Water Europe

Technology & Innovation

BUILDING EFFECTIVE WATER DIALOGUES AND ALLIANCES MAKING INTERNATIONAL COOPERATION IN WATER INNOVATION WORK


Water
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Prologue

Water Europe (WE) is the recognized voice and promotor of water-related innovation and RTD in Europe. WE is a value-based multi-stakeholder association that represents the whole diversity of the innovative water ecosystem. WE was initiated by the European Commission as a European Technology Platform in 2004. All WE activities are guided by its Water Vision and the ambition to achieve a Water-Smart Society. The Water Europe White Papers are aimed at informing readers about complex water-related topics in a concise and targeted way, and presenting WE's vision and philosophy on the matter. They present evidence-based opinions on multiple water-related challenges and on ways to overcome them. WE White Papers are produced as part of the WE Collaboration Programme by the WE Vision Leadership Teams and the WE Working Groups. They target a wide variety of potential audiences, including the EU institutions, international organisations, the water industry, water users and water-related strategic stakeholders, the economic sectors, as well as media, analysts, regulatory and governing bodies, citizens and society at large.

Durk Krol
Water Europe Executive director

Water Europe Vision 2023

The human right to water encompasses five requirements: 1) availability, 2) accessibility, 3) affordability, 4) acceptability, and 5) quality and safety. These must be fulfilled to satisfy the human rights to water and sanitation, and protect the health of users and the general public, regardless of their identity, location or ability to pay.
Adapted from the UN Water website, 2022.

The Water Europe vision for a Water-Smart Society

This Water Europe Vision document charts the pathways towards society's better use, valorisation and stewardship of our water resources, and the development of resilient and sustainable solutions to address our key water challenges. It describes how these challenges can be transformed into opportunities for developing and deploying new European technologies, solutions, businesses and governance models for the Water-Smart Society of the future. It projects a future of comprehensive water security, sustainability and resilience for all societal functions, and of full environmental protection. It is a vision in which all relevant stakeholders are involved in the sustainable governance of our water system, in a way that meets ecological, social and economic needs, without compromising the ability to meet these needs in the future; water scarcity and pollution of European groundwater and surface water are avoided, while biodiversity is restored; water, energy and resource loops are largely closed to foster a circular economy; the water system is resilient and robust against demographic pressure and climate change events; and European water-dependent businesses thrive, thanks to forward-looking research and innovation. Although the vision is focused on the European situation, many of its features are relevant to realising Water-Smart Societies all over the world.

A paradigm shift towards an inclusive Water-Smart Society

The Water-Smart Society envisaged by Water Europe entails a paradigm shift in the way the value of water is recognised and realised, water-smart solutions are developed and deployed, and our future society organised and managed with regard to water. This shift calls for bold and courageous decisions, investments, changes, and new types of stakeholder partnerships at all levels of society, involving citizens, public authorities at all levels, scientists, industries and farmers, as well as the stewards of the natural environment. It will require the development of a dual migration path to introduce both new solutions and governance practices, with the involvement of all relevant stakeholders at urban, regional, inter-regional, national and international level.

The Water-Smart Society will leverage both the dramatically increased manageability made possible by the emerging cyber-physical environment and 'digital water' technologies, as well as the increased availability of 'multiple waters' to complement freshwater sources. It will also be characterised by much deeper levels of awareness, integration and collaboration between organisations and citizens.

Since the migration towards the Water-Smart Society will demand significant investment in redesigned and adapted infrastructure, as well as innovative technologies, it comprises a complex mix of challenges and opportunities for European industry. These will demand a longer-term programme to drive a stable and successful migration towards the future Water-Smart Society.

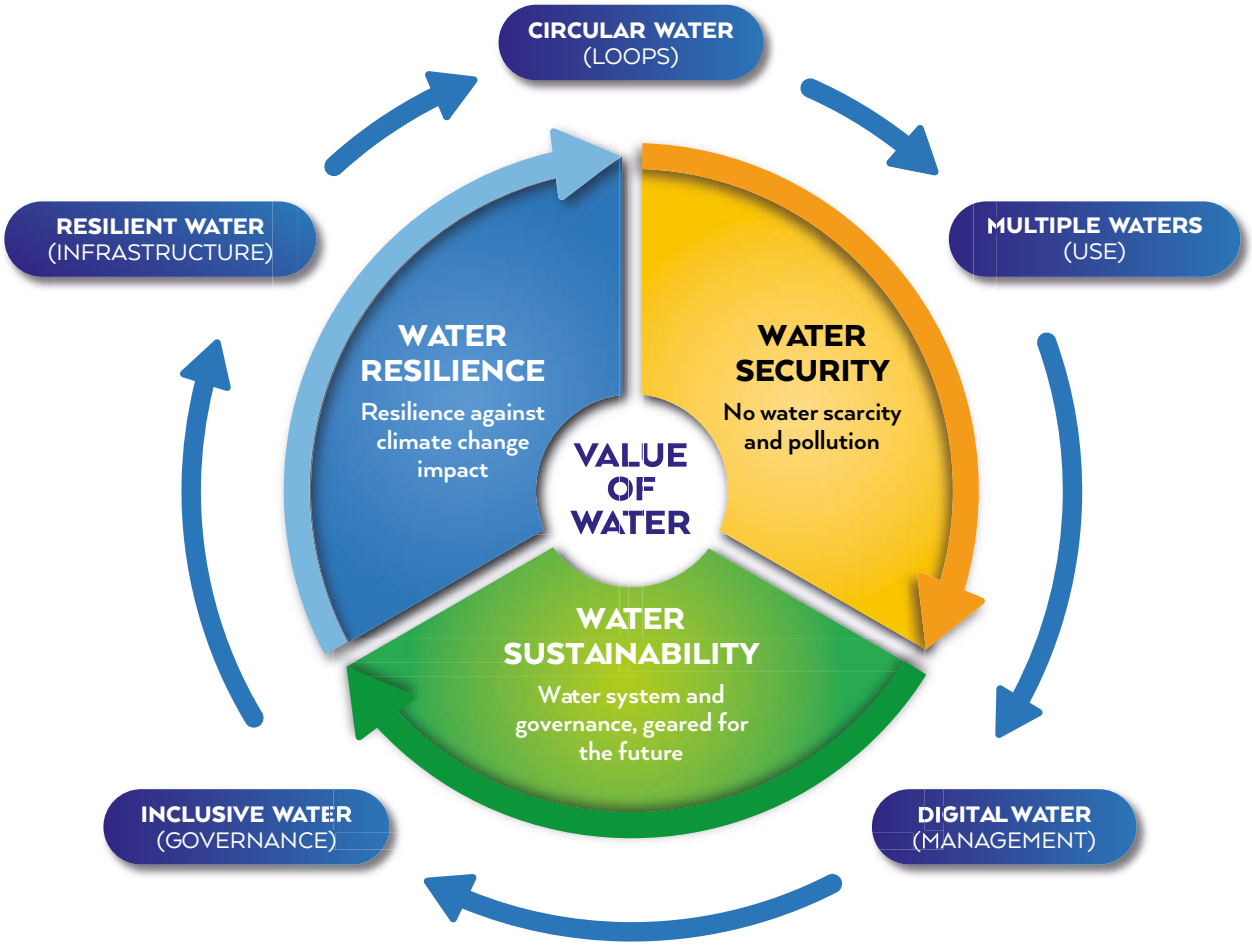
A Water-Smart Society

A Water-Smart Society is one in which the value of water is recognised and realised to ensure water security, sustainability, and resilience; all available water sources are managed so that water scarcity and pollution are avoided; water and resource loops are largely closed to foster a circular economy and optimal resource efficiency; the water system is resilient against the impact of climate and demographic change; and all relevant stakeholders are engaged in guaranteeing sustainable water governance.

