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ON SCIENCE AND TECHNOLOGY FOR DEVELOPMENT (CSTD)**

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Contribution by UNIDO

to the CSTD 2022-2023 priority theme on “Ensuring safe water and sanitation for  
all: a solution by science, technology and innovation”

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**PRIORITY THEME 2:** Ensuring safe water and sanitation for all: a solution by science, technology and innovation

**United Nations Commission on Science and Technology for Development (CSTD)**

To Whom it May Concern,

The [25<sup>th</sup> CSTD annual session](#) selected “Ensuring safe water and sanitation for all: a solution by science, technology and innovation” as one of the priority themes for its 26<sup>th</sup> session (2022-23 period). This theme addresses SDG 6 on Clean Water and Sanitation.

Water is a most critical natural resource for human beings while clean water and sanitation is essential for human’s daily life. The latest available data shows that in 2020, 26 per cent of the world population did not have access to a safely managed drinking water service while 46 per cent did not use a safely managed sanitation service. Lack of access to safe water has clear gender impact as the burden of securing water falls disproportionately on women and girls with consequences for their income and educational opportunities. Lack of sanitation also creates specific risks for women and girls’ safety.

A range of technologies provide effective and affordable opportunities to improve the management of water and sanitation. Some are purely technological (e.g., water purification technologies, wastewater treatment technologies and increasing water availability technologies) while others relate to information and data management and sharing (e.g., hydrological observation, data exchange and forecasting).

Under this theme, the Commission will examine the key challenges facing developing countries in providing safe water and sanitation to their population. It will also highlight successful practices in applying science, technology and innovation (STI) to the management of water and sanitation services. Finally, it will explore how to enhance experience and technology sharing among countries to effectively address water and sanitation challenges.

The CSTD secretariat is in the process of drafting an issues paper on the theme to be presented at the CSTD inter-sessional panel meeting on 25 -27 October 2022. In this context, we would like to solicit inputs from international organizations, UN entities and agencies, and regional commissions on this theme. We would be grateful if you could kindly answer the following questions based on your organization’s work at the global, regional, and/or national levels.

1. Can you give examples of projects/policies in your organization helping countries improve the management of water and sanitation and provide access to safe water and sanitation for all? What are the main challenges confronted (including the gender dimension) while trying to implement these projects/policies?

***Project example: “Improving public health by solar-powered water sanitation systems in Ethiopia” [Projects in Ethiopia 170160 \(unido.org\)](#):***

*By utilizing the potentials of the water-energy nexus UNIDO set up a solar-powered slow filtration system to produce clean water adopting Japanese innovative technologies in an Ethiopian rural area. The project focussed on the provision of clean water through solar-powered water sanitation systems under conditions of equality and gender equity; develop the technical capacity of communities to independently operate water sanitation systems and improve awareness of public health; and build the capacity of industry, engineering, procurement and construction contractors in order to strengthen their role in Ethiopia’s water and sanitation sectors.*

*About 60% of Ethiopia’s rural population do not have access to basic water services and, as of 2015, 14% - around 11 million people - relied on surface water for drinking purposes. Climate change-induced water shortages are adding to the problem. Droughts have affected several areas of the country, leading to water sources drying up or becoming extremely shallow over the past twenty years. Between 2000 and 2018, six drought episodes have been recorded, with devastating impacts in rural areas.*

*Innovative water sanitation technologies have emerged as potential solutions to the challenges at hand and for promoting social equality and economic growth, while also having further positive externalities, including enhanced safety and security, less water pollution, greater dignity and equality between men and women, growth in tourism and business, amongst others.*

