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The United Nations World Water Development Report 2023

# Partnerships and cooperation for water

## Facts, Figures and Action Examples

## The state of the world's freshwater resources

Globally, water use has been increasing by roughly 1% per year over the last 40 years (Aquastat, n.d.). The bulk of this increase is concentrated in middle- and lower-income countries, particularly in emerging economies (Ritchie and Roser, 2017).

A combination of population growth, socio-economic development and changing consumption patterns has driven this trend in use. Regions with the largest water withdrawals per capita have been Northern America and Central Asia (FAO, 2022).

Groundwater provides half of the volume of water withdrawn for domestic uses globally and around 25% of all water withdrawn for irrigation. Hotspots of groundwater depletion are found around the world, most often in areas with intensive groundwater withdrawals for irrigation or to supply large cities (United Nations, 2022).

Future trends in demand are difficult to predict accurately. Burek et al. (2016) estimated that overall global demand for water will continue to increase at an annual rate of about 1%, resulting in an increase of between 20 to 30% by 2050, with a margin of error of more than 50%.

The evolution of water demand is highly location-specific, reflecting shifting use patterns across the three major water use sectors – municipalities, industries and agriculture. Real growth in water demand will be highly dependent upon whether (or not) measures to improve water use efficiency are implemented across these different sectors.

Water availability per person varies significantly by region, but has been decreasing in all worldwide as a function of population growth rates. The decline in global per capita internal renewable water resources (IRWRs) was about 20% between 2000 and 2018; with a greater change in countries with the lowest per capita IRWRs, which are often located in Sub-Saharan Africa (41%), Central Asia (30%), Western Asia (29%) and Northern Africa (26%). Europe was the region showing the smallest decline, with 3% (FAO, 2022).

Global freshwater withdrawal was about 3,800 km$^3$/year in 2017 (United Nations, 2021; Aquastat, n.d.), roughly 10% of renewable water resources availability. But this global statistic is particularly misleading as it hides real problems related to local or regional physical water stress (WRI, 2019), a term used to describe water use as a proportion of water availability. Physical water stress is determined by a combination of factors, including surface and/or groundwater availability (which can be greatly influenced by varying climatic conditions), ecological requirements, and human abstractions.

Between 2.2 and 3.2 billion people lived under water stress for at least 1 month per year in 2010, corresponding to 32% and 46% of the world's population at the time. Around 80% of people living under water stress lived in Asia; in particular, northeast China, as well as India and Pakistan (Vanham et al., 2021).

The global urban population facing water scarcity is projected to increase from 933 million (one third of global urban population) in 2016 to 1.7–2.4 billion people (one third to nearly half of global urban population) in 2050, with India projected to be the most severely affected (He et al., 2021).

Twenty years ago, an estimated 1.6 billion people lived under conditions of economic water scarcity (Comprehensive Assessment of Water Management in Agriculture, 2007), and it remains unclear whether this number has gone up or down. Currently, about 25% of the global croplands are under agricultural economic water scarcity, where the lack of irrigation is due to limited institutional and economic capacity instead of hydrologic constraints (Rosa et al., 2020).

According to World Bank (2016), water scarcity, exacerbated by climate change, could cost some regions up to 6% of their Gross Domestic Product (GDP) by 2050 due to water-related impacts on agriculture, health and incomes, potentially spurring migration and even conflict.

## Water quality and ecosystems

Water quality data remain sparse, especially at the global level, due in large part to weak monitoring and reporting capacity. This is especially true in many of the least developed countries in Asia and Africa (United Nations, 2021).

Low-, middle- and high-income countries all show signs of risks related to water quality. Poor ambient water quality in low-income countries is often related to low levels of wastewater treatment (WWAP, 2017), whereas in higher-income countries runoff from agriculture is a relatively more serious problem (UNEP, 2021a). The release of hazardous chemicals from industry still occurs across all continents, and emerging pollutants, including microplastics and pharmaceuticals, remain a growing concern (WWAP, 2017; United Nations, 2021).

Freshwater ecosystems are among the most threatened in the world (Vári et al., 2022). A great majority of indicators of ecosystems and biodiversity have been experiencing rapid deterioration across the globe as a result of multiple human drivers. For example, 75% of the land surface has been significantly altered, with over 85% of natural wetlands area lost. Since 1970, land use change has had the largest relative negative impact on both terrestrial and freshwater ecosystems (IPBES, 2019).

The loss of environmental services and biodiversity is expected to continue as natural landscapes are lost to cultivated land (UNEP, 2019). How to maintain sustainable levels of production while avoiding further damage to the natural resources and the provision of ecosystem services will remain a central question in global debates on the future of food, water and agriculture (FAO, 2022).

## Extreme events

Over the period 2000–2019, floods are reported to have caused US$650 billion in economic losses, affecting 1.65 billion people and resulting in over 100,000 deaths. Over the same period, droughts affected another 1.43 billion people, with recorded estimated losses of nearly US$130 billion. Combined, floods and droughts accounted for over 75% of all disasters due to natural hazards affecting people (CRED/UNDRR, 2020).

