. Therefore, demystifying the barriers to water skills development in both their distinct and thematic or systematic forms is urgently needed. Its social, economic, cultural, and/or political perspectives as shown in figure 3.1-2 allows us to contextualise the wider challenge and use it as a basis to come up with solutions that respond to the specific needs of the youth.

The decisive role that youth plays in helping to accelerate progress towards achieving SDG 6 and the overarching SDG agenda cannot be overemphasised. With the already ongoing global climate-induced water crisis, there is now more than ever a crucial need to first explore and uncover the multifaceted barriers to water skills development among young people. This is necessary to develop robust initiatives and programmes that will attract, equip, nurture, and harness youth skills and talents for climate action and sustainable development. It is critical to meeting human capital investment needs in the global water sector, which will help bolster efforts towards achieving SDG 6.

Youth vibrancy and ingenuity present a positive force (UN-DESA, 2015) to help combat prevailing global threats and challenges, such as water and climate crises. Today, the youth population between the ages of 15 and 24 is estimated to be the world's largest ever, accounting for 1.2 billion young people – essentially a quarter of the global population (UNCCD, n.d.). Continental Asia and Africa are estimated to progressively continue having the highest population of young people in comparison to other regions (UN-DESA, 2015). By 2030, in Africa alone, the population of young Africans is projected to increase by 42% and more than double by 2055 (UNCCD; UN-DESA, 2015).

To promote discussion of this topic, a survey was deployed to the International Water Association and Grundfos Youth Action for SDG 6 cohort of fellows. The respondent sample was specifically targeted to encompass a youth cohort with a plethora of expertise and experience in WASH. The respondents were representatives of diverse lived experiences, working and/or conducting research in the WASH sector across Europe, Africa, the Americas, and Asia, indicative of a rich and broad mix of perspectives.

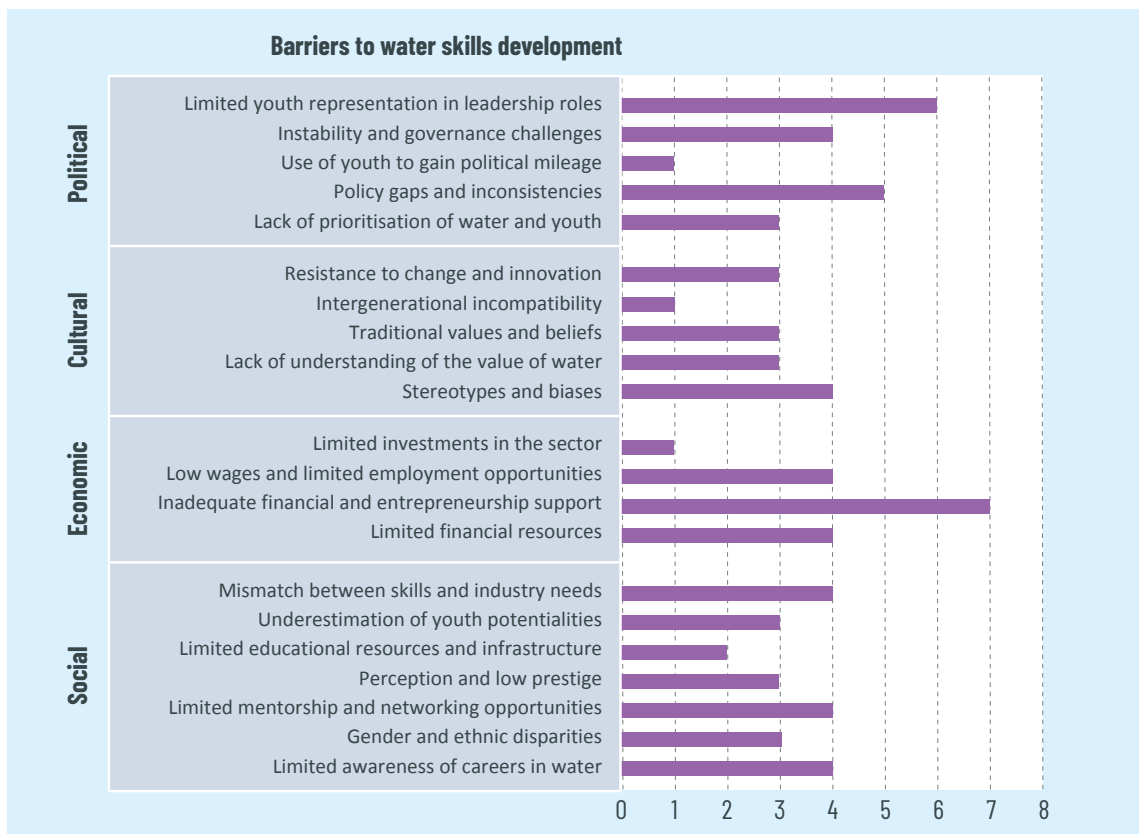


Figure 3.1-2 – Statements on the social, economic, cultural, and political barriers to youth water skills development

A total of 72 statements about the barriers to water skills development were collected and categorised into four thematic barriers: social, economic, cultural, and political. Furthermore, each thematic barrier was subdivided into sub-thematic barriers, under which the statements were appropriately classified. Statements relating to social barriers accounted for the highest number of statements received at 32%, followed by political barriers at 26%, economic barriers at 22%, and cultural barriers at 19%.

'Inadequate financial and entrepreneurship support' received the overall highest number of statements at 10% as an economic barrier, followed by 'Limited youth representation in leadership roles' as a political barrier at 8%. Finally, there was 6% for 'Limited awareness of careers in water', 'Limited mentorship and networking opportunities', and 'Mismatch between skills and industry needs' as social barriers; and 'Stereotypes and biases' as a cultural barrier.

The structural categorisation of barriers, as shown in Figure 3.1-2, demystifies and puts into context the often vaguely defined multidimensional barriers to development of youth water skills. This helps, on the one hand, both youth and older generations in positions of influence, to clearly understand the underlying barriers hindering youth integration into the water sector in their structural and systemic manifestations:

social, economic, cultural, and political. On the other hand, this serves as a baseline to devise setting-specific frameworks and models that effectively and efficiently help to upskill and develop the capacity of the youth in the water sector.

The world has, in recent years, shown great recognition for youth participation and a keen interest in nurturing and harnessing youth energy, skills, and talents to bolster efforts towards achieving the overarching SDGs. However, it is one thing to recognise youth potential and another to pragmatically harness it against the existing multidimensional hurdles that hinder youth integration. Therefore, it is crucially important for employers, international organisations, governments, policymakers, water sector leaders, and a host of players and cross-sectoral stakeholders to first understand the underlying barriers that themselves either continue to create and reinforce, consciously or unconsciously, or exist because of prevailing systemic and institutional social, economic, cultural, and political constructs.

3.2. A citizen science approach and guidance for adaptation in water and climate

Hadi Toure Guindo

The way forward for climate resilient development involves adaptive actions to improve peoples' health and livelihoods, reducing poverty and hunger and clean energy, water, and air (Calvin et al., 2023). These actions push for integrated policies and global data sharing strategies, as well as the adoption of holistic solutions with co-benefits to solve the interlinkages between water management, land degradation, climate change and biodiversity loss (Nyingi et al., 2023). When it comes to the analysis of large datapoints to extract actionable information and insights for improved water management, citizen science can be a solution (United Nations, 2020).

Examples in Japan, United States and United Kingdom have demonstrated how citizen science may solve key issues in ecology and conservation (Kobori et al., 2016). Research has shown that citizen science is already contributing to five SDG indicators and could contribute to 33% of the total of SDG indicators (Fraisl et al., 2020). Moreover, citizen science is an emerging opportunity to promote interaction and collaboration amongst different actors involved in hydrogeological processes, especially towards the governance of natural resources. Furthermore, several instances have shown that feedback loops in knowledge co-creation are possible when observed citizen science data is combined with existing global datasets to influence decision-making (Buytaert et al., 2014).

This text aims to present some examples where citizen science was implemented in relation to sustainable development, Agenda 2030 and SDGs. The cases presented here flow from different regions in the world, especially in the global south, encompassing young water professionals (YWPs) at the core of their conception, management, and implementation. They also testify that the integration of the knowledge co-production initiatives in the decision-making process, beyond activism and awareness-raising and the dissemination of the generated knowledge is a major challenge (UNESCO, 2023).

In the Upper Blue Nile Basin in Ethiopia, for example, high school students and farmers have received training to collect groundwater level, soil moisture and resistivity measurements that were used to validate regional groundwater models (Pateman et al., 2021; Rigler et al., 2022). The contribution towards the SDGs through the new data generated had social co-benefits: the students

forged new social and technical skills, along with the local farmers who felt empowered. This community participatory framework, commonly known as Citizen Science, has the potential to integrate social dimensions into scientific knowledge, therefore broadening the reach and impact of water and climate solutions.

Another example lies within the Ethiopian region. The region has demonstrated successful uptake of citizen science generated data in local decision-making in sustainable land management (water science policy, Walker 2023). The REACH programme, developed and implemented by International Water Management Institute (IWMI) and Newcastle University promoted the use of citizen science together with remote-sensing data to influence decision-making in the Amhara and Southern Nations, Nationalities, and Peoples's Region (SNNPR) in Ethiopia, implemented by the ministry of Agriculture and Natural resources (water science policy, Walker 2023).

These initiatives in Africa demonstrated the potential of citizen science. At the same time, they highlight the need for more collaboration from north to south to shed light globally on the priorities and methodologies adapted to conditions such as limited access to technology or poverty (Pateman et al., 2021).

Case Study 1: Valuing traditional knowledge for watershed and farmer-based erosion control practices in the Ethiopian highlands (Bahir Dar University and Cornell University Partnership)

With the advent of climate change, The Debri-Mawi watershed suffered severe land degradation resulting in governmental mitigation measures through water and soil conservation practices and farmer-led action for agroforestry (Mhired et al., 2019). One project through PEER (Partnerships for Enhanced Engagement in Research) from 2012 to 2017 looked at combining farmers' traditional knowledge with hydrogeological research to identify erosion control practices for the Ethiopian highlands. It also generated a physically based hydrological model to predict erosion hotspots, which were compared to traditional methods. The farmer's perception of their ability to change the formation of gullies in their agricultural fields was changed as well. Further information is available in the following blogpost: (Project 1-289 Ethiopia (nationalacademies.org)). In collaboration with Bahir Dar University, the Bureau of Agriculture of Amhara Region implemented the recommended measures from project research findings in their watersheds and is now up scaling the best practices from the pilot districts at regional level.



Figure 3.2.1 – Field images of High school students and farmers following citizen science training
Source – (Rigler et al., 2022).

In summary, this PEER-funded project helped improve collaboration between scientific professionals and local communities in raising water, environmental and climate change awareness. When developed with the community, solutions become more sustainable, require relatively low-cost data sources, and encourage public involvement (Theobald et al., 2015). The well upscaled practices from the research outputs were conditioned on the commitment of government combined with the active engagement of farmers in improving their livelihoods.

Case Study 2: Ahafo Ano southwest district in Mankranso upland watershed. Project: TAFS-WCA, citizen science for inclusive landscape management for decision-makers in Ghana

The TAFS-WCA project – Transformative African Food Systems – (West and Central Africa) is a regional initiative by CGIAR, a global research initiative. The expansion of subsistence farming and mining activities in the Ahafo Ano region in Ghana has caused an unsustainable use of natural resources and ecosystems in the Offin sub-basin (Atampugre et al., 2022). The model, generated from the analysis of CHIRPS (Climate Hazards Group InfraRed Precipitation with Station) remote sensing rainfall data, was able to predict the potential irrigation area from streamflow and groundwater recharge for increased water and food security for subsistent farmers (IWMI Webinar: Scoping the water resources for inclusive landscape management plan, July 2023). Because of limited availability of observed and validated remote

sensing data, the initiative partnered with KNUST (Kwame Nkrumah University of Science and Technology) to monitor groundwater levels, daily streamflow above and below the mining area and water quality of streams and wells. In a two-day citizen science workshop, a multidisciplinary team installed low-cost rain gauges, and staff gauges, hand-dug wells and identified water sampling sites. The use of local, low-cost instrumentation has been promoted as practical when using citizen science in other instances (UNESCO, 2023).

In the future, the project aims to continue collecting observation data through citizens to understand the water flow path and its quality and lobbying for inclusive landscape management planning. The comparative approach of using citizen science data for the validation of remote-sensing data enhances the value of the community’s generated knowledge. This approach defies the low uptake of citizen science research in academic journals and decision-making due to reliability issues (Nigussie et al., 2020).