The Water-Smart Society Model

Water Europe has developed a model for a Water-Smart Society to illustrate its key objectives, and the different elements involved in the above paradigm shift as well as their inter-relationships. As presented below, the model consists of one core value, three key objectives that need to be achieved to realise the core value, and five specific innovation concepts that are crucial to realising the objectives. The model indicates how the innovation concepts and key objectives are interrelated, and together generate a 'flying wheel' effect that drives the process towards the Water-Smart Society.

Figure 1. The Water-Smart Society model



Source: Water Europe

One core value

The Value of Water is at the heart of Water Europe's vision for a Water-Smart Society. This core value reflects the centrality of water as a human right and its fundamental role in our society. A multifaceted role that includes enabling all economic activities, underpinning societal functions related to citizen health and well-being, while also representing a source of economic value generated from the extraction and valorisation of raw materials and energy contained in water systems, thereby offering a unique sustainable source to serve a circular economy.

Three key objectives

1. Water Security: safeguarding sustainable access to sufficient quantities of affordable and fit-for-purpose water, in order to preserve the health of the population and ecosystems, foster the socio-economic development of society, and ensure their protection against water-related disasters, such as those resulting from climate change.

2. Water Sustainability: ensuring water infrastructure, management and use that are economically and environmentally sustainable, in a way that meets current ecological, social and economic needs, without compromising the ability to meet these needs in the future.

3. Water Resilience: achieving long-term resilience, so that natural and anthropogenic water systems can withstand unexpected disruptive events, averting serious consequences, such as droughts and floods, while guaranteeing the reliability of the water system.

Five Innovation concepts

1. Circular Water: circular water system that minimises water losses, captures and exploits the value in water, and fosters water security, sustainability and resilience.

2. Multiple Waters: incorporate a wide range of water sources and qualities (groundwater and surface water, rainwater, brackish water, brine, grey water, black water, recycled water) into a water-secure, resilient and sustainable water system.

3. Digital Water: exploit the benefits of the extreme interconnectivity of people, devices and processes, and create capillary networks capable of monitoring the water system, starting at its multiple sources through to the individual end-user, thus generating continuous flows of valuable data for innovative decision-support systems at different governance levels.

4. Inclusive Water: establish a water system whose governance balances the interests of all stakeholders in its design, management and maintenance.

5. Resilient Water: create a resilient and reliable hybrid grey and green water system, designed to withstand severe external and internal shocks – such as climate-change induced floods and droughts – without compromising essential functions.

Transitioning to a Water-Smart Society

In short, Water Europe envisions a significant transformation of the current European water sector. The innovation concepts outlined above, along with measurable objectives and key impact parameters for water security, sustainability and resilience, will drive decision-makers to realise this transition and build new water-smart economies. This will be enabled primarily by innovative governance models, new technologies created within inclusive, open innovation environments, such as innovation-enhancing Water-Oriented Living Labs (WOLLs), and by a transformed and updated water infrastructure serving the Water-Smart Society.

Overall, the Water Europe water vision aims at the implementation of a set of innovations which will result in a 50% reduction in the demand pressure exerted on our groundwater and surface water resources, thereby eliminating water scarcity in Europe.

By 2030, the transition to a Water-Smart Society will be in full swing, driven by visionary front-running industries, cities and rural areas. These will have taken the lead in laying out the migration paths towards the Water-Smart Society of the future. They will have implemented ambitious long-term investment and innovation programmes, as well as real-life WOLL experimental areas. WOLLs will have created a European network of fertile and inclusive innovation ecosystems, where solution developers, researchers, forward-looking water users and water governing bodies will develop the leading solutions of the future. In Water Europe's vision WOLLs will play an important enabling role in driving the transition to the Water-Smart Society. They will boost Europe's competitiveness in the global water market, creating numerous new green jobs in Europe, while making significant contributions towards achieving Europe's Green Deal targets and the UN's Sustainable Development Goal 6 (Clean Water and Sanitation) and other water-related SDGs.

Table of Contents

Abreviations and acronyms

BPR	Best Practice Repository
DG	Directorate General
EC	European Commission
EIB	European investment Bank
EU	European Union
FP	Framework Programme
IPCC	Intergovernmental Panel on Climate Change
JPI	Joint Programming Initiative
KH	Knowledge hub
MS	Member States
NIB	Nordic Investment Bank
R&I	Research and innovation
SDG	Sustainable Development Goal
STI	Science, Technology and Innovation
TAP	Thematic Annual Programming
WEFEH	Water, energy, food, ecosystem and health (nexus)
WWDR	World Water Development Report

Executive Summary

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 concerted global cooperation and action. This paper produced by Water Europe's 'Water Beyond Europe' Working Group emphasises the role of dialogue and partnerships in accelerating action on SDG 6 and implementing a Water-Smart Society, as described in the Water Europe vision 2023.

This White Paper builds upon the main concepts included in global agendas and policies, such as the UN 2030 Agenda on Sustainable Development Goals (SDGs), the recommendations of the Intergovernmental Panel on Climate Change (IPCC), and earlier agendas, such as the 1992 Dublin Statement on Water and Sustainable Development.

The SDGs in their entirety clearly point to the importance of water for the success of this ambitious UN agenda, while SDG 6 focusses specifically on water and reads: 'Ensure availability and sustainable management of water and sanitation for all'. While the omnipresence of water in the agenda is a theme that has been discussed in many reports and publications, this White Paper draws attention to the significance of SDG 17 – 'Strengthen the means of implementation and revitalise the global partnership for sustainable development' – as an overarching goal which, if successfully achieved, will constitute a key enabler in accelerating the realisation of SDG 6, since water resources are a crucial component of so many other SDGs. This then implies that people need to consciously agree to explore the many values of water in different SDG contexts. Furthermore, the paper argues that the connection between SDG 6 and the other SDGs must begin, first and foremost, with the human connection, which, in effect, is the essence of SDG 17.

In the paper, we discuss the potential of using SDG 17 as the main instrument to address all the water-related SDGs. We demonstrate the importance and the magnitude of the water challenges facing society, the opportunities that research, knowledge transfer and international cooperation, in particular, can respond to, and of the key issue of international cooperation financing. SDG 17, in various dimensions of resource mobilisation (domestic, European and international), multiple source financing and investment, policy coherence, and increased cooperation – on key elements, like science, technology, innovation and capacity development – is essential to achieving SDG 6 and other related SDGs of the 2030 Agenda.

Lastly, the 'Water Beyond Europe' Working Group arrives at the following six key conclusions, with implicit recommendations:

1. EU cooperation on water beyond Europe is gradually shifting from top-down approaches to partnerships based on equal participation.

2. Conscious stakeholder participation is imperative for sustainable development.

3. The eligibility for funding of international research and innovation (R&I) cooperation within the European Research Framework Programmes is crucial.

4. The participation of the economic sector must be recognised and increased to achieve the SDGs and produce a significant societal impact.

5. The road to ultimate effective impact is a long one, and often stretches beyond individual programmes and projects.

6. Living Labs and knowledge hubs are important mechanisms, in which researchers, practitioners from industry, social and natural sciences, as well as civil society, can work together in real-life environments.