Over the period 1985–2015, flood frequency has increased at both global and latitudinal scales, with floods in the tropics quadrupling since 2000, compared to a 2.5-fold increase in the north mid-latitudes (Najibi and Devineni, 2018). According to the Intergovernmental Panel on Climate Change (IPCC) (Hoegh-Guldberg et al., 2018), increases in drought frequency and magnitude are projected to pose substantially larger risks with a temperature rise of 2°C than at 1.5°C, particularly in the Mediterranean region (including southern Europe, northern Africa and the Near East) and southern Africa (medium confidence).

## Progress against SDG6 targets

**Drinking water and sanitation services (Sustainable Development Goal (SDG) Targets 6.1 and 6.2):** *"Five years into the SDGs, the world is not on track to achieve SDG Targets 6.1 and 6.2. Achieving universal coverage by 2030 will require a quadrupling of current rates of progress in safely managed drinking water services, safely managed sanitation services, and basic hygiene services. Least developed countries (LDCs) have the furthest to go and it will be especially challenging to accelerate progress in fragile contexts."* (WHO/UNICEF, 2021a, p. 7).

**Water quality and wastewater (SDG Target 6.3):** Globally, an estimated 44% of all domestic wastewater worldwide was not safely treated prior to its release into the environment in 2020. This number was extrapolated from data from 128 countries representing 80% of the global population (UN-Habitat/WHO, 2021).

About 60% of the world's reported water bodies were categorized as having 'good' ambient water quality. However, over three-quarters of the over 75,000 water bodies that were reported on in 2020 were in 24 high-GDP countries. The poorest 20 countries reported on just over 1,000 water bodies and are therefore grossly under-represented in this global estimate (UNEP, 2021a).

**Water use efficiency and water scarcity (SDG Target 6.4):** Water use efficiency rose by 9% from 2015 to 2018 (from 17.3 to 18.9 US$/m$^3$). All economic sectors have seen an increase in their water use efficiency between 2015 and 2018 (FAO/UN-Water, 2021a). However, these results are preliminary and remain inconclusive until more data points are forthcoming.

Three out of seven SDG regions had water stress values above 25% in 2018, including Central and Southern Asia with high water stress and Northern Africa with critical water stress. The remaining regions and subregions, representing approximately 31% of the global population, were at the 'no stress' level, but important differences in water stress levels were evident at country and major basin level. On average, 10% of the global population lives in countries with high or critical water stress, which significant impacts water access and availability for personal needs (FAO/UN-Water, 2021b).

**Water management and transboundary cooperation (SDG Target 6.5):** According to the latest indicator status report (UNEP, 2021b), while most countries have made some progress, the global rate of progress on integrated water resources management (IWRM) implementation needs to double to approach the target. None of the four IWRM dimensions are expected to be fully implemented by all countries by 2030.

In total, 153 countries share 286 transboundary river and lake basins and 592 transboundary aquifer systems. As of 2022, an estimated 58% of the world's transboundary basin areas had an operational arrangement for water cooperation. The global average of the aquifer component is 42% (UNECE/UNESCO, 2021).

**Water-related ecosystems (SDG Target 6.6):** The wetlands extent index, a primary indicator for SDG 6.6.1, tracks, tracks natural wetland area since 1700, showing an 80% loss since the pre-industrial era. The data are not yet refined enough to track discrete trends in recent years (UNEP, 2021c).

According to estimates by the Organisation for Economic Co-operation and Development (OECD), the official development assistance (ODA) disbursed and committed to 'water' in 2020 was estimated at US$8.7 billion globally, up from US$2.7 billion in 2002 (OECD.stat, n.d.).

The number of countries with clearly defined procedures in law or policy for participation by users/communities has increased between 2014 and 2019. Over the same period, the number of countries reporting high levels of participation has increased more rapidly, but still remains low overall. Levels for both laws/procedures and participation are very low for drinking water in both urban and rural settings compared to the other subsectors (UN-Water, n.d.).

## Food and agriculture

Water allocation from agriculture to urban centres has become a common strategy to meet freshwater needs in growing cities (Garrick et al., 2019; Marston and Cai, 2016; Meinzen-Dick and Ringer, 2008; Molle and Berkoff, 2006). Roughly one-third of the world's cities that are dependent on surface water are facing competition with agriculture, which uses approximately 72% of the global freshwater withdrawals (Garrick et al., 2019). Competition for freshwater between cities and agriculture is projected to grow due to rapid urbanization, for which urban water demand is projected to increase by 80% by 2050 (Flörke et al., 2018).

The use of reclaimed water in agriculture is an increasingly viable option in regions experiencing water scarcity, growing urban populations and growing demand for irrigation water.

## Water and environment

Water was included in 75% of countries' climate change National Adaptation Plans (NAPs) (Walton, 2015). Recognition of the role of ecosystems in climate change mitigation and adaptation in the Paris Agreement (United Nations, 2015) allows countries to focus on ecosystem-based mitigation and adaptation strategies in their NAPs and in the Intended Nationally Determined Contributions (INDCs) that will determine investment priorities as far as 50 years in the future.