- **Challenge gender dimension:** Given that some of the trainings provided by this project were of a technical nature, the project provided bridging training courses so that women who did not have a technical background had an intermediary training.
  - **Challenge financial:** Poor business management of water sanitation system or economic crisis could make the system not financially sustainable. To overcoming this challenge, the project worked closely with the local partners, to ensure the financial management plan is feasible and in line with the local context. A detailed financial model has been developed to substantiate investment in the water treatment technology. Capacity building activities of the project further ensured its financial sustainability.
  - **Challenge technical:** Poor source water quality or operation of water sanitation system could have a negative impact on the overall operation of the installed system. To overcome this challenge feasibility studies were conducted to baseline the quality of water source and to choose good project site. Technical staff were trained to ensure that source water is of a appropriate standard to be inserted in the sanitation system, equipment is regularly checked and changes are made promptly when needed, water analysis routinely carried out to ensure standards/ parameters are kept.<sup>1</sup>
- NEDA initiated the formulation of the **Philippine Water Supply and Sanitation Master Plan (PWSSMP)** – a set of strategies and policy reforms as well as priority programs needed to achieve water supply and sanitation (WSS) – related targets in the Philippine Development Plan (PDP) 2017-2022, and the UN SDGs). Launched in September 2021, the PWSSMP identified eight Key Reform Agenda (KRA) to address issues and gaps in the development of the WSS sector in the country. NEDA, in coordination with concerned government stakeholders and the United States Agency for International Development (USAID), initiated the development of a “KRA Action Plan” which identifies concrete actions and corresponding agencies responsible for advancing the eight KRAs of the PWSSMP. It is an integral part of the PWSSMP in ensuring its effective implementation towards achieving universal access to safe WSS by 2030.
  - Challenges encountered in implementing activities under the Work Plan include:
    - Issues on Tracking and Monitoring Progress The updating of the status of the key tasks and milestones in the Work Plan has been challenging as concerned agencies do not regularly or automatically provide updates on the Work Plan.
    - Possible Changes in Priorities for Policy Reforms The change in the administration may reset the prioritization of proposed policy reforms outlined in the PWSSMP. During the last administration, the following policy reforms were sought: (i) the creation of an apex body for water resources: the Department of Water Resources (DWR), (ii) the establishment of an independent economic regulatory body for the WSS subsector: the Water Regulatory Commission (WRC), (iii) the strengthening of the NWRB and its transformation into a National Water Management Council (NWMC), and (iv) the Unified Resource Allocation Framework (URAF) for WSS.
    - Challenges on Local Level Implementation. here is a need to establish how the implementation of the PWSSMP will be materialized in the local government units (LGUs) beyond NEDA’s efforts of cascading the master plan and regional data books and roadmaps through regional presentations.
    - Data Availability and Management. The most recent data, particularly on the WSS subsector statistics and cost/financing are not readily available. The statistics presented in the PWSSMP are as of 2015. There is also no central database for knowledge management in the sector. This is partly due to the absence of an apex body that will coordinate data collection, planning and programming for the sector.
  - The Department of Science and Technology (DOST) of the Philippines is putting water resource management as one of the major priorities in research and development (R&D) programs through a partnership with the public and private sectors. One collaboration of the DOST-Philippine Council for Industry, Energy and Emerging Technology Research and Development (PCIEERD) with the National Water Resources Board (NWRB) has been collaborating in monitoring the conditions of our water resources. Additionally, their Climate Resilient Initiative provides scientific information on planning, and critical infrastructure, particularly concerning climate change adaptation and disaster risk reduction.
2. Could you share specific examples that have successfully used STI, including frontier technologies (e.g., AI, drones, etc) or other forms of innovation in general in addressing the above challenges?
- The initial actions needed in addressing the abovementioned challenges do not require specific STI and frontier technologies as such depend on the new administration’s plans for the sector and the enhanced coordination, cooperation, and support of different agencies/entities.

In the **Philippines**, the USAID, through the Safe Water Project, is a key development partner of NEDA in the WSS subsector as it shares a common interest in achieving long-term water security for the country. Currently, the USAID provides technical assistance to NEDA's WSS-related activities, e.g., advocating the PWSSMP and updating and monitoring the said masterplan's workplan, among others.