1. Introduction

This White Paper addresses the approach of EU cooperation to the role of dialogue and partnerships, as a unique contribution to framing EU policies and actions in achieving Sustainable Development Goal (SDG) 17 – 'Strengthen the means of implementation and revitalize the global partnership for sustainable development' – which is a prerequisite for achieving all other SDGs. Figure 1 illustrates how SDG 17 cuts across other SDGs.

The paper is directed at policy-makers, in particular members and staff of the European Parliament and Commission and of the European Member States, who are responsible for shaping current and future EU international cooperation policies that promote effective and impactful implementation of EU-supported research and innovation (R&I). Other intended readers include water sector organisations that support the start-up and upscaling of their international cooperation efforts, with a view to contributing to the realisation of a sustainable society.

The demand for renewed international cooperation has emerged over the last few decades as a new paradigm through which to bring forward innovative solutions and build a Water-Smart Society, as outlined in the Water Europe Vision.[i] Global challenges are so intricately interconnected and complex that they cannot be addressed by a single country or sector. They require an unprecedented level of mutual learning among the various actors, who have differing perspectives, reflecting their different challenges, sectors and geographies.

In what follows below, we first discuss the role of water in the general sustainability agendas, as well as specific global water challenges, and make a case for more effective and impactful global partnership and cooperation. We then highlight the best practices and shortcomings in current partnership and cooperation frameworks, in light of the key recommendations concerning the need to strengthen international cooperation, with the ultimate goal of delivering tangible, on-the-ground contributions to achieve the SDGs.

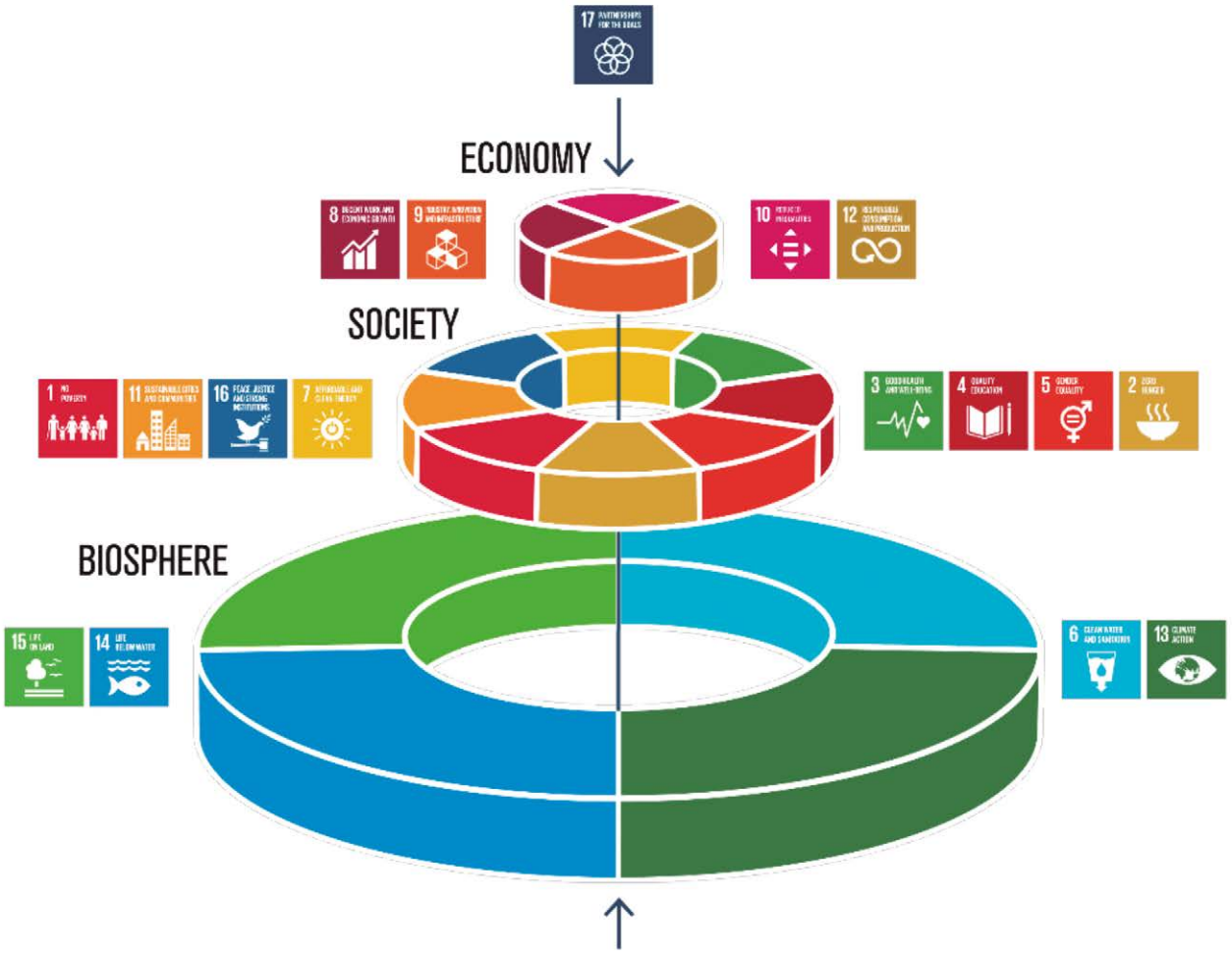


Figure 1. A vision of the SDGs and how SDG17 cuts across all of them.[ii]

2. Water and the SDGs

The Sustainable Development Goals, together with the reports of the Intergovernmental Panel on Climate Change (IPCC), increasingly shape EU and global political agendas. SDG 6 on water is moreover a particular catalyst in achieving all the other 16 SDGs, as reflected in a number of recent EC policies.[iii, iv, v] According to an UN-Water report, the indications are that progress in achieving SDG 6 is not on-track, and that the principal underlying factors that explain the slow progress are insufficient financing, inadequate or ineffective use of data and information, lack of capacity and innovation, and ineffective governance of the resource at different levels. The report thus launched a 'Global Acceleration Framework' in which these factors are seen as key to speeding up progress.[vi] The report also sees the need to ensure that actions are better coordinated, and that global cooperation and complementarity become the norm, as common denominators, in all these factors. Hence the importance of giving more prominence to SDG 17 and its related targets, with a view to achieving SDG 6 and other water-related SDGs.

Water is also a key element in climate change. Indeed, the role of water in mitigating, preventing and protecting against the impact of climate change is significant on a global scale. According to the IPCC, 80% of climate change adaptation measures involve water.[vii] The Sharm el-Sheikh Implementation Plan,[viii] which resulted from COP 27, contains the first explicit mention of water. It acknowledges 'the critical role of protecting, conserving and restoring water and water-related ecosystems in delivering climate adaptation benefits and co-benefits, while ensuring social and environmental safeguards.'

In recent years, discussions about the role of water in our society have increasingly integrated the theme of assigning water a proper value. The concern about correctly valuing water in its multiple aspects was addressed by the High-Level Panel of Water, [ix] in one of the latest World Water Development Reports (WWDRs) on Valuing Water,[x] in other policy documents, as well as in Water Europe's The Value of Water. The correct valuation of water has become essential, as all entities involved in addressing water problems need to consider water resources from multiple perspectives (environmental, economic, social and cultural) to ensure an impact on the ground.