The IPCC's most updated reports released in 2021 and 2022 (IPCC, 2021; 2022) confirm that climate change has already altered freshwater ecosystems, leading to diverse adverse impacts on human systems.

Wastewater, including agricultural runoff, is the leading cause of water pollution. It is intricately linked to human and ecosystem health, with over 80% of global wastewater estimated to enter water bodies untreated (WWAP, 2017).

The continuing rate of loss and degradation of freshwater ecosystems and the loss of freshwater biodiversity remains the highest among all ecosystem types (UNEP, 2021a).

Green infrastructure payments have protected, rehabilitated, or created new habitats on more than 486 million hectares of land around the world, an area nearly 1.5 times the size of India, with a total investment of US$25 billion in 2015, mostly going to landowners and local communities and mostly driven by water resources-related objectives (Bennett and Ruef, 2016). However, this is still a meagre 0.37 to 1.1% of the estimated amount of investment required in water infrastructure in the same year (WWC/OECD, 2015). A common means of financing these schemes is through water funds (Box 5).

Davidson et al. (2019) estimated the annual value of natural wetlands to be US$47.4 trillion per year at 2011 values, 43.5% of the global total value of the ecosystem services of all natural biomes, despite wetlands covering less than 3% of land area. Between 32% and 53% of the monetary value of inland wetlands comes from co-benefits such as food, erosion regulation, tourism, and recreation. This diversity and scale of the benefits forge strong interests among stakeholders and potential partners beyond the water sector.

Environment-related data form one of the most significant gaps in water-related knowledge.

Partnerships involving local communities ('citizen science') are increasingly used to improve monitoring of the environment. This is particularly so for water quality monitoring, in order to address the huge gaps in data availability. Engaging youth and women in data-scarce least developed countries is gaining attention, engendering personal empowerment and ownership, particularly for hydrological data (Rigler et al., 2022).

**Action example**

**Box 1 Adopt-a-River in action: UNEP and Four Rotary Clubs partner to clean up the Athi River (Nairobi, Kenya) and plant trees**

Following the signing of an agreement between the United Nations Environment Programme (UNEP) and Rotary International, local Rotary clubs embarked on a project to remove all solid waste along the Athi River. Following a waste assessment, the first phase focused on removing solid waste, installing traps at points where storm water carrying solid waste gets into the rivers and planting trees along the river to reduce surface erosion. The clubs collaborated with members of the community to provide labour. The next phase will include providing recycling bins in partnership with waste collection service providers. Industries releasing their effluent to the river through various channels will also be brought on board as part of efforts to improve upstream biological treatment of industrial waste.

*Source: Ombok (2021).*

## Water supply and sanitation for human settlements

In the global water operators' partnerships (WOP) database maintained by the Global Water Operators' Partnerships Alliance, out of the 425 WOPs documented, the majority (50%) involves two utilities from the Global South; and 38% are partnerships between a northern and a southern utility. The remaining are triangular partnerships (10%) and partnerships among utilities from the Global North (2%).

WOPs can be a valuable instrument to reach underserved populations in urban contexts, and implementing WOPs can have a ripple effect because the beneficiary or mentee utility, after having enhanced its capacities and acquired new competences, can go on and use this expertise to help other utilities.

The positive outcomes generated by WOPs include organizational changes related to improvements in staff knowledge, skills, awareness and attitude, in addition to a deeper understanding of the organization's needs and strategies on how to address them (Pascual-Sanz et al., 2018). This translated in an estimated number of 63.7 million indirect beneficiaries (UN-Habitat, n.d.). However, from a practical standpoint, some challenges still persist.

Many countries are still facing challenges in extending services to rural areas, where coverage of safely managed drinking water services (60%) is lower than in urban areas (86%) (WHO/UNICEF, 2021a).

At least 2 billion people (globally) use a drinking water source contaminated with faeces, putting them at risk of contracting cholera, dysentery, typhoid and polio (WHO/UNICEF, 2021a).

At the end of 2020, the number of forcibly displaced people was estimated to be 82.4 million, with 48 million of these internally displaced (UNHCR, 2022). International human rights law requires that states guarantee everyone the right to an adequate supply of safe water for personal and domestic use. However, forced migration puts an increased strain on water resources and more importantly, on the local entities (utilities, communities) responsible for providing water supply and sanitation services.

Action example

**Box 2 Providing water services to indigenous communities in Guatemala through the FESAN–ADECOR WOP**

In 2017–2018, the National Federation for Sanitary Services Cooperatives (FESAN) from Chile supported the Rural Community Development Association (ADECOR) to expand inclusive and sustainable access to safe drinking water for people living in rural areas of Guatemala, to support women in conditions of extreme poverty, and to increase women's participation in the sphere of water.