In addition, the Philippine Water Challenge (PhlWC) is a platform to formulate solutions, support improvements, and encourage innovations in the country's WSS subsector. It seeks to enhance the country's culture of innovation and network of innovators particularly in the WSS sector. PhlWC is an annual competition that aims to:

1. Identify innovative solutions (such as digital applications, financial models, process models and tangible innovations like equipment and devices) that will benefit both WSPs and users;
  2. Identify community demonstration projects that can contribute to improved WSS among water-stressed communities; and
  3. Promote cross-sectoral collaboration to address WSS-related challenges in these communities.
- At DOST-ITDI, nanotechnology was used to develop ceramic water filters with anti-microbial nanocoating and household /community-based filters for the metal in water. Both technologies have been field-tested in communities where there is a need for potable drinking water. At the same time, the development of "Mabuhay Straw" used the technology of additive manufacturing or 3D printing.
  - DOST has launched the DOST Artificial Intelligence Programs and Technologies: AI for Better Normal, Development of capability-building efforts like the Learning at Scale program, AIPinas, and SPARTA since 2016 to increase the country's competitiveness and ensure AI's maximum economic and social benefits.
  - Department of Science and Technology's Collaborative Research and Development to Leverage Philippine Economy (CRADLE) Program has funded a project led by researchers from the Asian Institute of Management (AIM). They are harnessing the power of artificial intelligence (AI) and machine learning to help curb water shortages in the east service area of Metro Manila. The research team developed simulation modeling software to enhance Manila Water Company's (MWC) capability in forecasting the water supply system of Angat-Ipo-La Mesa Dams and its treatment plants and storage reservoir. Their modeling software can also forecast the water supply of other dams in the Philippines, providing more opportunities for other agencies to benefit from this tool.
3. Can you provide examples of policies/projects/initiatives specifically aimed at strengthening national STI capabilities to address these challenges?

*Example: Master training programs in Water Management and Sanitation in Morocco ([brochure link here](#)) ([website link here](#))*

- A Public-Private Development Partnership combining hands-on experience and cutting-edge technology to equip the next generation of Moroccan water technicians with the skills necessary for ensuring a sustainable future of this critical natural resource
  - 4 modules have specifically been conceived to help professionals master both basic and operational concepts. They aim at providing trainees with the capacity to work in an efficient and productive manner, through the use of innovative training tools such as Virtual Reality (VR), Environmental Discovery Systems (EDS) and the IEA training platforms. Specific attention is furthermore given to health and safety, through a module addressing the main risks professionals of the water sector may face, with hands on simulations in real working conditions and Virtual Reality.
  - A fully equipped training hub has been established within the ONEE training center in Rabat
  - In total 23 training modules have been developed in the areas of wastewater treatment, drinking water, and operation and maintenance of water facilities as part of a nationally accredited curriculum
- In the **Philippines**, the PWSSMP KRA 8: Driving Research and Development (R&D) outlines the following priority actions which focuses on interventions related to research and development, innovative solutions, technologies, or policies that restrict the use of potential technologies concerning WSS:
    - a. NWRB to formulate research and development agenda based on priority needs of key partner agencies and stakeholders. The agenda should include, among others, technology on lowering energy costs and increasing water efficiency; sanitation technology options for challenging contexts (e.g., high water table, flood-prone, etc.); low-cost and decentralized septage systems; and policies such as raw water pricing and tradeable water regime;

- b. *NEDA to promote the conduct of research and development studies based on priority research and development agenda (i.e., tie-up with academe, WSS partners, and experts).*
  - c. *Create a Research and Development Division under the envisioned NWMC Planning Department with the immediate task of formulating the WSS research and development agenda based on needs*
    - *Moreover, the technology described in item #1 will be taught to academic institutions with fabrication capabilities to strengthen national STI capabilities in providing potable water supply to those in need.*
    - *In **Ethiopia**, Digital Ethiopia 2025, strategy took into consideration the current economic drivers (Agriculture, Manufacturing and Services) and Cloud seeding technology.*
4. **Could you share case studies of regional/ international cooperation that have strengthened STI developing countries' capacities in managing water and sanitation and improve their access for all?**

**Example: Global Partnership for improving the food cold chain in the Philippines** ([project website link here](#)) ([Publication link here – see page 10](#))