Science, Technology and Innovation (STI), together with the building of effective partnerships and capacity development are, as SDG cross-cutting processes, essential to achieving all of the SDGs. This is the reason for the importance of multi-stakeholder collaboration on STI for the SDGs; a collaboration that needs to include the Member States, civil society, economic sectors, scientific community and United Nations entities. The importance of these processes is further outlined in the 'EU global approach to research and innovation – EU strategy for international cooperation in a changing world', [xi] as well as in the broader context of the EU Green Deal.[xii]

When discussing water challenges, we must realise that water-related benefits and risks are usually measured from outside the water sector, leading to a lack of accountability.[xiii] Moreover, the significance of water is not sufficiently recognised at a broad political level, so that water challenges are not adequately reflected in R&I policies. For example, water is surprisingly not mentioned as an important subject for proper political consideration in the Green Deal. This was also reflected in the funding allocation under the Horizon 2020 Programme specifically earmarked for the Green Deal, in which the priority topics did not include water. Another underlying reason for this relative neglect, is the prevailing 'silo' approach, which effectively undervalues the sectoral interconnections and their nexus – e.g., of water and agriculture, or water and industry, or water and energy.

Lastly, international cooperation (closely related to SDG 17) as a stand-alone element is often taken for granted, vaguely 'encouraged' but rarely specifically addressed, at national or European levels, with a view to achieving an enhanced long-term impact. In fact, effective international cooperation represents a unique supplementary benefit in the process of achieving the SDGs.[xiv]

3. Sectoral challenges: the WEFEH nexus

Image by Sasin Tipchai from Pixabay

Water is the central component of the water-energy-food-ecosystem-health (WEFEH) nexus. The WEFEH nexus approach recognises the interconnectedness of water, energy, food security, ecosystems and health. It emphasizes the interdependence between these elements and acknowledges the role of water, soil and land in supporting their sustainability. By understanding the synergies among water, energy and agricultural policies, the nexus approach seeks mutually beneficial responses. It also offers a transparent framework for assessing trade-offs and identifying synergistic solutions that uphold the integrity and long-term sustainability of ecosystems.

Those responsible for the management of the nexus need to establish a coherent permanent national and international dialogue with their partners in other sectors, as well as take the lead in creating such initiatives, removing existing inter- and intra-sectoral fragmentation to ensure that global social and environmental issues are addressed correctly..

The positive impact of water on human health is of course clear. But besides its vital role in individual health, it is also a catalyst in lifting families and communities out of poverty. However, the risks of adverse water-related effects are increasing, for instance, through direct exposures (e.g., extreme weather events) and through more indirect impacts, with declining food yields, altered freshwater flows and quality, persistence of infectious disease patterns, family incomes and livelihoods. Water is consequently a factor driving populations migration.

Photo free of use – Nawa village, Afghanisthan
(https://pixnio.com/people/children-kids/children-in-nawa-village-afghanistan-fill-their-containers-with-fresh-running-water)

Migration is associated with a) increased frequency of droughts that affect agricultural production, damaging livelihoods and access to clean water; b) extreme weather events, such as frequent floods that destroy houses or arable land, and force people to relocate; c) rising sea levels that render coastal areas uninhabitable; and d) competition for natural resources that can lead to conflict, which in turn exacerbates migration.[xv]

Water has frequently represented an almost sacred transboundary element. Rivers like the Nile, the Danube, the Tigris, the Euphrates, or the Amazon, that flow across man-made borders have historically been immune to the effects of international rivalry and conflict. However, unilateral upstream development is becoming more frequent – for example, in the Middle East and North Africa (MENA) region.[xvi] This represents the perils of interregional and international conflicts, employed as a proactive, coercive arm (for example, the unspoken ability of one state to obstruct the supply of water to another) whilst also passively becoming a victim of conflict.

Water also plays a pivotal role in contexts where widespread famine, energy poverty and increasing economic instability need to be addressed. This role has been underlined by both the World Bank[xvii] and the World Economic Forum, which has listed water as a priority in its Global Risks Report since 2015, and highlighted it during the 2022 Davos Forum.[xviii]

The United Nations has made clear that '…one of the major challenges facing the world community as it seeks to replace unsustainable development patterns with environmentally sound and sustainable development is the need to activate a sense of common purpose on behalf of all sectors of society.'[xix] The probability of activating this sense of common purpose will depend on the willingness of all sectors to participate in genuine social partnership and dialogue, while recognising the independent roles, responsibilities, and special capacities of each party. Events such the conflict in the Ukraine demonstrate the need for a global reaction that underlines the importance of transboundary cooperation. From the tragic ashes of warfare, it is possible that a broader support for genuine cooperation across national divides will emerge if action is rapidly initiated.[xx]

4. Opportunities generated by international R&I cooperation

As noted earlier, knowledge and information are key enabling factors in achieving SDG 6, from the perspectives of (new) knowledge generation and exchange, sound management of water resources, and awareness of these two challenges and options to address them. This awareness can have a 'multiplier' effect, as it leads to concern, concern leads to engagement, engagement leads to social consensus, and social consensus leads to political action and policy continuity even on the international stage.[xxi] A new era of international understanding based on transparent and documented information is required to raise awareness among an extensive, international, heterogeneous social audience with distinct levels of technical comprehension; an audience that ranges from the concerned layman and students, to the professional stakeholder, the decision-maker, and to the specialized scientific and technical expert.

The promoters of more efficient international water strategies and collaboration have at their disposal a wide range of exciting mechanisms to improve transparency and public perception. These include, for example, participatory science for data collection, digital social platforms and augmented reality (AR), which are capable of demonstrating both the financial and practical benefits in a clear and accessible manner, thus promoting a common sense of purpose. Widespread knowledge produces stronger citizen engagement, and this can result in their proactive involvement in the co-creation, development, and subsequent implementation of international water policy.

Such practical communication and non-professional involvement leads to a far broader social consensus on an international scale, providing a much more solid base for policy continuity. The European Parliament, the Commission and the Member States of the European Union should act to ensure that all actors are trained in more social-oriented activities for their concrete implementation.[xxii]

Effective international water cooperation is based on many elements, but the central element is human trust, which is vital for stakeholder engagement. However, trust, though essential, is a highly neglected commodity. Trust, which is essential for any form of socio-political agreement, 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.

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, in order 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.[xxiii]

5. International cooperation for water innovation

International cooperation is required to tackle the global water challenges expressed in the SDGs and their global ramifications. Specifically, SDG 17 calls for enhanced global cooperation in the areas of science, technology, innovation and capacity development, placing these elements at the centre of sustainable development.

When we talk of enhanced global cooperation, special attention should be paid to the use and definition of the concept of participation to keep it meaningful in policy frameworks, where it can cover a wide range of experiences and different degrees of stakeholder engagement (e.g., the participatory ladder of consultation, partnership, delegated power, citizen control).