Case Study 3: Dji Mansa: youth-led citizen science initiative in Sub-Saharan Africa for ecological sustainability

At the United Nations 2023 Water Conference, Action-Formation-Recherche en Eau (AFR’EAU), a social enterprise co-founded by IWA and Grundfos Youth Action 4 SDG 6 fellow, young water and sanitation professionals' associations (AJPEA) from Mali and Niger were allied about water quality, respect for indigenous knowledge and the ambition to work together through their shared river. From this partnership,

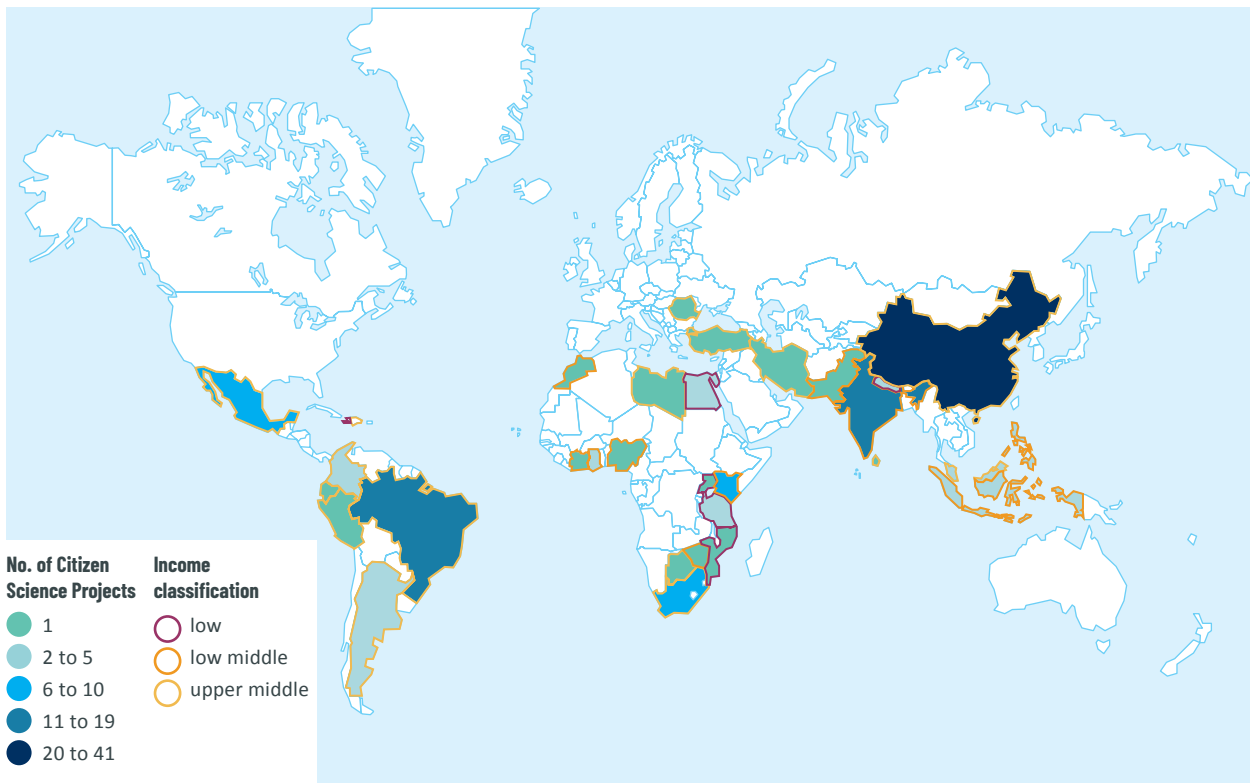


Figure 3.2-2 – Geographic repartition of Citizen Science Projects
Source – (Pateman et al., 2021)

IHE Delft, through the DUPC3 programme approved provision of funding to implement *Dji Mansa: Bambara for Water Masters*, a project that aspires to improve the quality of water in the Niger river by building awareness and trust amongst the stakeholders using West-African storytelling traditions. (<https://www.un-ihe.org/news/five-proposals-selected-funding-water-and-development-partnership-programme>). The project will take place from 2023 to 2025 will align with the DUPC3 programme’s strategy to promote ecological sustainability, addressing the root causes of climate change and contributing to strengthening the resilience of societies, especially marginalised groups in mitigating and adapting to climate change (DGIS & IHE Delft, 2021).

Dji Mansa explores interconnectedness of cultural heritage and water quality of the main river in West Africa: The Niger. Two of the cities that the Niger flows through are Bamako, Mali and Niamey, Niger. The cultural heritage is characterised by high diversity, but there is a cultural connection through the river and the people who live alongside it because in Niamey, Sorko and Bamako, Bozo ethnicities share a common title: ‘Masters’. In Niger, Sorko translates from the Songhai language as ‘Masters of the River’ (Wara, 2019) and in Mali, the Bozo ethnicity is referred to as *Dji Mansa*,

which translates from the Bambara language to ‘Masters of Water’. There is great depth of indigenous knowledge of the Niger in communities that have lived alongside the river for generations.

Case Study 4: Citizen science for skills development following a human’s rights-based approach

Human rights’ to drinking water, sanitation and hygiene are violated in many regions around the globe, including among the El Bordo inhabitant in Mexico (Calderón-Villarreal et al., 2022). In fact, the state of water quality of the Tijuana River has harmful impacts on the homeless population of El Bordo. They are often stigmatised and neglected in water and sanitation service provision. Active and meaningful participation empowers vulnerable people by strengthening their voices, and thus promoting inclusion in decision-making processes (Andres et al., 2018).

The Stockholm Environmental Institute adopted a human’s rights-based approach in performing citizen science for access to water and sanitation for the homeless in Mexico City. The project commenced in January 2023 and various stakeholders took part in a human rights to water and sanitation training on a voluntary basis. It used a co-creative

methodology, involving the citizens in topic selection, survey questions and location elaboration. An outreach programme including interactive workshops with games was conducted to boost participation in the data collection. The main tasks for the homeless were to collect pictures in a park and challenge their social skills by interviewing strangers. They were also trained on using the GPS to map the toilets around the area of study. The feedback from two 65-year old participants was their fulfilment in being useful again to society, though they received no compensation. This confirms the idea that the option for no compensation for citizens is successful in instances where their lives are positively impacted (Nigussie et al., 2020).

Case Study 5: TROSA (Transboundary Rivers of South Asia): A human rights-based approach to river dependent communities' participation in water governance

This 5-year regional governance programme, supported by OXFAM, brought together civil society, scientific community, and policymakers in an initiative to enhance citizen engagement in riverine governance policies across TROSA basins (Sehring et al., 2023) The citizen science initiative addresses common riverine issues including flooding, water quality, irrigation, erosion and unsustainable use of natural resources through focus-group consultations and trainings. The project set-up a women's empowerment centre in the Mahakali basin in Nepal together with a Water Governance Collective Action Network (WG-CAN) in India (Singh, 2020) with more than 378 volunteers engaged as citizen scientists and early warning volunteers. In Bangladesh, TROSA adopted a citizen science approach called Hilsa Watch to empower riverine community fisherfolk to enhance their compensation schemes for their harvesting activity. The government has undertaken measures to regulate the unsustainable harvesting of the Hilsa fish (Enamul et al., 2018).

Singh & Ruwudc, (2020, p.4) state that: 'The Hilsa Watch initiative has revealed that the expenditure of the fisherfolk families far exceeds the government compensation and that the seasonal and the geographical distribution and availability of the fish is skewed towards the coastal region comparison to upstream areas'. The Hilsa Watch example demonstrates the methodology of the human rights-based approach that seeks to investigate the root causes for structural inequalities. It also showcases how citizen science can be used as a tool to equip local communities with evidence-based knowledge for assessing the efficiency of government policies in place.



Chapter 4 –

Water collaboration across boundaries: navigating transboundary cooperation, cross-sectoral engagement, and scientific partnerships within the 2030 Agenda

Cooperation among various stakeholders and sectors is crucial for achieving the UN Sustainable Development Goals (SDGs), including SDG 6. Despite progress in achieving these goals, the Sustainable Development Goals Report 2022 emphasises the need for a fourfold acceleration in progress to meet drinking water, sanitation, and hygiene targets by 2030 (United Nations, 2022). To accelerate progress, better cooperation and, more importantly, collaboration across boundaries are required. This includes transboundary and international cooperation, cross-sectoral engagement and scientific partnerships, commonly aligned on the Water Action Agenda.

Water resources serve and are affected by multiple stakeholders, so water cooperation and collaboration should be inclusive of a wide range of stakeholders including government, private sector, the scientific community, civil society, Indigenous people and community groups, at all levels. Considering diverse values and perspectives in water solutions can generate benefits that accelerate progress.

This chapter focuses on the role Young Water Professionals (YWPs) play in fostering collaboration and engaging various stakeholders and sectors in action on SDG 6. The first sub-chapter discusses youth engagement as an approach to raise awareness on key water challenges and opportunities among the broader community. It outlines a case study in which a workshop and game were developed for school-aged youth in Australia to teach them the value of water and how they can contribute to achieving SDG 6. Early results show that engaging youth on these topics can increase their motivation to raise awareness of water challenges in their communities.

The second sub-chapter discusses a podcast designed to make water visible to all. It outlines how the Finding Water Podcast brings together water industry experts and public

audiences on the topics of water diplomacy, inclusive research, and the future of water, with guests selected to promote intergenerational and cross-sectoral conversations.

The final sub-chapter outlines a standardised approach to attain water positivity across all sectors. It discusses the process of ideating, defining, and standardising a framework for water positivity to make it more transformative, going beyond mere conservation efforts. The approach is applicable for industries, institutions and households, optimising water use efficiency to create a net-positive impact on water resources. It also outlines the role of youth in driving collective action towards this watershed development tool and achieving water-saving goals.

4.1. Youth engagement for action on SDG 6

Chelsea Hayward

The water sector is acutely aware of the global water crisis and the threat it poses to humans and the environment; however, unless they are directly facing the consequences, the broader community is typically not aware of the scale and seriousness of the issue, particularly those who have easy access to water. Often when an issue is not a priority for the general public, it does not sit high on the political agenda, thus stifling progress towards solutions. While technical solutions play an important role, progress towards achieving SDG 6 requires a much greater response, including drawing attention to the global water crisis and raising awareness of the key water challenges among all members of society.

When considering stakeholder cooperation for progress on SDG 6, it is easy to focus on the significant contributions of policymakers and water sector professionals; however,

community engagement is equally essential. The broader community holds the potential to drive grassroots change and should be acknowledged as a significant stakeholder in the water action agenda. Although some aspects of policy and technical solutions may be beyond the reach of many community members, their active participation remains vital, fostering collective awareness and understanding of the value of water.

As youth become increasingly conscientious and active participants in global society, they play a key role in raising awareness of and driving action towards achieving SDG 6. Young people have the potential to become agents of change in their communities by taking action to address water challenges. With a strong foundation of knowledge on the key issues and a passion for creating change, they can advocate for action and enlighten their peers, their families, and the wider community, acting as catalysts for a broader sense of empowerment in communities to contribute to creating their own positive outcomes.

To make meaningful contributions to water action, young people need to be educated on the water crisis and potential solutions. This is where youth education and engagement initiatives play a vital role, building awareness and inspiring the next generation of change makers. This sub-chapter presents an innovative youth outreach workshop that was developed and delivered in Australia as a pilot to raise awareness of the value of water and key water challenges and inspire Australian youth to drive action towards achieving SDG 6.

Approach to youth engagement

The workshop that was developed aims to educate young people and provide them with tangible actions they can take to become agents of change and water advocates in their communities. The workshop also presents a career in the water industry as one that is purposeful and filled with a variety of opportunities with the aim of inspiring young people to pursue a career in water.

In designing the youth outreach workshop, there were a number of objectives considered. The key objectives for the workshop are to:

- Raise awareness and knowledge of SDG 6 among young people, inspiring them to be agents of change.
- Increase awareness of SDG 6 and the actions that can be taken within the community to address the targets.
- Bridge connections between generations, united on a common cause; and
- Inspire young people to pursue a purpose-driven career in the water industry.

The target audience for the pilot workshop is Australian youth aged thirteen (13) to eighteen (18), particularly those who have grown up with easy access to water. This demographic was selected as they typically have some awareness of sustainable development challenges, particularly around climate change, enabling the inclusion of more complex concepts than younger audiences. Having had easy access to water, this demographic has potential for significant learning around valuing and caring for water and raising awareness in their communities.

There are a range of approaches to engaging youth on important topics from facilitated discussions to hands-on activities with the key element being an interactive component. The key is finding an approach that grabs young people's attention and generates ideas and learning. There is a range of activity ideas and resources available online for educating young people on various water topics, including a variety of virtual games; however, it is difficult to find an option for a game that is supported by group discussions and teamwork and that can link to the SDGs. The piloted youth outreach workshop discussed here addresses this gap by incorporating a face-to-face interactive game that requires participants to collaborate with team members to find a solution.

Gamified learning

The key component of the workshop is a game that challenges participants to consider the complexities of water supply systems. The game centres around water supply in a fictional region. Participants must consider a range of water users and water sources and make group decisions around how to supply limited water at the lowest possible cost and with the least social and environmental impact. Teams are presented with different scenarios, including population growth and drought, and must think carefully about how much water they will supply to each user and what water source(s) they will use.

While the game is designed to simplify the water supply system, it highlights many of the complex factors that must be considered in a typical supply system, while also introducing challenges around climate change and water access inequalities. The concept of cooperation among different stakeholders is also incorporated with team members representing different water users and their interests.