- *We need safe, clean water for hydration, sanitation but also for food production. Even the water that we use for agriculture has to come from safe sources. If we water our crops and grains with contaminated water, bacteria and disease can spread to those who consume the final products. Sadly, vast quantities of clean water – estimated at 250km<sup>3</sup> per year - are used to produce food that is ultimately lost or wasted.<sup>10</sup>*
- *Food loss reduction can therefore help us reduce the amount of clean water that it is wasted on an annual basis. For this, we need effective cold chains. The cold chain is a temperature-controlled supply chain that preserves and extends the shelf life of our food and other temperature-sensitive products (from vaccines to photographic film). For cold chains to be effective, we need to maintain an uninterrupted low temperature at every stage of the process. This includes cold storage, processing and distribution, refrigerated transport, and chilled display.*
- *To reduce food loss and maximise water-use efficiency, by establishing reliable cold chains, UNIDO is helping the GOV of the Philippines. The “Global Partnership for Improving the Food Cold Chain in the Philippines” project, is bringing together international and national technology and financial partners to mobilise resources, funding and technical expertise to promote sustainable and innovative cold chains. The Cold Chain Innovation Hub (CCI-Hub) is the physical and virtual platform for action in this project. The CCI-Hub connects a network of national and international actors to improve the efficiency and environmental sustainability of cold chains.*
- *In the **Philippines**, USAID Water Security for Resilient Economic Growth and Stability (Be SECURE) Project was a four-year project (2013-2017) that aimed to promote good governance and strengthen capacities for long-term water security, improve access to WSS services and build more resilient communities. It focused on increasing sustainable access to WSS services and increasing resilience to climate-related water stress and hydrological extremes. The project worked at the national level which involved activities to support water sector governance and regulation (e.g., technical assistance and stakeholder advocacy on the NWRB’s amendments to the Philippine Water Code, NEDA’s improvement of its Joint Venture (JV) Guidelines and creation of a WRC).*

*Be Secure also worked in six geographic sites (i.e., Iloilo, Leyte, Misamis Oriental, Maguindanao, Basilan, and Zamboanga City), working with local government units (LGUs) and WSPs at the watershed scale to improve capacities in integrating climate change into local planning and provision of WSS services. These activities include programs and training to reduce non-revenue water (NRW) (e.g., establishment of calibrated hydraulic models and development of a NRW management strategy), formulation of feasibility studies on new water sources, assistance in developing a public-private partnership, formulation of ordinances, selection of appropriate technology and sites, preparation of preliminary designs for septage treatment systems, conduct of financial analysis, and implementation on promotional campaigns. Training sessions on water auditing, water system development, interpretation and use of scientific data and information for updating of climate hazard/risk maps and plans as well as mentoring sessions on integrating climate resilience in business, emergency response planning, and water demand management were also conducted, among others. The project’s major accomplishments include over 1.6 million Filipinos gaining access to an improved drinking water source (i.e., against a 1.2 million target), including 909,097 people who live in conflict-affected areas in Mindanao. Meanwhile, over 1.04 million Filipinos gained access to an improved sanitation facility against the target of 400,000 Filipinos. More than 2,000 stakeholders also had increased capacity to adapt to climate impacts through the conduct of a total of 144 training sessions (i.e., against a target of 1,575 stakeholders)*



- In **Ethiopia**, under CRGE, Renewable energy water supply project to replace diesel pumps with solar and wind implemented by Ministry of water and energy (partnered with GCF, CR WASH).

Please indicate contact person(s) responsible for projects/policies and international collaboration in this context in case we need clarification on the inputs.

- **Ethiopia project:** For further information contact Mr Naoki Torii, UNIDO Climate Technology and Innovation Division; email: [n.torii@unido.org](mailto:n.torii@unido.org)
- **Morocco project:** For further information contact [H2O-Maghreb@unido.org](mailto:H2O-Maghreb@unido.org) or Mr. Stavros Papastavrou, UNIDO Department of Agri-Business; email: [s.papastavrou@unido.org](mailto:s.papastavrou@unido.org)
- **Philippines project:** For further information contact: Mr Adnan Atwa, UNIDO Department of Environment; email: [a.atwa@unido.org](mailto:a.atwa@unido.org)

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Please send your responses and any further inputs on the theme to the CSTD secretariat ([stdev@unctad.org](mailto:stdev@unctad.org)) by 31 July 2022. We look forward to receiving your valuable inputs.