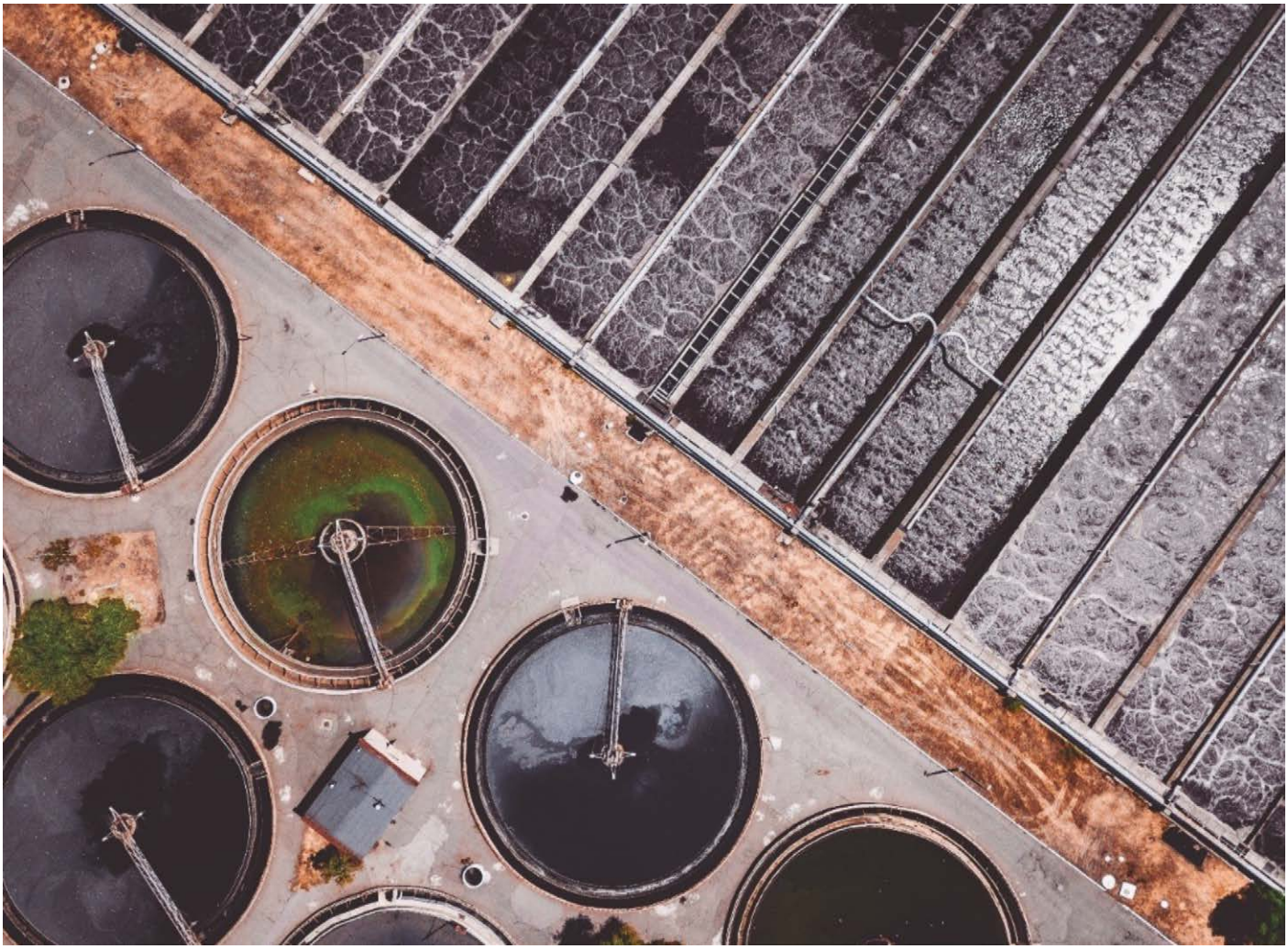


Photo by Ivan Bandura on Unsplash

To achieve enhanced global cooperation effective stakeholder engagement needs to be fostered. The general principle underlying engagement involves the participation, when relevant, of all relevant stakeholders at local, regional, national and international levels. Engagement should nurture a transparent process of co-creation, implementation and post-implementation evoking a broad range of water-related policies, which reflect stakeholder needs and visions, as well as the perspectives of civil society and the interests of the natural environment.[xxiv, xxv]

More specifically, a series of engagement mechanisms should be established and coordinated for the purpose of realising the ambitions of both supranational and local entities, allowing them to act in perfect alignment with, for instance, the EU Green Deal[xxvi] and to help them meet the UN objectives. The six main engagement mechanisms are the following:

1) Effective inter-sectoral nexus collaboration and a systemic approach encompassing all sectors: water, energy, food, waste, transport, health, social services, and the labour market to ensure a sustainable water smart community.

2) Supranational strategies that incorporate sustainability themes, to be implemented by regional and local stakeholders, ensuring the viability of long-term awareness creation, policy co-creation and political continuity.

3) The quintuple innovation helix framework, in which public authorities, the economic sector, the research sector, citizens and representatives of knowledge-oriented socio-cultural entities, become involved at all stages of policy creation and subsequent implementation.

4) The dissemination of new knowledge and innovation to local schools, colleges and universities, as part of a general, essential initiative to promote the engagement of younger generations.

5) A greater understanding of the interconnections between the different organisations/institutions, which have the influence, networking ability, and leadership capability within the different networks and communities.

6) Communication and knowledge exchange that target municipalities, regions and river-basin authorities, as well as the economic sector. This will entail, among other actions, the establishment of an open-source Best Practice Repository (BPR), which will make the objectives and actions of international organisations accessible to all social sectors and all age groups, no matter their geographical location.

6. Funding R&I development and implementation

Image by Tumisu, from Pixabay

To broaden international R&I cooperation in addressing water challenges, multiple instruments and agreement frameworks have been developed over the last few decades. International cooperation on R&I is funded through a variety of mechanisms, which depend on the topic of the activity and on the economic status of recipient countries. The details of the main mechanisms are as follows:

- For low-income countries, collaboration with European partners can be a challenge. Development aid programmes focussing on joint collaboration can offer a solution, even if they do not typically target R&I actions. The new EC DG International Partnership (DG-INTPA)[xxvii] (former DG Development Cooperation) is opening funding schemes that compensate for the lack of funds in low-income countries. The EU R&I Framework Programmes allow for the participation of legal entities from associated countries under equivalent conditions to those of legal entities from EU Member States, unless specific limitations or conditions are laid down in the work programmes. Participants from many low- to middle-income countries are automatically eligible for funding.
- For countries transitioning from low- to middle-income status, development cooperation will shift from development aid to peer-to-peer partnerships as a more appropriate mechanism to maintain mutually beneficial existing cooperation based on earlier capacity-building efforts. This has been applied to water-policy support and R&I funding at the EU level: the EC has developed bilateral programmes for water with for example India[xxviii] and China [xxix], in which these countries directly support research and innovation contributors in their respective countries.
- Win-win mechanisms, with funding open to all countries, typically involving calls for proposals with a virtual common fund. All participating countries draw up a Memorandum of Understanding with a dedicated budget to fund the research groups of their country. An excellent example is the Horizon Europe partnership Water4All[xxx], which is open to EU Member States and partners beyond the EU (e.g., Israel, Moldova and South Africa).
- Specific instruments have also been developed to facilitate the participation of less experienced countries in R&I programmes, namely:
    - Thematic Annual Programming (TAP) Action for a common research priority, which gathers a cluster of R&I projects selected from recently funded projects at national level, or selected after the launch of a common call text agreed by funders.
    - Knowledge hubs (KHs), for knowledge sharing, transfer and dissemination, which are networks of selected researchers within a defined scientific area and involved in R&I projects, which are funded under the Water Joint Programming Initiative (JPI)[xxxi] or at national level.
    - Living Labs are an essential instrument, which enable co-design, co-creation and taking R&I from research to practice, through the demonstration of new technologies or innovative approaches that use the quintuple innovation helix, both within and beyond Europe.

Financing international cooperation in the above mechanisms is undertaken through several different institutions and instruments, including:

- Global cooperation with the European R&I Framework Programmes (currently Horizon Europe);
- Multilateral country cooperation (co-development and equal-footing cooperation in JPI or partnerships);
- Bilateral country cooperation, by the European Commission (INTPA) or individual Member States (development aid, research support);
- Large enterprise foundations (e.g., Veolia, Danone, Grundfos);
- Charities (e.g., Bill and Melinda Gates Foundation);
- Investment funds and international financing institutions (e.g., European Investment Bank, Nordic Investment Bank).