To strengthen educational outcomes, the activity is supported by a presentation and additional short interactive activities on either side. The introductory presentation provides a broad overview of how water is used, where water comes from, water access around the world and key water challenges such as inequality of access, water scarcity

and water pollution. An overview of the UN Sustainable Development Goals is also provided with a focus on SDG 6. To keep youth engaged in the topics, the presentation includes visual prompts and discussions.

Following the activity, workshop participants take part in a moderated discussion on the game and its real-world links to sustainable water management, and step through the development of their own action plan to contribute to SDG 6 and raise awareness in their communities. Participants are encouraged to begin with simple tangible actions such as calculating and reducing their personal water consumption and sharing their learnings with families and friends. They are also encouraged to learn more about careers in the water sector.

Leveraging YWPs in workshop design and delivery

Involving young water professionals in the design and delivery of the youth outreach workshop was key to ensuring it is engaging and relatable for young people. The passion and ideas that YWPs brought to the project were very valuable as they were able to draw on their own experiences and perspectives as youth themselves.

Key inputs from YWPs included ideas on workshop themes and topics, activity / game concept and structure, and insights on why they enjoy working in the water industry which are used in the workshop to showcase careers in water. YWPs also led the delivery of the pilot workshops, ensuring there was a balance between having facilitators that are relatable, but who can also draw on professional experience in the water industry and have authority on the topics.

Pilot workshop outcomes

The workshop was piloted across three (3) Australian schools in August and September 2023. In total, there were 112 participants across three (3) 60 to 90-minute workshop sessions. All participants were aged fourteen (14) to sixteen (16) years old and were of mixed gender. Note that workshop outcomes were not linked to participant demographics.

Minor adjustments were made to the workshop between pilot sessions based on delivery and feedback from facilitators and participants. This included shortening the introductory presentation and updating the game instructions for improved clarity. To determine the outcomes of the workshop, participants completed pre- and post-workshop surveys. The surveys asked participants to rate their responses to the following questions on a scale of 1 to 5.

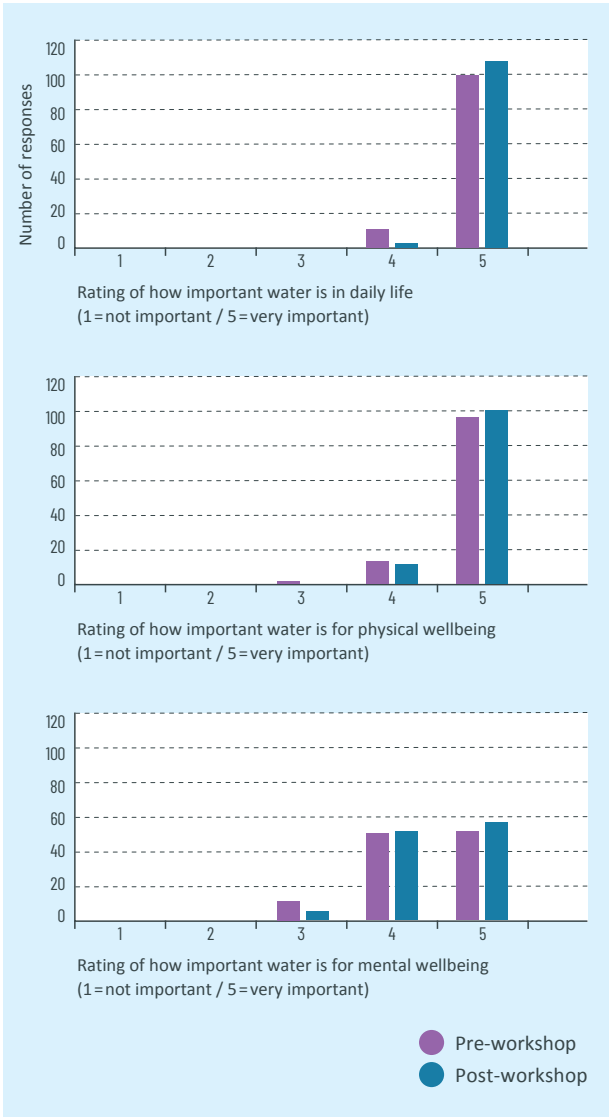


Figure 4.1 1 – Pre- and post-workshop survey responses to the question “how important is water in the following areas: a) daily life b) physical wellbeing c) mental wellbeing?”

Question 1 asked “how important is water in the following areas: a) daily life b) physical wellbeing c) mental wellbeing?” A rating of (1) meant “not important” and a rating of (5) meant “very important”. The survey results are shown in Figure 4.1-1.

Survey results show that there was already a high appreciation of the value of water in daily life and for physical wellbeing among participants. While appreciation was also high for the value of water for mental wellbeing, results are more spread than for other areas. There was an insignificant difference in pre- and post-workshops responses.

Question 2 asked “how often do you actively think about your water use / will you think about your water use more often going forward?” A rating of (1) meant “rarely/very unlikely” and a rating of (5) meant “daily/very likely”. The survey results are shown in Figure 4.1-2.

Survey results show that some participants actively thought about their water use prior to the workshop, but there was a marked increase in those who would think about it more often going forward. Question 3 asked “how aware are you of key water challenges (e.g., water access, water scarcity, water pollution)?” A rating of (1) meant “not aware of any challenges” and a rating of (5) meant “very aware of many challenges”. The survey results are shown in Figure 4.1-3.

Survey results show that there was some level of awareness of key water challenges among participants prior to the workshop, which may be linked to water topics covered within the Australian curriculum. Results show a small increase in awareness following the workshop. Question 4 asked “how motivated are you to increase awareness of water challenges in your community?” A rating of (1) meant “not motivated” and a rating of (5) meant “very motivated”. The survey results are shown in Figure 4.1-4.

Survey results show that prior to the workshop, there was little motivation among participants to increase awareness of water challenges in their communities; however, there was some improvement after the workshop with more participants indicating that they are somewhat motivated to raise awareness.

Question 5 asked “how interested are you in a career in the water industry?” A rating of (1) meant “not interested” and a rating of (5) meant “very interested”. The survey results are shown in Figure 4.1-5.

Survey results show that there is generally little interest in careers in the water industry. After the workshop, responses to this question improved; however, interest remained at the lower end of the scale.

Key takeaways from the pilot workshop outcomes can be summarised as:

- While appreciation for the value of water is high when asked about it, the appreciation is not equal across different areas, particularly the role water plays in mental health.
- Raising awareness of how we use water and how much we use may increase the amount of time youth actively think about their water use.
- There is some understanding of water challenges among Australian youth, but this may be improved through awareness initiatives and campaigns.

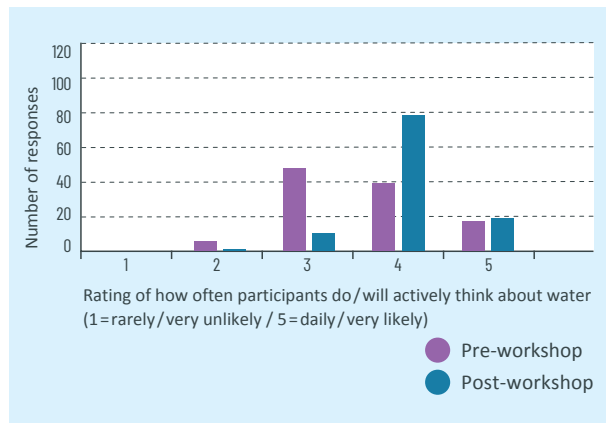


Figure 4.1-2 – Pre- and post-workshop survey responses to the question “how often do you actively think about your water use / will you think about your water use more often going forward?”

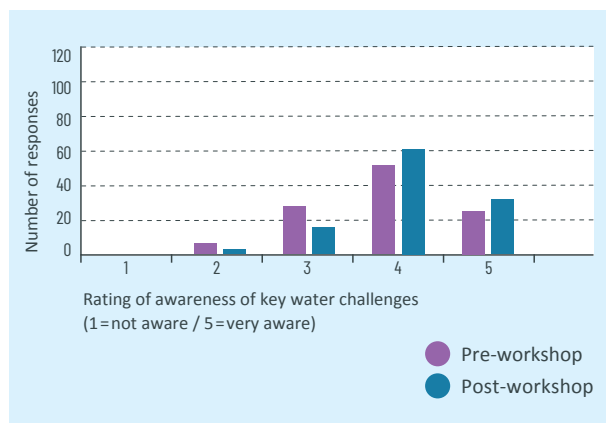


Figure 4.1-3 – Pre- and post-workshop survey responses to the question “how aware are you of key water challenges (e.g. water access, water scarcity, water pollution)?”

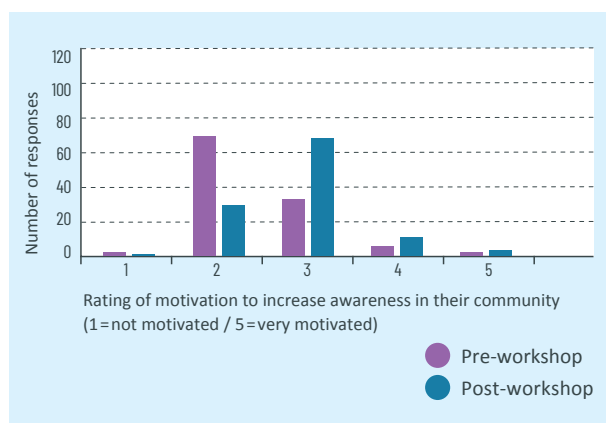


Figure 4.1-4 – Pre- and post-workshop survey responses to the question “how motivated are you to increase awareness of water challenges in your community?”

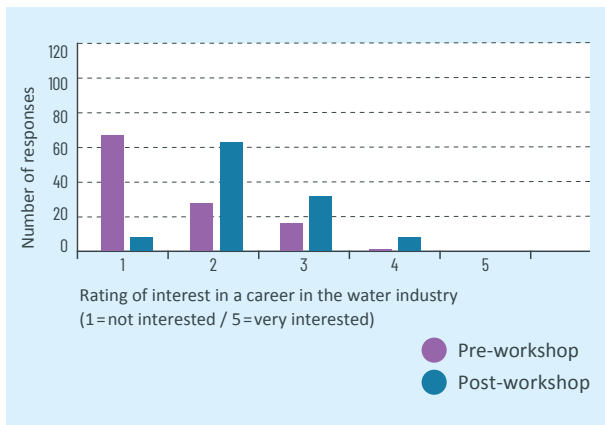


Figure 4.1-5 – Pre- and post-workshop survey responses to the question “how interested are you in a career in the water industry?”

- Increasing awareness of the value of water and key water challenges at a high level, may increase motivation for youth to drive action in their communities to some degree.
- Further work is required to increase interest in careers in water.

Overall, the results show that the pilot workshop was successful in meeting its objectives to some degree, particularly around increased awareness of SDG 6 and actions that can be taken within the community to address the targets among young people.

Opportunities for further development

Through the design and delivery of the pilot youth outreach workshop, a number of opportunities for further development have been identified. These include:

- **Creating a series of water workshops.** Additional workshops provide the opportunity to cover more topics in detail as the world of water is too vast to cover in a single workshop. These workshops could be delivered in sessions over the school year. There is also potential to more broadly cover the UN SDGs and how they are connected, with water playing a key role in many of the goals.
- **Incorporating a greater focus on youth action.** Dedicating more time in the workshop or introducing a specific workshop that focuses on youth creating individual action plans may highlight the importance of action on global water challenges and better prepare youth to become agents of change within their communities.
- **Providing additional training.** In line with the previous point, additional training in key messaging, public speaking and advocacy can empower and prepare youth to become agents of change and water advocates in their communities.

- **Delivering workshops outside of schools.** Expanding workshop delivery to other youth group and community settings may increase the reach of youth engagement. It also presents the opportunity for young people to bring their friends and families along to get involved, further raising awareness within communities.
- **Developing the workshop activity into a more formalised game.** The game that forms the key component of the workshop has the potential to be developed into a board game or virtual game. This could be made available to the general public or to educators as a teaching resource.
- **Expanding the target audience.** The workshop could be adapted to suit different age groups and geographies to increase its reach within Australia and globally.

4.2. Finding Water Podcast: making water visible to all to accelerate water action

Inês Breda

Accelerating water action requires coordinated movements of multiple stakeholders. For each of the stakeholders to find their role in water action, it is crucial to make the many values of water visible to all. Water, along with the associated impact of climate change, represents one of the biggest societal challenges of this century. A challenge that needs to be met with concerned global cooperation and action. Water cooperation requires an understanding of the values of water and the cost of inaction, and this understanding is based on the central element of trust. Trust can only exist if a) all parties are fully informed, at the very outset of an initiative, of all the associated advantages and disadvantages, and of the ultimate results of the action; and b) if all social sectors within the affected communities are truly engaged (Water Europe, 2023).

There is a need to activate a sense of common purpose in all sectors of society. Both bottom-up and top-down approaches must be pursued, to achieve the necessary global and societal consensus that will guarantee effective intra- and supra-national policy continuity, implemented within local communities. The probability of forging such a sense of purpose depends on the willingness of all sectors to participate in a genuine social partnership and dialogue while recognising each sector’s independent roles, responsibilities, and special capacities.