The WOP, financed by the Inter-American Development Bank, was characterized by the participation of water professionals and local leaders. A needs assessment was conducted that highlighted issues with water access, systems functionality and environmental hazards. Then, FESAN went on to share their rich experience about technical and administrative capacity-building. As a result, the Municipality of San Martín Jilotepeque in Guatemala decided to establish an independent drinking water service unit, aligned with the culture and identity of the Kaqchikel ethnic group. The final phase of the WOP focused on training women and men from Maya indigenous communities on sustainable management models for rural drinking water supply, which allowed them to expand career opportunities.

As a result of this WOP, local communities and rural water operators of the district of San Martín Jilotepeque were able to supply drinking water to indigenous populations. Considering the local culture in a participatory manner is fundamental to make a long-lasting impact in rural water suppliers, impact workers and help them take ownership of the solutions.

*Source: GWOPA (2019).*

Action example

**Box 3 Supporting community-based WASH collaboration in displacement settings**

The International Organization for Migration (IOM) has worked to improve access to safe drinking water and sanitation in the Gedo Region of Somalia. A crucial element for ensuring water sustainability has been the establishment of several water user committees, which own and manage the water infrastructure and services. Their members are elected by the community and entrusted with responsibility for the operation and maintenance of the waterpoints on the site, in order to ensure their long-term sustainability. Water committees can also take on other roles, such as promoting positive hygiene behaviour change such as safe storage and collection of water, and safe food and hand hygiene.

It is key for women to be active participants of the committees, given that they are primarily responsible for domestic water collection, and are the main water decision-makers at the household level. Water committees can also work to mitigate disputes over water, promoting cooperation and conflict resolution.

Women's participation and inclusion in labour (work) activities form also a challenge in northeast Nigeria, where the role of women is largely limited to domestic chores, with little or no opportunity to participate in activities that bring them out into the public domain. The IOM encourages women to be fully involved at every stage of programme development, for example selecting where to drill boreholes and place sanitation infrastructure. Further, the IOM has engaged Hygiene Promotion and Community Engagement Volunteers, 80% of whom are women, who are actively involved in mass campaigns and risk communication and community engagement, leading a large transformation in attitude towards, and access to, these types of roles.

*Contributed by IOM.*

## Industry and energy

Industry and energy together use approximately 19% of the world's freshwater withdrawals (Ritchie and Roser, 2017).

A regional distribution shows that industrial water withdrawal averages 17% of total water use in high-income countries but only 2% in low-income countries (Ritchie and Roser, 2017).

It has been estimated that two-thirds of all water consumption is involved in corporate supply chains (TNC, n.d.). Supporting this estimate, companies in seven major sectors – food, textile, energy, industry, chemicals, pharmaceuticals and mining – are affecting more than 70% of the world's freshwater use and pollution (CDP, 2018).

A study suggests a 24% increase in industry and energy's water demand by 2050 in a 'middle of the road' scenario (Burek et al., 2016). More recently, the CDP (formerly the Carbon Disclosure Project) reported that about two-thirds of the companies that responded to its survey are reducing or maintaining their withdrawals (CDP, 2021).

According to the CDP, issues of water quality have largely been overlooked, with only 59% of the responding companies monitoring their wastewater quality, only 12% setting pollution targets and only 4.4% making progress against them (CDP, 2021).

There are approximately 400 million small and medium enterprises (SMEs) globally, representing about 95% of companies and providing 60% to 70% of employment (National Action Plans on Business and Human Rights, n.d.). The International Finance Corporation (IFC) estimates that there are 9.34 million registered women-owned SMEs in over 140 assessed countries in the non-agricultural sector (IFC, 2014).

See action example in **Box 1** "Adopt-a-River in action: UNEP and Four Rotary Clubs partner to clean up the Athi River (Nairobi, Kenya) and plant trees".

## Health

Global data show that on average progress needs to be four times faster to meet the promise on safely managed water, sanitation and hygiene (WASH) for all by 2030 (WHO/UNICEF, 2020; 2021b; WHO/UNICEF/World Bank, 2022). WASH and health partnerships are needed to accelerate progress on WASH, and in turn accelerate progress on WASH-related health goals.

In 2019, 1.4 million deaths and 74 million disability-adjusted life years (DALYs) globally were attributable to inadequate WASH (WHO, n.d.).

Major gaps in basic WASH still exist, with 1.7 billion people using health care facilities that lack basic water services and 780 million using facilities with no toilets (WHO/UNICEF, 2022). The COVID-19 pandemic has exposed gaps in these basic services but also drew attention to the need for greater support for WASH in all settings.

Increasingly, though, COVID-19 efforts are being leveraged to strengthen policies, regulations and investments in WASH.

In 2015, it was estimated that annually there are 1.3 to 4.0 million cholera cases, affecting 69 countries across the globe (Ali et al., 2015). Cholera continues to disproportionately affect the world's poorest and most vulnerable communities, often occurring in 'hotspots' where access to safely managed water and sanitation is limited.

WASH programmes, often implemented at scale, can enhance the coverage and effectiveness of nutrition interventions to reduce the malnutrition and stunting that affect 22% or 149 million children under the age of five years globally according to estimates for 2020 (WHO, 2021).