As the list above indicates, there are a number of financial arrangements available to support water research, innovation and demonstration. However, these schemes are rapidly evolving and need to be closely monitored as more funding institutions and instruments may become available at a global scale. Lastly, it should be noted that insufficient attention is paid in the funding arena to SDG 17, when water-related challenges are discussed. In the future, targeted financial support for (new forms of) international collaboration and innovation capacity could in fact produce unprecedented results.

7. Findings and recommendations

In this paper, we have discussed the importance of SDG 17 as a key enabler in achieving all water-related SDGs. We have demonstrated the importance and magnitude of the water challenges, the opportunities that research, knowledge transfer and international cooperation, in particular, need to respond to, and of the key issue of international cooperation financing. The pursuit of SDG 17, in its various dimensions of resource mobilisation (domestic, European and international), multiple source financing and investment, policy coherence, and increased cooperation – on key elements, like science, technology, innovation and capacity development – is essential to achieving SDG 6 and other related SDGs of the 2030 Agenda.

The main findings and recommendations of this White Paper can be summarised as follows:

- All current funding mechanisms are necessary, as global societal challenges cannot be addressed individually by each country or sector. This is consistent with the main theme and targets of SDG 17 related to resource mobilization, in particular. The complementarity of funding mechanisms is a strong added value in tackling global water challenges.

- In global cooperation, the eligibility for funding within the European Framework Programmes is crucial. Several third countries have throughout the EU research and innovation Framework Programmes been eligible for funding, while others have benefited from intermittent financing under various EU foreign policy instruments, such as the Policy Dialogues Support Facility, the Technical Assistance and Information Exchange Facility, and the EU Partnership Instruments (e.g., Water Joint Programming Initiative, PRIMA foundation). Calls for R&I projects remain important means for strengthening international cooperation, especially when they support existing networks and alliances.[xxxii]

- The participation of the economic sector must be encouraged and increased, to achieve the SDGs and produce a significant societal impact. The R&I agendas must address and acknowledge that large enterprise foundations increasingly fund multilateral cooperation as part of their environmental, social and corporate governance. Moreover, the presence of private and public enterprises provides access to a wealth of information on the functioning of the water sector. The choice of thematic priorities and the targeted areas worldwide should provide the incentive for the economic sector's participation in the funding of R&I projects, based on demand-driven and rather than supply-driven approaches.

- Support long-term engagement to ensure time for outcomes to materialise and prevent adverse stop-and-go effects, which result in the waste of resources. Measuring research impact is of critical importance to research funders, who are interested in ensuring that the research they fund is both scientifically excellent and has a meaningful impact on the great challenges they are targeting.

- Conscious stakeholder participation is imperative for sustainable development especially in the form of co-design and co-creation: water management should be based on a participatory approach, involving awareness-raising on the importance of water among policy-makers, practitioners, the economic sectors, and society, as well as moving decision-making and management to the lowest appropriate levels, closest to the end-users. This may be achieved by involving local partners and businesses in the co-design and co-creation processes from the start and through the entire project cycle.

- Focus on engagement of civil society: engagement must extend to all social sectors. Neither race nor religion, economic status nor social class, gender nor age should be a constraint on participation, as diversity of participation of civil society, beyond a traditional engagement through membership of professional networks, should be the interest and concern of civil society participants to achieve sustainable and long-term solutions.

- Promote knowledge hubs and Water-Oriented Living Labs, where researchers and innovators from enterprises, and the social and natural sciences work together in real-life environments with relevant end-users, taking knowledge and innovation from theory to practice and demonstrating the scalability and replicability of the solutions. Moreover, Water-Oriented Living Labs, where innovation can be deployed with the necessary investments, allow for targeted interventions with a cross-sector nexus approach.

- Cooperation on water beyond Europe should move even more from top-down approaches to partnerships based on equal participation: this shift in development cooperation reflects the gradual transition of many external EU partner countries from low- to middle-income status, with a corresponding increase of capacities for dialogue and implementation – that will ensure increased ownership and sustainability of cooperation.

- Building linkages between research and related aid capacities for developing countries: some networks have established strong linkages that also support the development of capacity to conduct research with countries beyond Europe. For example, the Water JPI established close linkages with South Africa (the first non-European country to join the Water JPI).

- Encourage the use of brokers, between capital investors, enterprises, policy-makers and research institutions, to better connect the multiple parties involved. Funding itself is not the main problem; what is more important are the incentives for the conduct of water R&I by different the stakeholders, each of which has its own interest in participating.

- Diversity promotion: doors should always remain open to the younger generations. A culturally- and gender-diverse youth representation in decision-making contexts (steering groups and boards) is needed in discussions on the value of water, and should be based on up-to-date understandings of the water crisis and access to the latest knowledge. The intergenerational engagement – which is naturally boosted by the younger generations' familiarity with social platforms – enables a novel approach to discussing water. It creates committed relationships between the leaders of today and the leaders of tomorrow, and engenders continuous engagement, based on an honest conversation about water values and the construction of a conscious strategic response to the water crisis.

The members of the Water Beyond Europe Working Group endorse the above findings and recommendations. They are also committed to stressing the importance of achieving all the goals of the UN 2030 Agenda for Sustainable Development, in particular through policy and advocacy actions within the Water Europe platform, and in support of even broader processes such as the follow-up from the UN 2023 Water Conference (the Water Action Agenda).[xxxiii]

Annex 1: Water and the SDGs

Water has now its own stand-alone SDG (SDG6), with a set of targets which expand the scope of the previous Millennium Development Goals, which only covered Drinking Water and Sanitation issues.

SDG 6. Ensure availability and sustainable management of water and sanitation for all.

SDG 6 Targets

- 6.1 By 2030, achieve universal and equitable access to safe and affordable drinking water for all.
- 6.2 By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations.
- 6.3 By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally.
- 6.4 By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity.
- 6.5 By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate.
- 6.6 By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes.
- 6.a By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies.
- 6.b Support and strengthen the participation of local communities in improving water and sanitation management.

SDG 17 is a dedicated goal related to establishing a Global Partnership to achieve other SDGs, with a number of targets closely related to establishing the best cooperation ecosystem, including complementarity, financing, capacity building, data management, and systemic approaches, all related to effective enabling environments to achieve the SDGs

SDG 17. Strengthen the means of implementation and revitalize the global partnership for sustainable development.

SDG 17 Targets – related to Finance

- 17.1 Strengthen domestic resource mobilization, including through international support to developing countries, to improve domestic capacity for tax and other revenue collection.
- 17.2 Developed countries to implement fully their official development assistance commitments, including the commitment by many developed countries to achieve the target of 0.7 per cent of ODA/GNI to developing countries and 0.15 to 0.20 per cent of ODA/GNI to least developed countries; ODA providers are encouraged to consider setting a target to provide at least 0.20 per cent of ODA/GNI to least developed countries.
- 17.3 Mobilize additional financial resources for developing countries from multiple sources.
- 17.4 Assist developing countries in attaining long-term debt sustainability through coordinated policies aimed at fostering debt financing, debt relief and debt restructuring, as appropriate, and address the external debt of highly indebted poor countries to reduce debt distress.
- 17.5 Adopt and implement investment promotion regimes for least developed countries.