The Dublin Statement on Water and Sustainable Development (1992) refers to a participating approach by raising awareness of the importance of water among the public (Partnership). More recently, in his last message as Special

Water Envoy, Henk Ovink calls us to be *#waterambassadors* (Ovink, 2023). Being a water ambassador brings a ‘multiplier’ effect, as raising awareness leads to concern, concern leads to engagement, engagement leads to social consensus, and social consensus leads to political action (Elelman & Feldman, 2018). In addition to facilitating local, national, international, and cross sectoral cooperation, raising water awareness is also crucial to make water careers visible.

The water sector faces challenges with an aging workforce, and there is a shortage of interest in careers related to sanitation. There is low representation of women in the workforce and low female graduation in universities. The female role in water is also described in the IWA report titled *An Avoidable crisis - WASH human resource capacity gap in 15 Developing countries*. A key recommendation from this report is to find new incentives to attract newly qualified and skilled personnel and retain experienced personnel within the sector and reverse a professional drain to other sectors. Young water professionals are key to shift that paradigm. Showcasing that youth can have a role in climate action through the water agenda can bring new skills to the sector and prevent the deceleration of action at a critical time. In a global world running at full pace, awareness must be raised by genuine, accountable, and authentic voices, available online 24/7 in a widespread language.

The Finding Water Podcast ³ was created to fill this gap, inviting the general public to see and understand water, making water careers visible to the next generation of water professionals and increasing intergenerational communication among seniors and young water professionals. The ambition is to make water visible to all through inclusive dialogues from experts to society. The Finding Water Podcast aims to share the values of water through the voices of those experiencing water, the struggle, the success, the fear, and the flame that drives researchers, local politicians, advocates, and influencers. Ultimately, by making water visible to all, the Finding Water Podcast will activate a multifront wave capable of accelerating water action.

Each episode will have two guests, a water expert, and an active listener outside of the water sector representing the public audience. The selection of the guests considers both age and educational background to promote intergenerational conversations and cross-sectoral backgrounds. These two transversal commitments ensure that we communicate water across generations and beyond the water sector bubble.

The three thematic pillars: water diplomacy, inclusive research, and future of water

The decisions around the thematic pillars started during the initial formulation of the podcast and were connected to an arts assignment that was given to 12-year-old students from Porto, Portugal. They were asked to show their view of the ocean. One of them, a young girl, combined an aquarium, an old maths book, a blue plastic bag, wood sticks, and two threads one black and another green. This was her ocean. She explained to the class that the origami fishes made with her old maths book represent statistics on biodiversity decline. The plastic bag is now the plastic waste spread across the ocean. The wood sticks, a lifeless coral reef, and the black thread, the overfishing.

When asked about her future, a water career was not among her options. The young girl was not aware that a water job can intersect with others jobs. And this is was a common perception among our students that reflects the general understanding of the society. Water jobs goes beyond the public’s perception of water jobs (plumbers and technicians), and many professional skills can be used in the water sector. From advocacy, diplomacy, computer science, technical expertise, management, innovation, product development, through to research, and others.

The Podcast’s development also considered some of the global trends and initiatives related to young people. The latest Global Risks Report (WEF, 2023), for example, detected strong signs of youth disengagement, lack of confidence and loss of trust in existing economic, political, and social structures on a global scale. The report noted that part of this youth disengagement is connected to climate action failure and lack of political awareness. Political continuity and progress in green agenda can be compromised as most youth do not trust that the responsible bodies know how to coordinate action.

Another inspiration is drawn from the 303030 Youth Target, designed by Noémie Plumier in 2022 and launched during the Second International High-Level Conference on the International Decade for Action “Water for Sustainable Development” ⁴, held on 6-9 June 2022 in Kokhi Somon, Dushanbe, Tajikistan. The initiative, supported by many organisations of the Global Youth Movement for Water, aims to increase by 30% the number of people aged under 30 who work in the water sector by 2030.

Finally, it considered that there is a need to increase the literacy of the public to show water in fashion, food, energy, construction, etc. At the same time, we should use the link between water experts and the public to understand the readiness for the implementation of new technologies

³ Available at <https://open.spotify.com/show/4DnKMUnePwAG64VgfyqSE3?si=2d817e6941bf41ed>

⁴ More information about the event can be found here: <https://iwa-network.org/news/lessons-learned-from-the-un-water-conference-in-tajikistan/>

and solutions. For example, some communities might be interested and ready to reclaim rainwater and use it for toilets, while others would rather use reclaimed water for agriculture. The Podcast was created considering that is key that the next generation know how they can use their talents to advance water action.

It recognises that there is a strong need to let youth attain game-changer positions in the organisational structures of the private and public water sectors. In order to enable this, the themes of the conversations are organised in three verticals: Water Diplomacy, Inclusive Research, and the Future of Water. The selection of the themes was based on the outcomes of the UN Water Conference 2023, Water for Cooperation Interactive dialogue and the launching of the 2030 initiative. Other supporting themes will also be included in the podcast series, such as the connection between water and arts, water history, diversity, sustainability, and communication.

On the topic of Water Diplomacy, the podcast will focus on transboundary water management while demystify governance and sharing the journey of water diplomats with the public. Sixty percent of the world's freshwater flows come from transboundary waters. These waters are shared by 153 countries, each having territory within at least one of the 286 transboundary river and lake basins and 592 transboundary aquifer systems. However, in many countries, transboundary cooperation is lacking, and not all their transboundary basin areas are covered by operational arrangements (UN-Water, 2022).

The interconnected nature of these waters means that actions taken in one country can have far-reaching consequences in others. Overexploitation and pollution of lakes, rivers, and aquifers can pose risks to ecosystem services across borders. For example, if a country unilaterally constructs a dam, it could significantly reduce the downstream flow of a river in another country (UN-Water, 2022). Upstream activities also pose threats to coastal resources. Depleted aquifers can lead to saltwater intrusion in coastal areas, along with increased concentrations of harmful substances like arsenic and fluoride (UN-Water, 2022).

As Maria Guayan said *“The more scarce the resources are, the most difficult it is to develop cooperation”* Lack of action will threaten peace and enhance migration. The solutions for



Figure 4.2-1 – Documenting the journey of the Podcast

transboundary water management have been defined (e.g., governmental cooperation, protection of transboundary ecosystem services, economic integration across borders, and data gaps must be addressed) but there is still a lack of understanding of the urgency by all the key stakeholders.

The second theme, Inclusive Research, in the context of the podcast, refers to the work developed by students and researchers of the global south to increase understanding of the impacts of water challenges and possible technical solutions. Over the past years, for example, YWP chapters of Denmark and Ghana have put collective effort in to organising workshops on Applied Research and its importance to accelerate water action in Global South. At the last YWP International Conference in Toronto (2019), the workshop concluded that PhD students were being evaluated by the number of citations and publications rather than the impact that their studies could have in solving the water challenges. The topic was developed further together with the YWP Malaysia chapter at the IWA World Water Congress and Exhibition 2022 in Copenhagen, illuminating into the link between young researchers and entrepreneurs.

At a time where local implementation of water solutions is crucial, there is a strong need to accelerate inclusive research by seeking a cultural fit between the scope of the research and the researcher. Ideally, research should include the entire five-helix understanding (academia, industry,

governance, citizen, and environment). Currently, there needs to be more access to facilities or methodologies that could support local researchers to drive solutions for their communities. For that reason, the Global North has been leading research for the Global South which retracts its ownership and cultural understanding of the local five-helix dynamic. Further, unfitting research meets high obstacles in implementation.

Firm steps have been taken to make research available to non-English speakers (e.g., IWA Publishing Open access commitment and multilanguage publications). However, there is still a need to tackle equality and fairness in global research publication – a global south vs global north perspective (e.g., ensure an inclusive peer review process that accommodates the cultural understanding of applied research).

The topic of inclusive research has also been addressed at the UN 2023 Water Conference with participation of IWA in the *Inclusive Science for Water Security side event*. In addition to raising the issue of the lack of southern globe authorship, the side event also referred to the need of local documentation of water stories beyond scientific research. Dissemination goes beyond scientific publications. Asking researchers to thrive within an environment that does not measure their real contribution to the sector has to stop.

The YWP chapters of Ghana, Denmark and South Africa are proposing a workshop entitled “Inclusive Research – the role of Science to accelerate water action in the Global South” for the IWA World Water Congress and Exhibition 2024 Toronto (Canada) to reinforce the importance of the theme among global researchers.

For the third theme, Future of Water, the Podcast wants to inspire youth to take an active role in water and climate beyond saving water and recycling. Youth is currently classified as people between 15 and 24 years of age. This generation has been brought up with climate change and news about water crises: floods, drought, scarcity, and migration (Crescenza Calculli, 2021). Red for Humanity messages raise the urgency, but it does not explain how to act. The avalanche of information available leads to confusion and fragmentation of opinion.

Final considerations

The Finding Water Podcast was released on Spotify in September 2023 with an introductory episode. The first episode had over 50 plays in the first seven days and gained 52 followers. Marketing and branding are done through Instagram and LinkedIn to ensure that both the public and experts can follow up on the conversations. The launching was done through LinkedIn generating to date close to 10 000 impressions, 3000+ promotional video views, and

250 engagements (with 14 reposts). The Instagram page has been built and the content will be further developed as the next episodes are released.

The Finding Water podcast is made to help people find water in their lives (home, business, sports, nature, ...) and inspire each of them to use their skills to protect it. If you want to join the movement, follow the Finding Water Podcast on Instagram, and subscribe to the podcast on Spotify. Together, we can make water visible to all. Are you ready? Let's do it!

4.3. Defining, ideating, and standardising framework for 'water positivity' across institutions

Krithika Iyer Shivakumar

Addressing the criticality of water use in industries necessitates a multi-faceted approach. Embracing water-efficient technologies, recycling and treating wastewater, and implementing sustainable practices are essential steps for reducing the water footprint of industrial processes. Collaboration between industries, governments, and communities is crucial to establishing water stewardship programmes that promote responsible water use, resource protection, and equitable access to clean water for all. Recognising the vital role of water in industrial operations, it is incumbent upon companies to adopt a forward-looking mindset that integrates water sustainability into their core business strategies. By doing so, industries can not only mitigate environmental impacts but also enhance their resilience to potential water-related risks, regulatory changes, and societal expectations.

The criticality of water use in industries cannot be underestimated. Embracing sustainable practices and responsible water management is not just an environmental imperative but also a strategic necessity for businesses to secure their future viability and contribute to a more sustainable world. By safeguarding water resources and promoting water stewardship, industries can pave the way for a prosperous, inclusive, and water-secure future.

Water positivity represents a transformative approach to water management that goes beyond mere conservation efforts, aiming to have a net-positive impact on water resources. Embracing water positivity is of paramount importance in the context of water saving, as it fosters a proactive and sustainable mindset that not only minimises water consumption but actively replenishes and restores water sources. This high-level concept holds the key to addressing global water challenges and securing a resilient future for both ecosystems and societies.

At its core, water positivity entails optimising water use efficiency across various sectors, including agriculture, industry, and households. By implementing water-saving technologies, promoting responsible consumption practices, and reducing water waste, entities can significantly diminish their water footprints. Such measures not only contribute to immediate water savings but also set the foundation for a more sustainable and resilient water future.

The true strength of water positivity lies in its capacity to promote innovative solutions and long-term thinking. By investing in water recycling, rainwater harvesting, and decentralised water treatment systems, organisations can bolster their water resilience while easing the burden on overburdened water sources. This multifaceted approach fosters self-reliance and reduces the vulnerability of communities and industries to water scarcity and unpredictable climatic conditions.

Moreover, water positivity fosters a ripple effect of positive impacts. Replenishing water sources, restoring wetlands, and enhancing watershed management contribute to healthier ecosystems, biodiversity preservation, and improved water quality. In turn, this benefits not only the natural world but also the communities that depend on these ecosystems for their livelihoods and well-being.

Water positivity extends beyond the confines of individual entities or regions: it is a collaborative and interconnected concept. Partnerships between private and public sectors, local communities, and governments are vital for driving collective action in achieving water-saving goals. Through information sharing, knowledge transfer, and joint initiatives, stakeholders can amplify the impact of their efforts and create lasting change on a global scale.

High-level water positivity requires a fundamental shift in mindset and a commitment to sustainability at all levels. Decision-makers, industry leaders, and policymakers must recognise that water is not an infinite resource, and that responsible water stewardship is an urgent global priority. By setting ambitious targets for water positivity and aligning them with the United Nations Sustainable Development Goals, the international community can work together to address water-related challenges such as water scarcity, water pollution, and inequitable access to clean water.

The idea calls for defining, ideating, and standardising a framework for ‘water positivity’ across the institutions. Being Water Positive is about creating a system of sustainability, and sustainability is balancing the activity cohesively and collaboratively with the resource and the environment. Water positive means that more water is loaded into the freshwater sources, than is removed. But, while defining an institution as water positive/negative/neutral, various parameters in Figure 4.3-2 must be considered.