Sincere regards,  
CSTD secretariat

## **CASE OF MADAGASCAR**

### **PRIORITY THEME 2:** Ensuring safe water and sanitation for all: a solution by science, technology and innovation

1. Can you give examples of projects/policies in your organization helping countries improve the management of water and sanitation and provide access to safe water and sanitation for all? What are the main challenges confronted (including the gender dimension) while trying to implement these projects/policies?

*In Madagascar, UNIDO's support to the national water, sanitation and access to safe water is through the project "improver public health by solar powered water sanitation system with in the national One WASH national program Phase II program.*

*The challenge encountered is weak involvement of the women for leadership of the WaSHco (local scheme ownership and management organ). In addition, setting cost reflective tariff setting for sustainable water scheme operation.*

*In the Government's effort to increase access to water and sanitation for all, many initiatives are currently ongoing in the WASH sector, while a national platform is set up and operational.*

*In the Government's effort to increase access to water and sanitation for all, many initiatives are currently ongoing in the WASH sector, while a national platform is set up and operational.*

*According to a recent report carried by UNICEF in March, only 63% of the drinking water supply systems in Madagascar, all types combined, were functional and 23% could be broken 1 to 3 years after their constructed. This situation is not very different from the Rural to urban areas*

*In urban areas many facilities are outdated, resulting in leakages and blockages that cannot meet the demands of growing urban populations. Likewise, facilities built in rural areas suffer from poor management and unavailability of spare parts leading to insufficient provision of drinking water. 1 Few sewage systems exist in Madagascar. 17% of households in the Antananarivo urban area are connected to the sewage system while it is only 1% in peripheral municipalities. Wastewater is discharged into the environment without prior treatment<sup>2</sup>.*

*A root cause of the dysfunctional water system is that water governance mechanisms at municipal levels are not effective. Organizational capability is low and local technical skills for construction, management and maintenance are lacking. Clients' willingness or ability to pay is low. Moreover, as the water sector is considered as a social sector, business creation around water has not been well developed so far.*

2. Could you share specific examples that have successfully used STI, including frontier technologies (e.g., AI, drones, etc) or other forms of innovation in general in addressing the above challenges?

*UNIDO, in partnership with UNICEF, is preparing a proposal to replicate the H2O Maghreb project in Madagascar, using virtual reality and high tech to implement training for youth and professionals in the water sector. This initiative will be carried out with the Ministry of Water, local training centres and universities and private operators in the sector.*

3. Can you provide examples of policies/projects/initiatives specifically aimed at strengthening national STI capabilities to address these challenges?

*Ministry of Water, Sanitation and Hygiene (2020) " Madagascar: National Water, Sanitation and Hygiene Policy (PNEAH) " March 2020*

*Code de l'eau Madagascar*

Please indicate contact person(s) responsible for projects/policies and international collaboration in this context in case we need clarification on the inputs.

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<sup>1</sup> Ministère de l'Eau, de l'Assainissement et de l'Hygiène (2020) « Madagascar : Politique Nationale de l'Eau, de l'Assainissement et de l'Hygiène (PNEAH) » March 2020

<sup>2</sup> <https://www.gret.org/2016/02/madagascar-working-on-the-entire-sanitation-chain-for-inhabitants-health/?lang=en>

## Case of H2O Maghreb project

### 1. Can you give examples of projects/policies in your organization helping countries improve the management of water and sanitation and provide access to safe water and sanitation for all?