Climate change has already started influencing the transmission and spread of vector-borne diseases, and its impacts are likely to worsen (Rocklöv and Dubrow, 2020).

Workers doing toilet cleaning (predominantly women), faecal sludge management and sewer cleaning (predominantly men) are among the most vulnerable workers (World Bank/ILO/WaterAid/WHO, 2019).

See action example in **Box 3** "Supporting community-based WASH collaboration in displacement settings".

## Climate change

The opportunities that the water (and sanitation) sector represent for emission reductions – ranging from biogas recovery from wastewater treatment systems to geothermal power generation (UNESCO/UN-Water, 2020) – deserve greater attention from climate planners and should open the door to further collaboration with water stakeholders. For example, wastewater treatment and discharge directly account for 11.8% and 4.2% of global $CH_4$ and $N_2O$ emissions, respectively (Crippa et al., 2019). In addition, drinking water and wastewater management are responsible for approximately 4% of global electricity consumption in 2014, often associated with indirect carbon emissions (IEA, 2017).

**Action example**

**Box 4 Promoting cooperation on water and climate at the ministerial level**

The triple climate, health and economic crisis has highlighted the crucial role of water, sanitation and hygiene (WASH) in building resilient communities and achieving sustainable development, including meeting environmental goals.

For the first time since its inception, the Sanitation and Water for All (SWA) Partnership convened in May 2022 a High-Level Sector Ministers' Meeting on water, sanitation and hygiene with ministers of environment, climate, health and economy[1] to discuss joint solutions for climate change resiliency, pandemic prevention and increased economic development. The overall theme for discussion was *Building Forward Better for Recovery and Resilience*.

During the event, ministers of environment and climate had the opportunity to collaborate with water, sanitation and hygiene ministers so that agreements could be forged to make

[1] For more information, please see: www.sanitationandwaterforall.org/2022-sector-ministers-meeting.

sure that water adaptation needs, as well as mitigation opportunities, are introduced in national climate plans. The meeting also served to discuss how to ensure that climate priorities are integrated into national COVID-19 recovery plans.

The 2022 Sector Ministers' Meeting was preceded by a six-month-long preparatory process, composed of multi-stakeholder discussions at national and regional levels. During those discussions, water and climate stakeholders jointly analysed national progress on identified bottlenecks and successes regarding water and sanitation, and agreed on joint action.

As a result of this WASH and climate collaboration, a set of 25 commitments by country governments and other constituencies were formulated. An example is the commitment made by the Ministry of Water and Sanitation of Malawi to increase alignment to sector strategies, such as the Nationally Determined Contributions (NDCs) and the National Water Policy, by closely working with climate stakeholders. The outcomes of the meeting were followed up through national-level processes, contributing to the preparatory process of the 27th Conference of the Parties (COP27) to the United Nations Framework Convention on Climate Change (UNFCCC), the 2023 UN Water Conference, and the Sanitation and Water for All 2023 Finance Ministers' Meeting.

## Regional perspectives

### Sub-Saharan Africa

Of the 771 million people still lacking even a basic drinking water service in 2020, half lived in Sub-Saharan Africa (WHO/UNICEF, 2021a). There is a widening gap in water supply between urban and rural dwellers (Adams et al., 2019; Grasham et al., 2019; Niva et al., 2019) where governments have not been able to expand the necessary infrastructure to meet growing demand.

Community–public partnerships (CPPs) have been linked to the resolution of water-related conflicts. In Ghana, a partnership between the Ghana Water Company, private operators and community water boards enabled a successful mediation of water tariff conflicts by showcasing broader communal benefits (Galaa and Bukari, 2014).

In Uganda, more than 500 hectares of wetland areas were reportedly restored through a partnership between companies and local industries operating in the Ruwizi River catchment area (IWaSP, n.d.a). In Tanzania, a stewardship partnership comprising development partners resulted in successful restoration of the Mlalakua River and safeguarded it from pollution (IWaSP, n.d.b).

Cooperation is crucial for ensuring water security in the region's many transboundary basins and aquifers. In the Stampriet Transboundary Aquifer shared by Botswana, Namibia and South Africa, a joint assessment of the water system required the harmonization of data across the countries. The project has generated more than 40 thematic maps. The coordination mechanism supports science-based decision-making on water allocation and sound management at the basin level.

See action examples in **Box 1** "Adopt-a-River in action: UNEP and Four Rotary Clubs partner to clean up the Athi River (Nairobi, Kenya) and plant trees"; **Box 4** "Promoting cooperation on water and climate at the ministerial level"; **Box 7** "Joint monitoring of groundwater levels across borders"; and **Box 8** "Citizen science for development".

### Europe and North America

The Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (Aarhus Convention – UNECE, 1998) and the Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Water Convention – UNECE, 1992) have facilitated the development of various types of partnerships in the region and are also contributing to stakeholder participation outside the region.

Since 2006, National Policy Dialogues (NDPs) have been implemented in in countries of Eastern Europe, the Caucasus and Central Asia under the EU Water Initiative (EUWI). NPDs have strengthened water governance and IWRM in line with the provisions of the Water Convention, its Protocol on Water and Health, and EU Directives.