Figure 4.3-1 – Project phase representation

The project is structured around 3 phases:

Phase 1 – Ideation, methodology and formula

Phase 2 – Testing, survey and feedback

Phase 3 – Pilot through partnerships, and making it a watershed movement

METHODOLOGY:

- The framework definition shall incorporate the below factors while defining the watershed
- Then, understand the water extraction and consumption pattern, within and beyond the boundary
- Analyse and assess the impact created by the institution on the watershed
- Conduct gap analysis
- Interventions based on the demand and supply
- In principle, the best practice is, sum of water shed management within the boundary, beyond the fence and management at the supply chain, should be greater than the extraction to attain water positivity

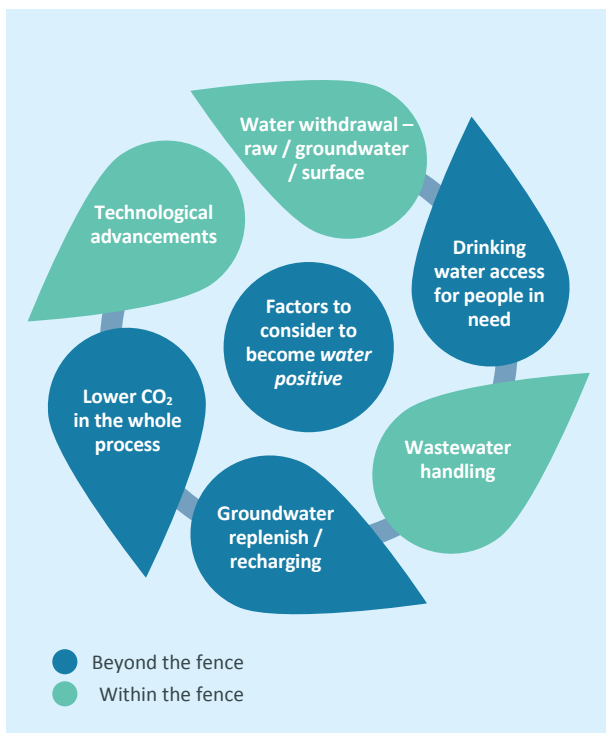


Figure 4.3-2 – Proposed framework for water positivity

PARAMETERS TO CONSIDER DEVELOPING THE GLOBAL FRAMEWORK:

- Universal access to safe water and sanitation both within the fence and beyond the fence
- Adaptation of water use efficiency and conservation techniques
- Implement water quality management
- Integrated water resource management
- Enhancing climate change resilience
- Demonstrate cross- sectoral collaboration
- Deploy technology and innovation
- Educate and spread awareness
- Monitoring and reporting
- Sustainable financing

PROPOSED FORMULA:

$$\begin{aligned}
 & \sum (\text{water and wastewater management at site level}) + \\
 & \sum (\text{water conservation in site's watershed}) + \\
 & \sum (\text{drinking water access for people}) + \\
 & \sum (\text{groundwater level restored at the watershed}) + \\
 & \sum (\text{water conservation efforts in supply chain watersheds}) + \\
 & \geq \\
 & \sum (\text{direct freshwater withdrawals and consumption at site level}) + \\
 & \sum (\text{water withdrawals at site and supply chain level})
 \end{aligned}$$

A survey was rolled-out among various eco-entrepreneurs, organisations/industries, educational institutions, youth representation organisations, not-for-profit organisations

working in water and integrated water management. Around 150 responses were received. The survey results are shown in Figure 4.3-4.

During the workshop and brainstorming sessions, some of the critical challenges stated by the participants making it difficult for them to commit towards water positive are:

1. Cost and investment: Implementing water positivity initiatives may require significant upfront investments in infrastructure, technology, and training. This can be a deterrent for organisations, especially those with limited financial resources.

2. Complexity of water issues: Water-related challenges are often complex and interconnected, requiring a comprehensive approach. Organisations may struggle to identify the most effective strategies and solutions that suit their specific context.

3. Regulatory and policy barriers: In some regions, there might be inadequate or conflicting regulations related to water management. Organisations may face legal and bureaucratic challenges while trying to comply with or advocate for better water-related policies.

4. Limited awareness and understanding: Not all organisations have a clear understanding of the importance of water positivity and its long-term benefits. Raising awareness and education within the organisation can be a hurdle.

5. Short-term focus and priorities: Many organisations are driven by short-term financial goals, which may overshadow the long-term benefits of investing in water positivity initiatives.

6. Lack of data and monitoring: Without accurate data on water usage and its impact on the environment, organisations may find it difficult to assess the effectiveness of their water management efforts.

7. Supply chain complexity: For organisations with complex supply chains, ensuring water positivity across the entire network can be challenging, as it may involve coordinating efforts with multiple suppliers and partners.

8. Resistance to change: Introducing new water-positive practices may face resistance from employees, stakeholders, or traditional organisational cultures that resist change.

9. Water availability and climate change: In some regions, water scarcity due to changing climate patterns can make it challenging to achieve water positivity, as the natural water resources might be insufficient.

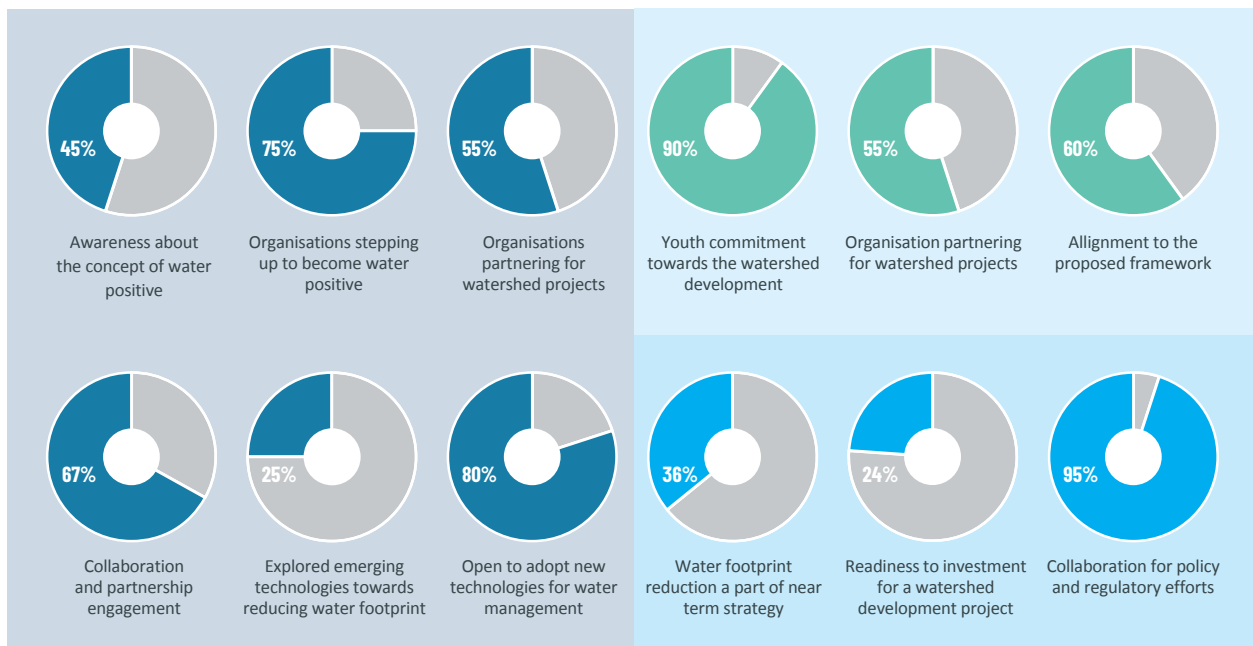


Figure 4.3-4 – Survey result outcomes

10. Competing sustainability priorities: Organisations may have to balance water positivity with other sustainability goals, such as carbon reduction or waste management, which could be perceived as more urgent.

11. Scaling up initiatives: Even if an organisation successfully implements water-positive practices at a small scale, scaling them up across the entire organisation can be a logistical and managerial challenge.

12. External stakeholder engagement: Organisations may need to collaborate with external stakeholders, such as local communities or governments, to implement water positivity initiatives effectively. Building and maintaining such partnerships can be demanding.

Despite these challenges, organisations have a crucial role to play in promoting water positivity and sustainable water management. Addressing these obstacles requires a commitment to long-term planning, investment, collaboration, and continuous improvement to ensure a positive impact on water resources and the environment.

Inference

To establish a global framework for water positivity, international organisations, governments, NGOs, and the private sector need to collaborate and align their efforts. This could involve integrating water positivity principles into existing sustainable development frameworks like the SDGs or creating a new dedicated framework. The success of such



Figure 4.3-3 – Factors to consider to develop the global framework for water positivity

a framework would depend on strong political will, collective action, and a shared commitment to safeguarding water resources for present and future generations.

Conclusion and next steps

Collaborate with key stakeholder organisations such as industrial bodies, governing bodies, and educational institutions to agree and align on the action plan to take one water shed as a pilot in Chennai, Tamil Nadu. Onboard all relevant stakeholders to drive towards making the watershed a water positive.



#WaterAction

TAIDEN®

TAIDEN®

13:21

CH:02 French

Chapter 5 –

Fostering youth empowerment to leverage the Water Action Decade

In an era defined by rapid technological advancement and interconnectedness, harnessing the collective power of youth has become an indispensable force for driving change across sectors. Within the water domain, the critical challenges posed by water scarcity, pollution, and inadequate sanitation demand innovative solutions and fresh perspectives. As we embarked on the Water Action Decade, a crucial global initiative aimed at accelerating the implementation of sustainable water-related objectives, it becomes increasingly apparent that young individuals are at the forefront of this transformative journey.

This chapter delves into the dynamic interplay between young individuals and the global effort to accelerate progress towards water-related SDGs. Comprising two distinct yet interconnected narratives, this chapter illuminates the transformative potential of youth engagement and participation in shaping the future of water security and sustainability.

The first sub-chapter delves into the pivotal role of young professionals in redefining the water sector's landscape. As organisations navigate the complex challenges of the Water Action Decade, the infusion of youthful energy, fresh ideas, and diverse perspectives becomes increasingly indispensable. This sub-chapter explores how fostering an inclusive environment that empowers young voices can lead to innovative strategies, enhanced decision-making, and more agile responses to evolving water issues. By spotlighting successful initiatives, key learnings, and actionable recommendations, this account underlines the imperative of cultivating a vibrant ecosystem where youth are not only valued stakeholders but also drivers of transformative change within water sector organisations.

The second sub-chapter uncovers the dynamic role of young individuals in leveraging the expansive reach of social media to promote SDGs. In an era dominated by digital platforms, youth wield a unique ability to drive awareness, mobilise

communities, and advocate for positive change. This sub-chapter unveils inspiring narratives of how young water professionals have harnessed the power of social media to amplify the SDG agenda and raise public consciousness about pressing water-related issues. By exploring innovative approaches, effective communication strategies, and impactful campaigns, this text underscores the potential of youth-led social media initiatives to contribute to the objectives of the Water Action Decade and pave the way for a more sustainable water future.

5.1 The onus is on us: elevating youth engagement in water sector organisations

Yang Villa

There are two halves to cultivating meaningful youth engagement in the water sector—and many organisations only get one right. The first half aims to activate and mobilise the youth by raising their awareness and building their capacity. There is plenty of indication that the youth are not only informed about water issues but are also interested in participating and contributing to collective action and meaningful change. When asked, young people know what youth leadership should be like in the water sector. A series of interviews by the Global Water Partnership shows that young people have a vision of youth leadership in the water sector, as quoted in Table 5-1.

Raising awareness has become the focus for many organisations. Through information, education and communication campaigns using various methods and channels (including social media), awareness has become the lowest-hanging fruit in cultivating meaningful youth engagement. Campaigns focus on breadth, that is, reaching as many young people as possible, and therefore is the

Table 5.1 – Answers to “Describe what youth leadership in the water sector means or looks like to you” by young water professionals

“Youth leadership in the water sector empowers youth to combat challenges.”
Youth leadership means “being able to participate in decision-making processes related to water issues, participating in discussions, and contributing to tangible changes.”
“Leadership means young energetic individuals ready to shape and help maintain global water bodies in their own small way or space.”
Youth leadership entails “young and diverse voices leading the sustainable management of water, incorporating a fresh perspective, and remedying some aspects of mismanagement that have hitherto plagued the industry.”
Youth leadership is the “capacity to be a spokesperson and influencer to communicate to decision-makers the needs of young people.”
Youth leadership is “taking charge and responsibility for the future of water resources and management.” It means that “duty is recognised by and to them, enabling them to make real changes for themselves and future generations.”

Note - Adapted from *Global Water Partnership (2021)*

foundation for widespread youth engagement. However, awareness alone does not cultivate meaningful youth engagement.

Other organisations go beyond raising awareness and provide capacity building. Building youth capacity takes many forms such as training, mentorship, internship, participation in conferences and other methods to instil knowledge, develop skills and upgrade competencies necessary for young people to contribute to solutions. As with raising awareness, capacity building is a necessary but insufficient element of cultivating meaningful youth engagement in the water sector. Leadership skills need to be applied in real-world situations which bestow increasing levels of responsibility upon youth leaders, so that young people may test and hone themselves in dealing with complex problems.