SDG 17 Targets – related to Technology

- 17.6 Enhance North-South, South-South and triangular regional and international cooperation on and access to science, technology and innovation and enhance knowledge sharing on mutually agreed terms, including through improved coordination among existing mechanisms, in particular at the United Nations level, and through a global technology facilitation mechanism.
- 17.7 Promote the development, transfer, dissemination and diffusion of environmentally sound technologies to developing countries on favourable terms, including on concessional and preferential terms, as mutually agreed.
- 17.8 Fully operationalize the technology bank and science, technology and innovation capacity-building mechanism for least developed countries by 2017 and enhance the use of enabling technology, in particular information and communications technology.

SDG 17 Targets – related to Capacity-Building

- 17.9 Enhance international support for implementing effective and targeted capacity-building in developing countries to support national plans to implement all the sustainable development goals, including through North-South, South-South and triangular cooperation.

SDG 17 Targets – related to Trade

- 17.10 Promote a universal, rules-based, open, non-discriminatory and equitable multilateral trading system under the World Trade Organization, including through the conclusion of negotiations under its Doha Development Agenda.
- 17.11 Significantly increase the exports of developing countries, in particular with a view to doubling the least developed countries' share of global exports by 2020.
- 17.12 Realize timely implementation of duty-free and quota-free market access on a lasting basis for all least developed countries, consistent with World Trade Organization decisions, including by ensuring that preferential rules of origin applicable to imports from least developed countries are transparent and simple, and contribute to facilitating market access.

SDG 17 Targets – related to Systemic issues

Policy and institutional coherence

- 17.13 Enhance global macroeconomic stability, including through policy coordination and policy coherence.
- 17.14 Enhance policy coherence for sustainable development.
- 17.15 Respect each country's policy space and leadership to establish and implement policies for poverty eradication and sustainable development.

Policy and institutional coherence

- 17.16 Enhance the global partnership for sustainable development, complemented by multi-stakeholder partnerships that mobilize and share knowledge, expertise, technology and financial resources, to support the achievement of the sustainable development goals in all countries, in particular developing countries.
- 17.17 Encourage and promote effective public, public-private and civil society partnerships, building on the experience and resourcing strategies of partnerships.

Data, monitoring and accountability

- 17.18 By 2020, enhance capacity-building support to developing countries, including for least developed countries and small island developing States, to increase significantly the availability of high-quality, timely and reliable data disaggregated by income, gender, age, race, ethnicity, migratory status, disability, geographic location and other characteristics relevant in national contexts.
- 17.19 By 2030, build on existing initiatives to develop measurements of progress on sustainable development that complement gross domestic product, and support statistical capacity-building in developing countries.

All other SDGs are to different extents related to water management and water security.

SDG 1: No poverty

Water enables cultivation of economic crops, thus contributing to eradicating rural poverty.

SDG 2: Zero hunger

Water is essential for food production, thus contributing to alleviation of hunger. Irrigated agriculture produces most of world food crops and uses most of its freshwater resources.

SDG 3: Good health and well being

Water is essential for life and hygiene, thus contributing to good health and well-being. Access to water improves health by 80%, while safe water contributes the remaining 20%.

SDG 5: Gender equality

Access to water in rural areas has been the single most important contribution to gender inequality in water-scarce rural areas.

SDG 7: Affordable and clean energy

Water is the principal medium for cooling of energy plants and transport energy for district heating. 90% of global power generation is water-intensive. Around 15% of global water withdrawals are for energy production; hydropower supplies about 20% of the world's electricity, a share that increases in-step with recovery of energy from wastewater treatment, but is water-demanding due to abstraction, distribution and discharge of water.

SDG 9: Industry, innovation and infrastructure

Water is essential for hygienic industrial food production, while mining and construction of subsurface infrastructure depend on withdrawal of groundwater.

SDG 10: Reduced inequalities

Readily available water for domestic purposes allows the female population in particular to save time occupied in fetching water and devote it to other tasks, like gaining proper education, generating income and engaging in self-fulfilling activities.

SDG 11: Sustainable cities and communities

Water has an intrinsic value that is essential for the quality for urban life, recreational areas and stabilisation of urban micro-climates.

SDG 12: Responsible consumption and production

Water-use efficiency enhanced by the concept of virtual water is a key determinant for the responsible use of water.

SDG 13: Climate action

Water has a global significance in the mitigation of climate change, with oceans being the principal carbon sink; water also accounts for 80% of the climate change adaptation measures identified by the IPCC.

SDG 14: Life below water

Water quality and temperature are essential to maintain life below water.

SDG 15: Life on land

Water is essential to maintain surface- and groundwater-dependent ecosystems.

SDG 16: Peace, justice and strong institutions

Water has during the past 20 years fostered international cooperation within river basin organisations, but competition for water is an increasing threat to international stability.

The Dublin Statement on Water and Sustainable Development, agreed at the International Conference on Water and the Environment in January 1992, still provides a good summary the underlying values guiding many political agendas, and outlines some key aspects to achieving water security at the global level.

THE 1992 DUBLIN STATEMENT / PRINCIPLES[xxxiv]

1. Freshwater is a finite and vulnerable resource, essential to sustain life, development, and the environment. Since water sustains life, effective management of water resources demands a holistic approach, linking social and economic development with the protection of natural ecosystems. Effective management links land and water uses across the whole of a catchment area or aquifer.

2. Water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels. The participatory approach involves raising awareness of the importance of water among policy-makers and the general public. It means that decisions are taken at the lowest appropriate level, with full public consultation and involvement of the users in the planning and implementation of projects.

3. Women play a central role in the provision, management, and safeguarding of water. The pivotal role of women as providers and users of water and guardians of the living environment has seldom been reflected in institutional arrangements for the development and management of water resources. Acceptance and implementation of this principle require positive policies to address women's specific needs and to equip and empower women to participate at all levels in water resources programmes, including decision-making and implementation, in ways defined by them.

4. Water has a social and economic value in all its competing uses and should be recognised as an economic good. Within this principle, it is vital to recognise first the basic right of all human beings to have access to clean water and sanitation at an affordable price. Past failure to recognise the economic value of water has led to wasteful and environmentally damaging uses of the resource. Managing water as an economic good is an important way of achieving efficient and equitable use, and of encouraging conservation and protection of water resources.

Annex 2: Case examples

What follows are a number of illustrative case examples of cooperation activities supporting R&I in water.

EC collaboration with China

The China Europe Water Platform kicked off in 2012, with the support the EU Policy Dialogue Support Facility (PDSF I and PDSF II), and the Technical Assistance and Information Exchange Facility (TAIEF). In 2017, a further major 5-year programme was agreed by the EU and China, with co-financing from the EU Partnership Instrument. The platform's aim is to promote policy dialogue, joint research and business development in the water sector. This is implemented through analysis, workshops, conferences, study tours and joint projects to promote exchange of experiences, transfer of technology and improvement of opportunities for business and research.

Brazil inclusion in Water JPI activities (multi-lateral mechanism)

Targeted by the Water JPI consortium since its launch in 2011, Brazil was chosen following to become a candidate for participation in the Joint Transnational Calls (JTC) for R&I proposals for the following reasons: a) it faces major water challenges; b) the presence in the country of major funding organisations; c) the pre-existence of R&I programming initiatives with EU funders (European Commission and Member States); d) joint EU-Brazil scientific publications; and e) positive market analysis results. Moreover, the EU-Brazil Sector Dialogues on Science and Technology was initiated shortly after the World Water Forum of 2018, which was held in Brasilia. The Sector Dialogues are an instrument aimed at reinforcing the strategic partnership between the EU and Brazil, based on the principles of reciprocity, complementarity and mutual interest, around key priorities for Brazil and for the EU.