The International Joint Commission (IJC) between Canada and the United States of America demonstrates good practices for successful water cooperation and for the establishment of partnerships not only across borders but also within countries and between sectors, administrative levels and other stakeholders. Public outreach and engagement are foundational components of the IJC's activities.

### Latin American and the Caribbean

In Latin America and the Caribbean, rural drinking water and sanitation services are generally led by community organizations, such as administrative boards or water vigilance committees. An estimated 80,000 of these associations were active in the region's rural and peri-urban areas in 2011 (AVINA, 2011). However, these associations tend to have weak management capacities, mainly due to the lack of funding, insufficiently trained technicians, poor or insufficient infrastructure, and/or the difficulty of agreeing on rates or fees with the local population.

The current gender gap in governance and decision-making in the water sector has been recognized by policy-makers across Latin America and the Caribbean, and in fact, of all gender-related water policies established over the past 20 years, 58% address gender equality in governance and participation in the sector (Saravia Matus et al., 2022).

In Latin America, only 4 of the 22 countries (Argentina, Brazil, Ecuador and Paraguay) have arrangements for at least 90% of the surface of their transboundary basins. Furthermore, in ten countries, the area of the transboundary river and lake basins covered by operational arrangements does not reach 10%. There are however, several encouraging examples (UNECE/UNESCO, 2021).

**Action example**

**Box 5 Santiago Maipo Water Fund**

To address water security challenges in the Maipo River basin, particularly the growing water deficit (mega-drought), the Santiago Maipo Water Fund brings together multiple water users to find collective solutions. The objective of this partnership is to implement projects aligned with six strategic lines of action: (i) source water protection, (ii) water use efficiency, (iii) information management, (iv) risk management, (v) awareness and communication, and (vi) territorial planning. For instance, the water fund has launched a demonstration project based on restoration and reforestation for the protection of natural habitats, such as high Andean wetlands and key riparian areas in the Maipo River basin. A pioneering initiative for environmental monitoring of wetlands has also been launched. The fund has the support of the Metropolitan Regional Government and forms part of the Resilience Strategy of the city of Santiago.

*Source: Fondo de Agua Santiago-Maipo (n.d.).*

See also action example in **Box 2** "Providing water services to indigenous communities in Guatemala through the FESAN–ADECOR WOP".

## Asia and the Pacific

Several of the region's major river basins are experiencing high to critical levels of water stress. Compounded by the effects of climate change, these stress levels are reported to be increasing (UN-Water/UNESCAP, 2022).

Inequity in terms of water access remains an issue. Households with low education that also belong to the bottom 40% in wealth distribution face higher restrictions in access to basic sanitation (UNESCAP, 2018). Women and vulnerable groups suffer more from limited access to water and sanitation (Brighton, n.d.; UNESCAP, 2018). Furthermore, women, who are primarily responsible for water collection in local communities, often have limited participation in water management due to traditional norms and practices, such as power imbalances and sociocultural factors (Thai and Guevara, 2019).

Other critical regional challenges include inadequate sanitation services, pollution – both very closely related (WWAP, 2017) – as well as shortcomings in transboundary cooperation.

Public–private partnerships (PPPs) have been set up for infrastructure projects supporting water distribution, treatment and transmission (ADB, 2022), benefitting 67.5 million people in Asia and the Pacific in 2013 (Jensen, 2017). There has been an increase in PPPs for water services in China, Singapore and South Korea since 2000, but some have experienced a lack of sustainability when financial viability is not ensured.

Asia and the Pacific records generally high levels of IWRM implementation (GWP/UNEP-DHI, 2021), which attest to a focus on both water and land management for social and economic development.

## The Arab region

Characterized by its arid to semi-arid climate, the Arab region suffers from surface water scarcity. Over 392 million people in the region live with less than 1,000 $m^3$ of renewable freshwater per person per year (Aquastat, n.d.; UNDESA, 2019). This and other rising challenges, such as climate change, high dependency on transboundary water resources and high usage of water resources by the agricultural sector, require successful cooperation and partnership initiatives.

Fifteen out of the twenty-two Arab states are riparian to a shared surface water basin, and all Arab states, except the Comoros, are riparian to a shared aquifer. Several examples of cooperation modalities do exist in the region, including transboundary aquifers. The Nubian Sandstone Aquifer System, the North Western Sahara Aquifer System and the Orontes River basin are among those where such cooperation arrangements are in place.

See action examples in **Box 6** "$H_2O$ Maghreb: A training partnership responding to Morocco's water challenges"; and **Box 9** "Blended finance example: The As Samra wastewater treatment plant expansion in Jordan".

## Education and capacity development

The recent COVID-19 pandemic has given a major boost to the development of digital content and the adoption of information and communication technologies (ICT) for teaching and training worldwide. For example, the International Capacity Development Network for Sustainable Water Management (Cap-Net UNDP) experienced a 200% increase in demand for online courses during the pandemic (Cap-Net, 2019; 2021).