The second half to cultivating meaningful youth engagement is to sustain engagement through consistent exercise of leadership. This entails the actual practice of leadership skills that young people have acquired through capacity building. Without opportunities to deploy the skills they learn within a controlled environment (such as the training classroom), young people will not be able to advance their leadership skills, particularly those that come with experience: critical thinking, stakeholder management, effective communication, and negotiation. The youth engagement pyramid (Figure 5.1-1) depicts the two halves, each subdivided into two subcategories. In the lower half, composed of raising awareness and capacity building, the youth are considered as passive recipients of knowledge and training. In the upper half, composed of sustained exercise

and embedding of youth leadership in the system, the youth are considered as active partners for meaningful change and lasting impact.

Arguably, the second half (top half of the pyramid) is harder to achieve. It requires a higher level of effort to successfully pull off. Making the youth an active partner, beyond tokenism, entails not only recognising their capabilities but also making space for their contribution. Consequently, it also requires a higher level of trust upon young people to carry out the responsibilities of leadership.

The ultimate goal of meaningful youth engagement is to embed youth leadership into the system wherein young people gain influence on decision-making. When embedded into the system, youth leaders can have a multiplier effect: more attention is given to the various challenges faced by young people, resources are allocated for solving such challenges, more young people are motivated to follow the example of their leading peers, and greater pressure is applied to keep senior leaders accountable.

The role of water sector organisations

Water sector organisations (WSOs) ⁵ are uniquely placed to deliver both halves of the equation, however not many move past the second step of the pyramid (capacity building). The specific barriers and reasons for this are discussed below. In this section, a case is made in favour of WSOs as key actors in meaningful youth engagement.

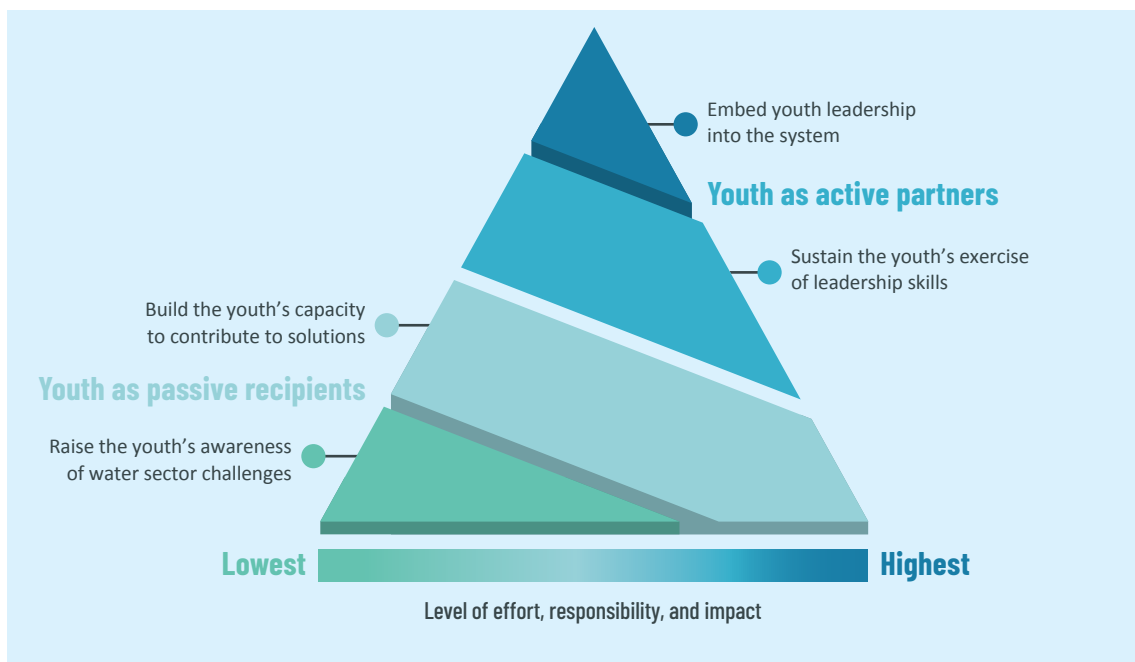


Figure 5.1-1 – Youth Engagement Pyramid in the Water Sector
Source – Author

With respect to young people, WSOs are places for employment and career growth, training, and upskilling, working, and engaging with other stakeholders, and solving complex problems. WSOs, especially those which are established and influential, attract young people with the potential (if not promise) of magnifying their individual contributions to yield greater impact in the water sector. The youth understand that it is WSOs—and the leaders and managers behind them—that set the agenda, mobilise funds, prioritise solutions, and initiate changes in the water sector. As articulated in the quotes given above, the youth seek to be part of this process. WSOs are the engines that young people can go to and be part of—whether as employees, beneficiaries, or partners—in order to fulfil this. The question is whether WSOs are making the most of the youth’s potential for meaningful contribution. In other words, which step of the youth engagement pyramid are WSOs able to deliver and achieve for their youth stakeholders?

To help WSOs fulfil meaningful youth engagement in an intentional and programmatic manner, a formal and documented youth engagement strategy can serve as a roadmap and guide. However, not all WSOs have a youth engagement strategy in place. At the Asia Water Forum in August 2022, for example, a poll asked 90 participants how well their organisations empower youth to participate in achieving water security objectives. A staggering 30% of respondents said their organisation does not have a

youth engagement strategy; another 44% said they only implement youth programmes sporadically and without a guiding strategy. Only 17% of the respondents claimed to have a youth engagement strategy that is fully resourced and consistently implemented. Figure 5.1 2 summarises these results.

It is important for WSOs to have an intentional and programmatic youth engagement strategy that is formalised and documented. Being intentional and programmatic means that efforts, projects, and programs are aligned with the organisation’s strategic architecture (vision, mission, strategic objectives, and organisational values). There is an unambiguous declaration that youth engagement is critical to achieving the organisation’s overall objectives. Having a strategy in place increases the likelihood of youth engagement efforts being prioritised and allocated more resources, while making programmes more deliberately and carefully designed and implemented to meet predefined monitoring and evaluation standards.

In the absence of a formal youth engagement strategy, WSOs may run the risk of implementing ad hoc and sporadic programmes that do not yield tangible results. Resources are wasted on ‘wants’ rather than ‘needs’ which may result in youth engagement fatigue, a situation where some or all stakeholder involved— including the funders, programme champions and facilitators, or the youth themselves—feel exhausted without having achieved clear or significant

³ WSOs are organisations involved primarily in the water sector. WSOs are the public agencies, private companies, non-governmental organisations, academic institutions and civil society organisations whose mandate and mission revolve around the water cycle, whether in its entirety or an aspect thereof. WSOs may operate on the global, regional, national, subnational or local level. WSOs are the entities that manage water resources, provide essential water and sanitation services, represent and mediate stakeholder interests, produce new knowledge, and set the rules and guidelines for coordinating all these efforts.



Figure 5.1-2 – Poll results from Asia Water Forum, August 2022. Source: Asian Development Bank (2022)

outcomes. To demonstrate how a formal and documented youth engagement strategy can serve as guidance for WSOs, the following subsections summarise three case studies.

SANITATION AND WATER FOR ALL YOUTH STRATEGY 2021-2025

Sanitation and Water for All (SWA) is a global partnership of governments, utilities, regulators, donors, civil society, financial institutions, UN agencies, and research organisations, and the private sector. All working together to promote universal water, sanitation and hygiene (WASH). Its youth engagement strategy aims to empower the youth to become leaders and negotiators for scaling up action on the SDGs. The strategy is aligned with the broader SWA Partnership Strategy Framework 2020-2030 which seeks to include the youth in multi-stakeholder approaches, decision-making and accountability processes. The strategy acknowledges that there persists marginalisation and discrimination against youth, particularly women and girls. Figure 5.1-3 shows an example of success indicators.

The 18-page strategy document serves as guidance for SWA’s member organisations, many of which are youth-led and/or youth-focused, to integrate youth engagement into their work. After briefly outlining the benefits of youth engagement and clearly defining the ‘youth’ constituency (in terms of age, gender and experience), the document provides guidance on activities and outcomes that SWA and its members will aim to achieve at the global, regional and national levels. Success indicators are also defined: what they expect to see, what they would like to see, and what they would love to see (Figure 5.1-3). Finally, the strategy document comments on the means of implementation by inviting member organisations and individuals to coordinate with SWA Secretariat staff.

UNION FOR THE MEDITERRANEAN WATER & YOUTH ENGAGEMENT STRATEGY 2023-2028

The Union for the Mediterranean (UfM) is an intergovernmental institution composed of 43 countries that promote dialogue and cooperation in the Euro-

Mediterranean region. UfM consulted with over 60 representatives of Mediterranean water youth organisations to develop its water and youth engagement strategy, which is based on the broader UfM Youth strategy that aligns all UfM’s sectoral work including water. In setting the context for its youth strategy for water, UfM specifically mentions that matching skills to job market needs, amplified by appropriate career development opportunities, is the key driver for improving youth readiness for the emerging water job market, as well as to enable their entrepreneurial pursuits within the water sector. To ensure that the youth are not regarded as an afterthought, the strategy provides guidance on integrating youth programmes into UfM’s work in the water-employment-migration nexus, water-energy-food-ecosystem nexus, WASH nexus, and water and climate change adaptation nexus. The document also relates how the 5-year strategy aligns with and leverages other regional strategies, including Sweden’s strategy for regional development cooperation with the Middle East and North Africa 2021-2025 and the European Commission’s Southern Neighbourhood new agenda. Potential partners are identified for each of the strategic objectives. Finally, to guide execution of the strategy, the document provides an implementation timeline, a program monitoring and evaluation framework, and a note on financial resourcing. An important element of the strategy document is its transparency by showing the process of its development. The 21-page document is the product of five years of development, which is summarised in Figure 5.1-4.

GLOBAL WATER PARTNERSHIP YOUTH ENGAGEMENT STRATEGY 2015

With a vision for a water secure world, the Global Water Partnership (GWP) is regarded as one of the WSOs at the forefront of sustainable and equitable management and governance of water resources. GWP’s network has 13 regional water partnerships, 85 country water partnerships, and over 3,000 partners located in 178 countries. Published in 2015, GWP’s Youth Engagement Strategy related the youth to the 2014-2019 GWP strategy Towards 2020: A Water Secure World. Recognising its role in engaging and

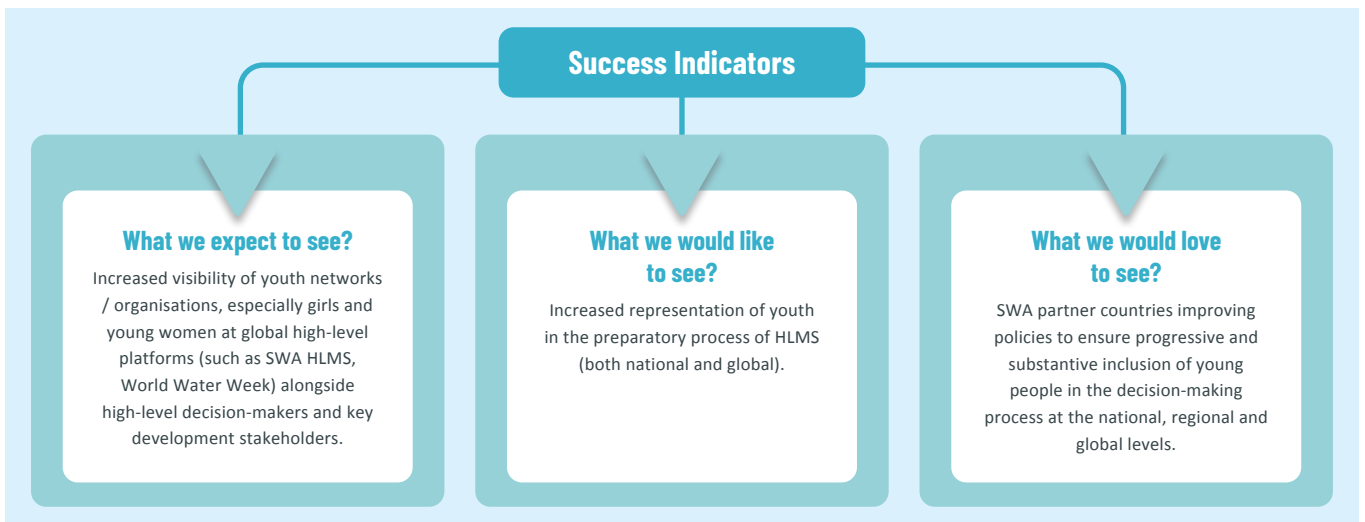


Figure 5.1-3 – SWA’s success indicators for youth engagement at the global level
Source – Sanitation and Water for All (2022)