South Africa contribution from WRC and Water JPI

South Africa is the other success story of the inclusion of a third country in the Water JPI's calls for proposals. Not only has South Africa participated in six calls out of the seven launched by the Water JPI (through the Department of Science and Technology and the Water Research Commission), but the country also became a full partner of the Water JPI in 2017, in particular contributing in support of gender/youth agenda of the Water JPI.

URBWat Project – coordinated by Wits University (South Africa) in 2017 Water JPI call for proposal

This project aims at designing and constructing a grey-water reticulation and treatment system within an urban informal settlement in Johannesburg, South Africa. The system will consist of a network of local disposal points, connecting to multiple subsurface flow constructed wetlands (CWs) throughout the study area and draining to either a storm-water system or sewers. The CW will provide in-situ treatment and divert grey water, and any sewage, from the street to protect the local population. This project gathers researchers and PhD students, and combines experiences from community work with frontier microbial genome studies and wastewater chemical engineering research. The City of Johannesburg and a not-for-profit organisation are also active participants in this Living Lab.

Afrialliance[xxxvi]

AfriAlliance is an innovation platform (the Africa-EU Innovation Alliance for Water and Climate) which was developed with EU Horizon 2020 funding. AfriAlliance, coordinated by IHE Delft, is supporting the existing networks in identifying appropriate social innovations and technological solutions for key water and climate change challenges. It is capitalising on the knowledge and innovation base and potential in Africa and in the EU. The project is supporting effective means of knowledge sharing and technology transfer within Africa and between Africa and the EU, all with the aim of increasing African preparedness to address the vulnerability of water and climate change-related challenges. AfriAlliance is making extensive use of existing/emerging communication channels and events (EU/African platforms, conferences and social media) to streamline climate change issues into water-related networks, thereby raising awareness about their impacts and proposing adaptation measures.

IHE Delft Water and Development Partnership Programme[xxxvii]

Launched over a decade ago, the Water & Development Partnership Programme (formerly referred to as DUPC), has been nurturing a global community of scientists, practitioners and policy-makers from over 40 countries, with the support of the Dutch Ministry of Foreign Affairs. The Programme's overall objective is to bring socially inclusive and ecologically sustainable transformations to the water sector, mainly by bringing together diverse knowledge and stimulating join-learning within and between inter- and transdisciplinary project teams. For this purpose, the programme supports joint research, open education and knowledge sharing on actual water-related challenges faced by actors in low- and middle-income countries. The third phase of the programme will explicitly invest in projects that aim to pluralize the knowledge on water.

Grundfos Foundation

The Grundfos Foundation was established in 1975 by Grundfos founder Poul Due Jensen, who, with an 88% shareholding, remains the main owner of Grundfos, a world-leading pump manufacturer. The company is especially renowned for its submersible groundwater pumps, which have set the EU energy efficiency standard. Grundfos Foundation - About us (pdjf.dk)

The Grundfos Foundation supports humanitarian, scientific, business, environmental and social causes in three main areas: Water, Research and Inclusion. In 2021, the foundation distributed 200m DKK (ca. €27 million), of which 46 % went to Water projects, 34 % to Research, and 20% to Inclusion and Community Engagement. Grundfos Foundation - Philanthropy. Examples of the foundation's initiatives include:

- Research. Transient Electro-Magnetic System (t-TEM) technology, developed for field use by the HydroGeophysics research group at Aarhus University Centre for Water Technology, WATEC, with support from the Grundfos Foundation. In 2021, it spun off to become the private company Aarhus GeoInstruments. Meet the researchers | Water Dowsing with Science.
- Water. Water supply to the Nyarugusu refugee camp and surrounding communities in Western Tanzania, where the foundation financed siting of boreholes by testing the t-TEM and establishing a modern solar-powered groundwater-based rural water supply system, the world's largest to date, serving more than 300,000 people. Grundfos Foundation - Nyarugusu Refugee Camp.
- Community engagement. Annual foundation reserve of 20m DKK, which allows the companies in the Grundfos Group to engage locally in projects to further social progress and apply for Community Engagement Grants on behalf of local partners. Grundfos Foundation - Community Engagement in Grundfos.

Dutch Government twinning programmes

The Dutch Ministry of Infrastructure and Environment, in the framework of its international cooperation programmes, developed with China a couple of so-called 'twinning programmes', in which specific research activities are performed in areas having similar physical characteristics and presenting similar challenges. One of these twinning activities was performed in the Taihu lake (China) and the Ijsselmeer lake (Netherlands). Both these water bodies are 'shallow' lakes that are prone to having water quality issues. Several studies took place with, for example, Chinese students studying in the Netherlands performing practical research in both the Taihu and Ijsselmeer lakes, and the results being shared with both the Chinese and Dutch concerned authorities.

Danish Strategic Sector Cooperation: transition from top-down development aid to partnerships

In 2015, Denmark initiated Strategic Sector Cooperation (SSC) with six countries that were transitioning from low- to middle-income status, and thus no longer eligible for Danish development aid. The SSC builds on previous development aid, but shifts to peer-to-peer partnerships, with a focus on Danish competence areas in environmental management and related technologies of special relevance to the partner country. Cooperation involves public utilities and the private sector, with a view to solving specific issues and challenges in sectors perceived as Danish strongholds, where both the public and private sector can offer useful models and environmentally efficient solutions.

All SSC projects are based on the prerequisite that the Danish and the partner-country authorities jointly agree on the objectives, approach, division of labour and responsibilities to make project a true joint venture or partnership, with obligations and inputs from both partners.

Water is an important part of the SSCs, in particular those with China, India, South Africa, Ethiopia, Ghana and Morocco. Examples of water-related SSC projects include:

- Integrated Water Resources Management
- National regulatory frameworks for urban water management at municipal level
- Water leakage and no-revenue water
- Wastewater treatment (including climate impact)
- Regional groundwater resources survey by airborne geophysics (SkyTEM)
- New geophysical tools applied for siting of groundwater wells (t-TEM)
- Integrated groundwater management in a semi-arid catchment with diverse stakeholders
- Managed aquifer recharge

Next Generation Water Action (NGWA)[xxxviii]

This is a university-powered initiative to boost international cross-sectorial innovation. The aim is to inspire, empower and connect a next generation of young talents, for them to see a future within the water sector, make sure they are given a voice to share their ideas and perspectives with leading industries and decision-makers, as well as bridge research into action, through challenge-based collaboration between students and partners.

NGWA was originally designed and implemented as the innovation track, as part of the inaugural P4G (Partnering for Green Growth and the Global Goals 2030) Summit 2018 in Copenhagen, and later brought into the C40 World Mayors Summit 2019. The third iteration of the programme was co-created together with the International Water Association, the Young Water Professionals network, leading universities and industries across the globe, leading up to the IWA World Water Congress & Exhibition 2022 in Copenhagen.

In the 2021-22 edition, NGWA connected over 190 university students from leading technical universities from Denmark, Kenya, Ghana, Mexico, South Korea and India, to the water solutions of the future. Working in 43 teams on solving 10 real-life challenges, NGWA equipped the international students with the network, partnerships and tools to develop sustainable water solutions. The solutions were presented locally in their home countries, and worldwide on an online global stage. Selected teams meet at the IWA World Water Congress and Exhibition, connecting the international innovative young minds with the current water experts.

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Colophon

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BUILDING EFFECTIVE WATER DIALOGUES AND ALLIANCES MAKING INTERNATIONAL COOPERATION IN WATER INNOVATION WORK

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