Awareness that scientific knowledge needs to be better integrated with other knowledge bases, such as local and indigenous knowledge, is also increasing. This is particularly relevant for managing water resources and risks. As women often play a major role in traditional water management, this also provides opportunities for women's empowerment and gender mainstreaming (Feijoo and Fürst, 2021).

The Global Multi-stakeholder Coalition that supports the 'Call for Action to accelerate gender equality in the water domain' initiative, coordinated by UNESCO's World Water Assessment Programme (WWAP) is a recent example of an active partnership that spurs the development and implementation of gender-inclusive strategies and transformative actions.

North–South and South–South inter-institutional educational collaboration can make e-learning materials locally relevant, improve their quality, and train local teachers and academics to make best use of those materials in local curricula.

The United Nations Educational, Scientific and Cultural Organization (UNESCO) Water Family, which includes approximately 30 water-related category 2 centres as well as 70 water-related UNESCO Chairs and the University Twinning and Networking Programme is a prime example of a partnership that aims to enhance institutional and human capacities through knowledge-sharing and collaboration. The category 2 centres also function as regional and global hubs to foster collaborative action and capacity development on strategic priorities including water.

Greater uptake and development of open science, as advocated by the *UNESCO Recommendation on Open Science*, can also support local relevance of, access to, and dissemination of training materials (UNESCO, 2021). Open Science promotes not only the co-development and sharing of knowledge (e.g. through open courseware), but also tools and techniques to create locally relevant knowledge, for example through open software, open laboratories and open innovation.

Partnerships between scientists, entrepreneurs and venture capitalists can support the integration of new technologies and innovation in capacity development, through the incubation of start-up companies, the creation of innovation hubs, and the local commercialization of new ideas and solutions. This has the potential to create new jobs and commercial activity, but also to actively stimulate the participation of women and minorities in the workforce.

**Action example**

**Box 6 $H_2O$ Maghreb: A training partnership responding to Morocco's water challenges**

The lack of a skilled workforce in a water-scarce country like Morocco prevents industry and agriculture from exploiting the full potential of growth (through improved water use efficiency and water quality/pollution control, among others). Responding to Morocco's water challenges, the United Nations Industrial Development Organization (UNIDO) launched the project *$H_2O$ Maghreb* in 2017, as a public–private development partnership between the Moroccan government, the United States Agency for International Development (USAID), the Moroccan National Institute for Water and Electricity (ONEE), and the private sector partners Festo Didactic SE and EON Reality (UNIDO, 2019). Festo Didactic and EON Reality have created a Virtual Reality Aquatronics training simulator that features several water and wastewater scenarios in which users interact with a virtual water treatment plant, operate machinery and perform emergency procedures. Virtual Reality (VR) applications introduce professionals to new disciplines and technologies, as well as to situations that are dangerous and difficult to reproduce.

*$H_2O$ Maghreb* introduces cutting-edge solutions to urgent water needs in Morocco and the region, while improving the skills and employability of young Moroccans by providing them with a market-driven training programme in a newly established water training hub (USAID, 2022). By developing a new water management curriculum, the project brought together the public and private sector to provide innovative training and equipment. The *$H_2O$ Maghreb* training programme combines elements from different professions (e.g. mechanics, electronics, hydraulics, chemistry, biology) to address the challenges of improving water management, access to water and water quality in a systematic manner (UNIDO, 2019).

*Additional information about the $H_2O$ Maghreb training programme can be found at https://lkdfacility.org/h2o-maghreb/.*

See action example in **Box 2** "Providing water services to indigenous communities in Guatemala through the FESAN–ADECOR WOP".

## Data, information and monitoring

Despite the essential importance of data and information in water-related decision-making, a range of challenges exist in producing holistic data sets, including a general lack of data across all use sectors, limited gender-disaggregated data (Miletto et al., 2019), temporal and spatial variability in local water availability, and difficulties (or reluctance) in sharing data, especially across international borders (Mukuyu et al., 2020).

Joint monitoring of transboundary water resources promotes a shared understanding of the system and provides a platform where data can be shared in real time and applied in a timely manner. As more data are generated, water use planning can thus be supported by evidence to harness shared benefits across the transboundary landscape and manage water in transboundary basins or aquifers more sustainably.

In many countries, obtaining access to data and sharing them transparently remain important challenges. Water-related data, in particular, have been criticized for being siloed across different sectors and therefore not interoperable for multiple users due to differences in terminology and other factors (Cantor et al., 2018). Transparency supports better management of water resources and promotes accountability when dealing with challenges such as pollution and over-abstraction.

With the advent of the digital era and the rollout and uptake of mobile phones, the potential for data generation is phenomenal. The ability of satellites to produce remotely sensed data, along with the Internet of Things and associated sensors, are also increasingly providing high-frequency data in real time.

## Innovation

New technologies are making the exploitation of new and non-conventional water sources more feasible. For example, solar energy may allow harvesting drinking water from the air (Lord et al., 2021) and simultaneous production of electricity and freshwater (Wang et al., 2019). Innovations in treatment technologies are creating opportunities for the recycling and reuse of wastewater (WWAP, 2017).