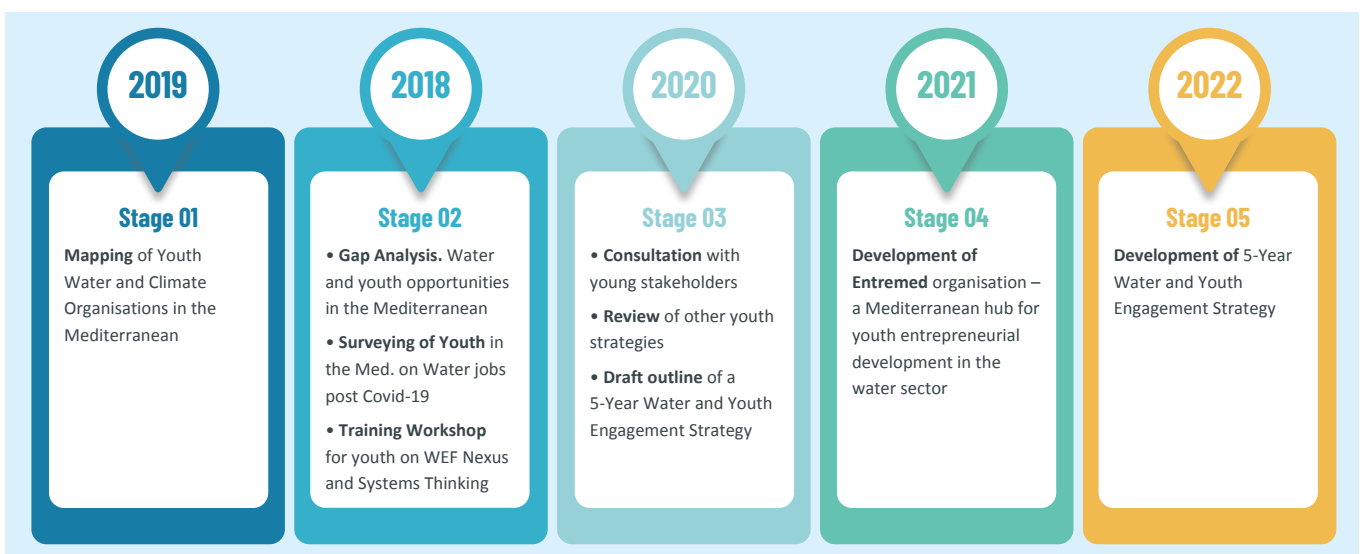


Figure 5.1-4 – SWA’s success indicators for youth engagement at the global level
Source – Sanitation and Water for All (2022)

empowering the youth, GWP is committed to upholding the approach “by youth, with youth, for youth”. The strategy provides guidance on implementation and delivery in terms of monitoring and evaluation, ensuring diversity and inclusion, and securing financial resources.

Key lessons

Several lessons can be gleaned from the three case studies presented. These are summarised below as the three Cs of an effective youth engagement strategy: context, collaboration, and continuity. First, the youth engagement strategy of SWA, UfM and GWP are all pegged on the specific context and challenges faced by their respective youth stakeholders and constituencies. This ensures that the strategy addresses the actual needs of the young people that the WSOs seek to serve. It is equally important for the strategy to clearly state which of the challenges faced by the youth can be addressed

by the strategy, recognising the capabilities and limits of the WSO. Second, collaboration with youth stakeholders underpins the strategy. The strategy is not a blueprint for ‘saving’ the youth by solving their problems, rather it must be a roadmap for empowering the youth so that they become the WSO’s partners and collaborators for meaningful change. In terms of the youth engagement pyramid, this means advancing from the bottom half (passive recipients) to the top half (active partners). The strategy document must also demonstrate that engaging the youth as active partners is mutually beneficial for both the youth and the WSO: not only does it help the youth solve the challenges they face, also accomplishes the WSO’s overarching goals. Finally, the strategy must provide guidance on its continuity of implementation. The strategy must bind the WSO’s leaders, staff and members into a commitment in the foreseeable future (5-year period in the case studies) which becomes a reference for holding WSOs accountable.

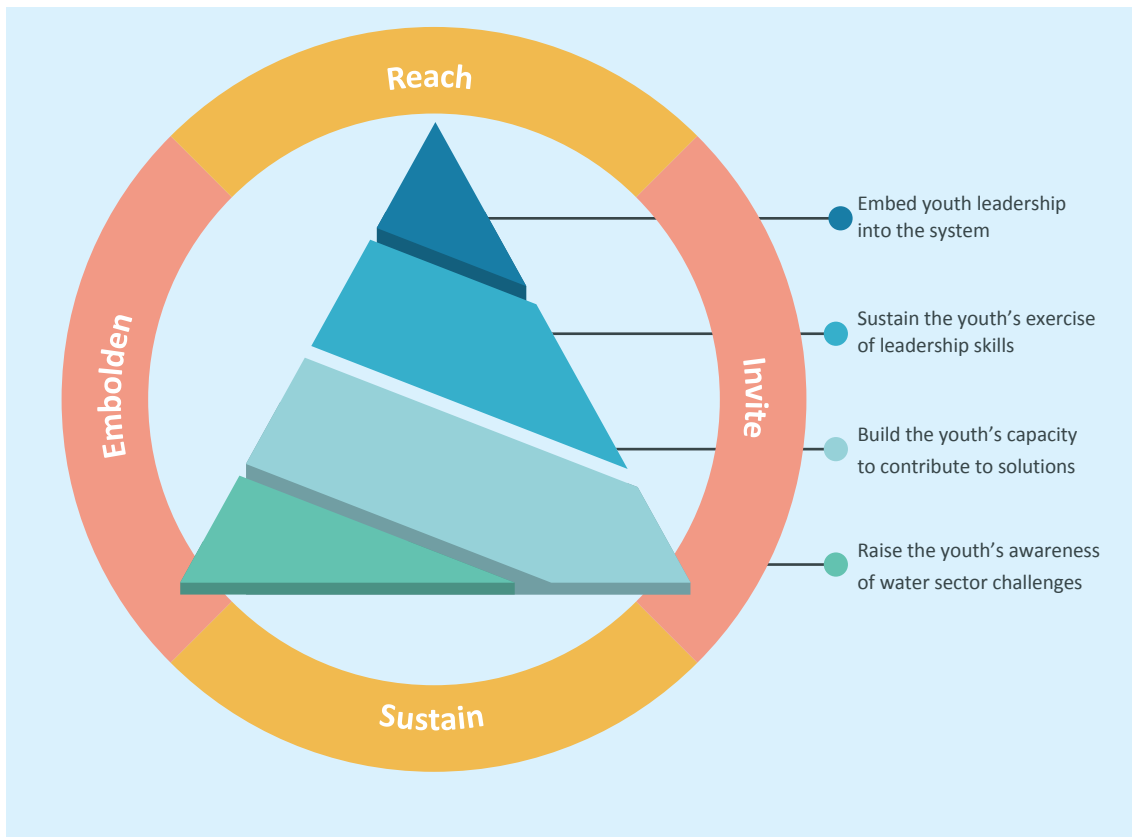


Figure 5.1-5 – The RISE framework for elevating youth engagement in WSOs
Source – Author

Barriers to meaningful youth engagement

To better understand the factors (in particular, barriers) affecting a WSO’s meaningful youth engagement, interviews with representatives from seven WSOs were conducted from June to July 2023. These WSOs are Maynilad Water Services, Inc.; Manila Water Company, Inc.; Australian Water Partnership; Japan Water Forum; Masy Consultants; World Toilet Organization; and University of Technology Sydney – Institute for Sustainable Futures. All interviews were conducted online, in English, and using a semi-structured conversation framework developed for this purpose.

Based on the interviews, four barriers to elevating youth engagement in WSOs are identified. First, youth stakeholders and interests are invisible. Some of the WSOs have not formally identified or mapped their youth stakeholders, who are often encompassed within other formally acknowledged stakeholder groups (e.g., employees, marginalised communities, women, indigenous people). Second, young people are turned off by leaders that they perceive are untransparent, untrustworthy, or relentlessly inhabiting positions of power. Even when youth engagement programmes or platforms are made available by WSOs, young people may not engage due to the perception that engagement is tokenistic and disingenuous. Third, it could be difficult to monitor and evaluate long-term impacts. The lack

of empirical evidence to demonstrate the benefits of youth engagement remains a challenge, especially when WSO senior leaders require an airtight business case and return on investment from such programmes. Finally, there could be limitations imposed by the organisation’s funding and operating models. The short funding cycles or rigid revenue model of some WSOs constrain them from doing ‘legacy building’ work, that is, going beyond the bare minimum in terms of youth engagement. This keeps WSOs within ‘safe’ operating parameters that, consequently, discourage them from moving beyond the bottom half of the youth engagement pyramid.

There could be many more barriers and ‘disablers’ to meaningful youth engagement encountered by WSOs which could be gathered through a wider survey. When crafting a youth engagement strategy, it is also advisable for WSOs to outline the barriers and risks that they could potentially encounter.

The RISE framework to elevate youth engagement

Elevating youth engagement means moving upward the youth engagement pyramid, thereby turning youth stakeholders into active partners rather than passive recipients. To overcome the barrier to elevating youth engagement, the RISE framework is proposed as a set of principles that WSOs can follow to cultivate meaningful youth engagement within their given context. Brief examples from the interviews with WSOs are provided.

REACH all youth stakeholders. WSOs must recognise and reach all of its internal and external youth stakeholders, understand the many ways that they are diverse, and uncover their various interests. Manila Water Company, Inc. through various information and education campaigns shapes the youth's interests and highlights how water education and advocating for the environment impacts their future.

INVITE through feasible entry points. WSOs must offer feasible entry points for the youth to be involved, clearly articulating the expectations, outcomes and impacts of youth engagement for each entry point. Maynilad Water Services, Inc. provides opportunities for young employees, regardless of formal rank, to be part of and even lead cross-functional teams that aim to solve complex problems.

SUSTAIN collaborative problem-solving. WSOs must sustain their collaboration with youth and other stakeholders by jointly identifying and implementing solutions to progressively overcome barriers to meaningful youth engagement. Masy Consultants, a youth-led social enterprise, trains educators to continuously engage schoolchildren as partners in sustainable WASH behaviour change.

EMBOLDEN youth participation. Most young people still seek permission—to enter, to participate, to speak up, to be involved—and the onus is on WSOs to always signal that permission is granted and that there are no barriers for young people to confidently engage. The University of Technology Sydney's Institute for Sustainable Futures has an explicit intent to share power across young and senior professionals through a culture of participation, listening and mentoring support.

The onus is on us all, as individual members of the water sector, to apply the RISE framework. It is incumbent upon WSOs to cultivate meaningful youth engagement because of their convening and agenda-setting power in the sector, as well as their role in incubating young talent. To solidify their commitment to youth engagement, WSOs must acknowledge the vital contribution of the youth in achieving broader organisational and strategic objectives. The RISE framework can help in overcoming barriers, thus elevating meaningful youth engagement in the water sector.

5.2. Power of youth in social media and promoting SDGs

Farokh L. Kakar

Social media has undeniably become an integral part of modern youth culture. With the widespread availability of smartphones and internet connectivity, young individuals across the globe have embraced various social media platforms as a means of communication, self-expression, and connection. However, this opportunity has not been leveraged to its maximum potential in the context of promoting SDG goals, raising awareness, advocating for each goal, and urging people toward action. Youths' energy, initiatives, and creativeness have not been harnessed enough to make their impacts and fully contribute.

The global reach of youth social media users

Information travels faster than ever in the current era through social media while youth are the main users and drivers of these media. According to Baltaci and Ersoz (2022), there are approximately 3.78 billion social media users globally, and a significant portion of this number constitutes the younger population. Indeed, according to the Zen media CEO Shama Hyder, "Youth are the media themselves". People aged 16-29 spend the most time on social networking platforms (3 hours daily), see Figure 5.2-1. This is almost eight thousand hours for one youth until 2030 and billions of hours for 2 billion young people globally (Rana et al. 2023).

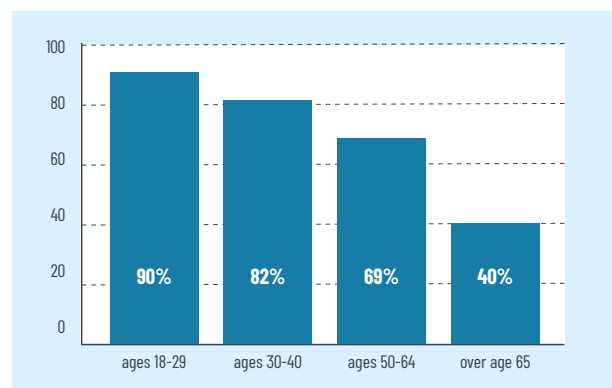


Figure 5.2-1 – Social media usage by age Global distribution of social media usage

Reference – (high speed internet, 2022)

With each passing year, the number of youths engaging in social media platforms continues to rise, showcasing the ubiquitous nature of these online spaces in their lives.

Most popular social media platforms among youth

When it comes to preferences, Facebook, once the dominant platform, has seen a decline in youth engagement. Meanwhile, newer platforms like Instagram, Snapchat, TikTok, and X (formerly known as Twitter) have emerged as the go-to choices for young users (high speed internet, 2022). Instagram's visually appealing interface and Stories feature, Snapchat's ephemeral content, TikTok's short-form videos, and Twitter's real-time updates have resonated strongly with the youth, influencing their online interactions and content consumption.