*In the area of technical cooperation, UNIDO has been active in the field of water management and sanitation with the project H2O Maghreb ([H2O Maghreb – LKD Facility](#)) in Morocco to establish a new water knowledge and training hub in Rabat. Through state-of-the-art technology, virtual reality tools and cutting-edge curricula, H2O Maghreb aims at enhancing the country's capacity for sustainable water and wastewater management in both the public and private sectors. The project is a private-public partnership among Morocco's Ministry of National Education and Ministry of Equipment, Transport, Logistics and Water, EON Reality, FESTO, ONEE, UNIDO and USAID. Overall, 112 young Moroccans were trained through this project, out of which 76% were women. 75% of those who graduated before the COVID outbreak started found gainful employment within 6 months from training completion.*

*Project summary and further information:*

- *see postcard and project document ([UNIDO open data platform](#))*
- *USAID factsheet and overview article ([here](#) and [here](#))*
- *videos on the [globalwaters.org](#) platform ([here](#))*
- *onepager in French (attached)*
- *brochure in French (attached)*
- *detailed training modules in French (attached)*
- *social media presence ([here](#))*

### What are the main challenges confronted (including the gender dimension) while trying to implement these projects/policies?

*In Morocco, although women historically formed a minority in technical positions in the water sector and often still suffer from forms of discrimination during recruitment, the project's experience has indicated an upward trend in the number of women recruited to such positions in recent years, as female profiles are increasingly valued by recruiters, and therefore sought after. To help close this gap within the water sector, the project especially targeted women for training through specific communication campaigns. Highlighting the project's female trainers also helped attract young women to the training.*

### 2. Could you share specific examples that have successfully used STI, including frontier technologies (e.g., AI, drones, etc) or other forms of innovation in general in addressing the above challenges?

*At the heart of H2O Maghreb, it is the use of digital learning tools to prepare a new generation of water technicians. In partnership with EON Reality, virtual reality (VR) training solutions were introduced to enable water technicians to gain hands-on experience in operating virtual water treatment facilities and responding effectively to real-life emergencies that may occur at water and wastewater plants. VR-based training has the major advantage of training students to deal with dangerous and/or complex situations—such lightning strike, flooding or chemical accidents—within a safe learning environment. <http://eonreality.com/unido-partners-eon-reality-promote-avr-based-knowledge-transfer-good-water-management-practices-morocco>. In partnership with Festo Didactic, digital education materials on water management system, that is the Environmental Discovery System, were used to give trainees the opportunity to try out the different functions in the water cycle and experience directly the interaction between functions and how to influence them.*

- *H2O Maghreb is successfully using VR technology, more information on this can be found in [this](#) article by EON Reality (in addition to articles shared with this submission)*



**3. Can you provide examples of policies/projects/initiatives specifically aimed at strengthening national STI capabilities to address these challenges?**

*A key partner in H2O Maghreb is the National Office of Electricity and Water (ONEE) in Morocco [ONEE - Branche Eau \(onep.ma\)](http://onee.ma). Under the project, a water training hub was established at ONEE's International Institute for Water and Sanitation to deliver cutting-edge training in water management and, in turn, provide a platform for increasing the capacities of existing water professionals and preparing the future generations of water technicians. The project also supported the upgrading of ONEE trainers' skills in relation to the use of the H2O Maghreb equipment and didactic tools. By placing the water knowledge hub at ONEE, the project put the basis for dissemination of good practices and replicability.*

**4. Could you share case studies of regional/ international cooperation that have strengthened STI developing countries' capacities in managing water and sanitation and improve their access for all?**

*ONEE is working with several regional/African water providers, and the equipment provided by / training modules developed through H2O Maghreb at ONEE's IEA can also benefit other developing countries' capacities in managing water. In addition, there is a strong interest from water providers in other African countries to replicate H2O Maghreb*

*H2O Maghreb was initially designed as a pilot project, in order to test its training approach with the idea that, if successful, it could prove useful model for countries facing similar constraints in terms of water management and skills shortage. As a result, international and regional outreach activities were fully integrated to the project logical framework. Following the project implementation, other countries in Africa have been considering replicating H2O Maghreb. In addition, water technicians from Guinea benefitted from training sessions provided by ONEE at its water management hub and with support from the H2O Maghreb project.*