Taking account of social innovations, for example regarding working conditions, education, community development or health, can further enhance the partnerships, making them more transparent, robust, sustainable, resilient and inclusive.

Intellectual property issues, such as restrictive licences and patents, can pose challenges to the sharing of technologies, even within partnerships. The adoption of the Open Science principles can help avoid intellectual property issues and promote a more sustainable and equitable approach to technology-sharing (UNESCO, 2021).

The introduction of new technologies and innovations, such as ICT to facilitate new partnerships, may favour participation of those that are more knowledgeable and able to pick up those technologies. Care should therefore be taken that the introduction of new technologies does not lead to unintended side effects, such as a widening of the digital divide (Mirza et al., 2019).

**Action example**

**Box 7 Joint monitoring of groundwater levels across borders**

In the Tuli Karoo Transboundary aquifer system shared by Botswana, South Africa and Zimbabwe, efforts to generate data about the system have been improved through cooperation. Prior to this intervention, monitoring had not been managed in an integrated manner, resulting in limited spatial and temporal data about the system and how it can sustainably support the livelihoods of the mainly rural communities through food security and climate resilience. Joint groundwater-monitoring allows for the assessment of long-term and annual changes in aquifer storage due to climate change and water withdrawals.

Collaboration among the three country governments, the regional entity (the Southern African Development Community Groundwater Management Institute) and the basin organization (the Limpopo Watercourse Commission) led to the co-design of the groundwater monitoring system.

*Source: Adapted from Ebrahim et al. (2021).*

Action example

**Box 8  Citizen science for development**

Citizen science is a partnership in which volunteers, scientists and potentially other partners jointly create new scientific knowledge. While some projects focus only on the intellectual challenge, citizen science is increasingly explored as a means to support sustainable development. For example, community-based hydro-meteorological monitoring can help filling gaps in statutory monitoring networks and generate information that can support local water resources management. Efforts in Ethiopia and Nepal have shown that community-based monitoring can produce reliable and consistent measurements (Walker et al., 2016; Davids et al., 2019). In South Africa, the Water Research Commission is putting major efforts in engaging citizens in water quality monitoring, while citizen science is also explored as a method to generate evidence for the implementation of the Sustainable Development Goals (SDGs) (Fritz et al., 2019). A major challenge of applying citizen science in a development context is to create sufficient value for volunteer participants to ensure long-term sustainability of citizen science activities.

*For more information, please see: www.wrc.org.za/.*

## Funding investment and efficient spending

Water-related investments have historically been financed by public budgets, including international transfers, with contributions from water users (e.g. water tariffs). Official Development Assistance (ODA) for water increased steadily since the beginning of the millennium, from US$2.7 billion in 2002 up to US$9.6 billion in 2018, then dropping to US$8.7 billion in 2020. Compared to other sectors, these funds represent a minor share of total ODA, with just below 4% allocated to water over the 2016–2020 average (OECD.stat, n.d.).

The amount of private finance mobilized through official development finance for water supply and sanitation totalled US$4.6 billion between 2016 and 2020, compared to over US$48 billion for the energy sector (OECD.stat, n.d.).

In 2020, 80% of ODA allocated to water was labelled as contributing to 'climate change adaptation'. For other policy objectives, such as 'climate change mitigation' and 'biodiversity', these percentages are significantly lower (19% and 5% respectively) (OECD.stat, n.d.), suggesting there is room to coordinate and communicate mutual benefits between water and other objectives more explicitly to financiers.

Action example

**Box 9  Blended finance example: The As Samra wastewater treatment plant expansion in Jordan**

The As Samra wastewater treatment plant is the first in the Middle East to have used a combination of private, local government and donor financing, which can serve as inspiration for similar projects in emerging markets. This blended financial package was put in place with a viability gap funding mechanism (VGF) and grant financing.

The 2012-initiated project consists of the expansion of the As Samra wastewater treatment plant. It aims at expanding services for initially 2.3 million inhabitants to around 3.5 million people, thus covering 70–75% of the population of Amman and Zarqa (two of Jordan's most populous cities) by 2025. The total expansion costs of US$223 million were co-financed by a US$93 million grant from The Millenium Challenge, and a US$20 million grant from the Government of Jordan. This combination of donor and public funding, referred to as 'viability gap funding', was critical in leveraging an additional US$110 million in private financing. The largest share of US$102 million came from private debt (banks), and a smaller share of US$8 million was mobilized in equity by the contracted private operator, The Samra Plant Company (SPC). The duration of the Build-Operate-Transfer contract is 25 years, including 3 years for construction and 22 years of operation and maintenance, running until 2037.

In sum, by bringing down the capital costs, the grant funding enabled the project to be financially viable, thus benefiting the government and local rate-payers, without subsidizing the private sector. This new mechanism provides significant leverage and is likely to allow new projects to materialize.

*Sources: WWF (2020, pp. 37–38); Kolker and Tremolet (2016); MCC (2018); private communication from Veolia to AquaFed (July 2022).*

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