Besides the common platforms, social media or platforms developed mainly for water professional such as IWA Connect Plus are great tools for young water professionals to promote and discuss SDGs and specific water issues. However, the low popularity of these platforms means they cannot reach a broad audience, making common social media's necessary for amplifying the outcome of discussion on the water platforms (Sheela, 2021).

Geographical variations in youth social media usage

While social media has a global presence, its usage patterns vary significantly across different regions. Asian countries, such as India, Indonesia, and the Philippines, exhibit higher social media engagement among the youth, partly due to the rising penetration of smartphones and affordable internet plans (Figure 5.2-2). Meanwhile, in some Western countries, where social media has been prevalent for longer, usage rates might have plateaued or even slightly declined (high speed internet, 2022).

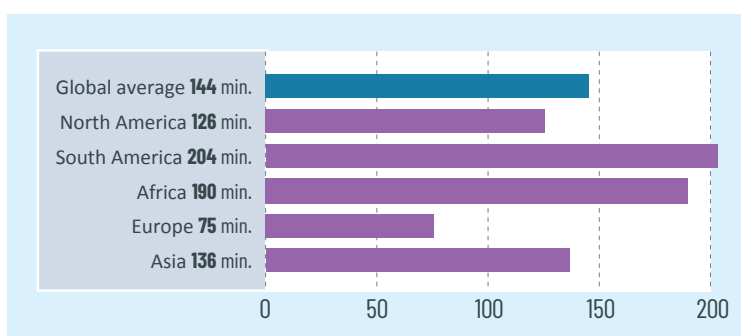


Figure 5.2-2 – Global distribution of social media usage
Reference – (high speed internet, 2022)

Influence on social and political activism

Social media has proven to be a powerful tool for youth-driven social and political activism. Movements like *#BlackLivesMatter*, in USA or *#LetHerLearn* in Afghanistan have gained traction and international support through online platforms, amplifying their impact, and mobilising global solidarity. Therefore, campaigns for promoting SDGs and its actions are more than achievable through social media. Figure 5.2-3 shows the various reasons youth use social media including supporting good causes.

Although it is disappointing that this reason is at the bottom of the graph, the bright side is that there is a natural desire among social media users for action that can be leveraged if this potential is studied and utilised.

Social media influencers and water professional's perspective

Experts in the industry, young water professionals, and influencers were interviewed to gain their views on the role of the young generation in promoting SDGs through social media. Four outstanding professionals were picked from different locations, backgrounds, and gender. Below is a glance at their biography and their answers to our questions in this regard.

The **private sector representative** from North America has shared her perspective as follows: Youth and social media can play a vital role in implementing the SDGs due to their digital savvy, global connectivity, activism, innovative ideas, information sharing, and participation in decision-making processes. They can raise awareness, mobilise support, and hold governments and corporations accountable. Social media can also be used for information dissemination and education, and young people can create content that educates others about the SDGs. However, challenges such as the digital divide, misinformation, and the potential

for social media to amplify negative voices should be addressed. Social media activism should complement real-world action, and it is essential to use these tools responsibly and inclusively.

Comparing high- and low-income countries, social media usage among youth varies significantly between low-income and high-income countries. Factors such as access to technology, literacy levels, cultural norms, and governmental regulations can impact the usage of social media. High-income countries have stable internet access and personal digital

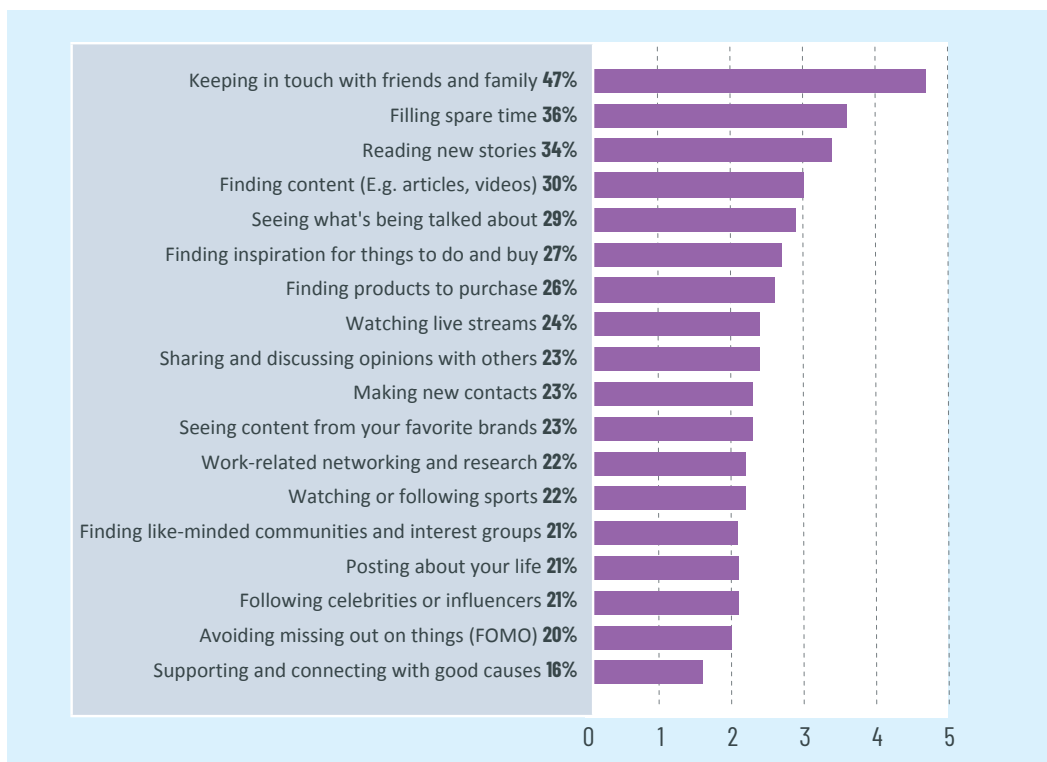


Figure 5.2-3 – Social media usage reason

Source – 1(highspeedinternet, 2022)

devices, facilitating more extensive use of social media platforms. However, low-income countries may struggle with lower literacy rates and digital literacy skills, inhibiting social media usage. Cultural norms and expectations can also impact social media usage, with some societies limiting online presence. Government regulations and censorship can also affect social media usage. High-income youth use a wider variety of platforms, while low-income countries may focus on fewer platforms. Economic opportunities in high-income countries include professional networking, education, and employment.

Build your brand! Personas will always beat organisations or corporate brands. Every time you break down a door, you get the chance to hold it open for someone else. There is no such thing as self-promotion, only the continuous journey of fostering a more connected, empowered community. As you share your authentic experiences and lessons learned, you're not merely promoting yourself. Instead, you're providing valuable insights, paving the path for open dialogues, and nurturing a community. By aligning your actions with your mission, you evolve into a catalyst, stimulating growth and empowering others within your community. This isn't self-promotion; it's the cultivation of a personal brand that illuminates pathways, inspires change, and holds the door open for others to also make a difference.

The **academic representative** has expressed his opinion about the role of youth and social media in raising awareness about SDGs as follow: Youth's involvement in raising awareness about the Sustainable Development Goals (SDGs) is crucial for achieving global goals. They are creative, energetic, and can use social media to spread messages and engage communities. Social media, with billions of users worldwide, can be a powerful tool for raising SDG awareness. It allows for quick message spread, educates people about the SDGs, and encourages innovative approaches. By asking questions and opening discussions about the SDGs, awareness can be increased, and more people and organisations can contribute to achieving global goals. Tracking and analysing data from social media can help understand public awareness and their willingness to contribute to changes.

Universities can influence youth and empower them to contribute to the SDGs. They can increase awareness, include SDGs in curriculum, and provide scholarships and internships. Universities can also use social media to advocate for SDGs, educate students, staff, alumni, and the public. Frequent posts, sponsored campaigns, and live events can help educate and engage students.

The **NGO representative** from Asia think youth has a very important role in raising awareness of SDGs. The increase in sharing such posts on social media is mainly a result of strong

Table 5.2 . Interviewees demography

GENDER	REGION	SECTOR	HOW OFTEN DO YOU POST ABOUT SDGS?
Female	USA	Private sector	Not a Water Professional
Male	Canada-Egypt	Academia	Not very often, about 3-5 times a week, however, I try to promote the SDGs by following the posts related to SDGs and reacting to them and reposting them.
Male	Tajikistan	NGO	I post a few times a month both on policy-level engagement and at the grassroots level.
Female	Nigeria-Canada	Consulting	I post monthly about SDGs, sharing articles, videos, and recognition from individuals or companies. This helps increase attention, educate colleagues, and initiate conversations about the importance of achieving these goals.

interest by youth and their passion to bring about change. Youth has already created a lot of space for themselves specifically in the water arena. This has led to strong lobbying and subsequent advocacy at the country, regional and global levels on key challenges related to SDGs and their potential solutions. Times have changed and social media can really be used as an influencing tool and to be heard by all levels.

He believes that the usage of social media by youth is higher in high and middle-income countries because the level of awareness is high, and its perception as a strong tool for advocacy. Governments can be called on and criticised for not delivering and held accountable. On the other hand, in some low-income countries, the freedom to express on social media is limited. At the same time, engagement on SDGs is not that strong because more coaching and guidance is needed where there is limited investment as of now. The world’s highest users of social media are in fact not the developed counties but the emerging economies such as China and India with a big chunk of the global population and proportion of youth. This also includes usage on promoting solutions to achieve SDGs, and for making the policy makers listen. It is a highly effective tool no matter which income group you are from.

The **consulting representative** from North America sees posts on SDGs at least weekly (this is how often she logs on to LinkedIn). Her membership in water and environment professional organisations means that many of the individuals that she is connected with professionally are people who work in the water or environment industry. So,

her feed is full of people sharing their research, projects, and the impact it has on UN SDGs. She often encounter posts about events (webinars, conferences) where such goals are discussed, and task groups are formed.

She thought social media is critical in raising and maintaining awareness about SDGs. Most youths get a significant amount of information from social media, whether news or current affairs, and many get advice on everything from fashion to finance, vacation, and meal ideas. Over the past few years, we have seen large movements rise from what started as hashtags. While there is valid concern about misinformation, social media presents a large platform to provide good information to a wide audience with little to no barriers to access. Youth are especially important since they are not only familiar with the nuances that come with creating content, but they know how to appeal to their peers. Youth spend more time on social media than any other group, so there is a significant opportunity to engage and keep conversations about SDGs going.

She also suggested universities, academicians, researchers, and leaders should embrace social media as a real platform rather than a leisurely pursuit. Three-minute thesis presentations can make scientific information accessible to the public, while leaders should encourage mentees and student researchers to create content for social media. The growth of research groups with social media accounts can be further enhanced by using short videos, think, TikTok, or reels to make content more accessible.

Recommendations

There is simple information and resources that could transform someone's life if delivered by the young generation since youth tend to listen and get influenced more by their peers and the younger generation. For example, a simple message raising awareness on using dual flush toilets, disinfecting hygiene materials for girls, closing the tap while brushing your teeth, and so on can change the way people behave in their daily life. Beyond these specifically through YWPs communicating why SDG goals are set, what is youth's responsibility for achieving them, and how these goals impact them directly, are the messages to be delivered.

The opportunity for youth power in social media is there and is more real than in any era. What we need is to understand this opportunity and utilise it. It is the duty of experts and decision-makers as well as the youth themselves to recognise this opening and take action. Senior water professionals could develop tools to use the opportunity by giving leadership roles to YWPs, including youth in discussions, keeping them aware and educated.

With any right comes responsibility. If the right of making a decision is given to youth, it is the youths' responsibility to maximise the opportunity to spread the word and make an impact. Young professionals should recognise the given roles, seek involvement, and most crucially use their social media to impact their community in a positive way. However, the scale of engagement should not be a barrier. Even a small tweet, story, or TikTok video on water usage may make a huge impact on achieving SDG goals. One might think "I am not getting likes or comments posting such things", yes, it might be true that you cannot see the number of likes and comments but there is something called the "Dark Web" where people see but they don't make comment. So, youth should not hesitate, to post what they want, people will see it and there will be an impact that one cannot see and measure. Let's use the power of youth engagement in social media to build a water-wise world.

Final considerations

The statistics of social media usage among youth globally reveal its widespread influence and significance in shaping young lives. As social media continues to evolve, it is crucial to maintain a balance between its benefits and potential drawbacks. Empowering young individuals with digital literacy skills, fostering a supportive online environment, and promoting responsible social media usage can contribute to harnessing the positive potential of these platforms for the benefit of the society as a whole.

The young generation's role in using social media to promote sustainable development goals is crucial. Social media platforms provide a powerful and far-reaching means for young people to raise awareness about sustainable development issues, advocate for positive change, and mobilise others to take action. By sharing information, stories, and initiatives related to sustainable development goals (SDGs), they can inspire and engage a broader audience in the pursuit of a more sustainable future. Additionally, social media enables young people to collaborate, connect with like-minded individuals, and participate in collective efforts to address global challenges, making them influential drivers of positive change on a global scale.

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