2 The Challenge of Financing Water-related Investments

This chapter provides insights into the challenges related to financing water-related investments and why concerted policy action is required to overcome them. It helps characterise the order of magnitude of the challenge by highlighting estimates of investment needs and financing capacities for select regions (Europe and Asia-Pacific). It also presents data related to investment in agricultural water and trends in development finance for water. Finally, the chapter documents how water risks could translate into material financial risks, including by generating financial impacts on corporates.

2.1. Scope and definitions

The scope of this report is the range of investments that contribute to water security through the delivery of water and sanitation services, the management of water resources and water-related risks ("too much", "too little" and "too polluted"). Investments in water security comprise a very heterogeneous range of activities. For example, investing in a wastewater treatment plant is very different from financing a nature-based solution to protect a city from flood risks. Similarly, financing the construction and start-up of a new desalination plant raises different challenges and opportunities than financing the refurbishment of one already in operation.

Investments in water security can include a range of infrastructure types (including conventional "grey", and nature-based solutions, or a combination thereof) as well as large, centralized infrastructures and small-scale, decentralized systems. This broad category may also include investments designed for other purposes, which contribute to water management (e.g. green roofs or permeable surfaces that limit rainwater runoff). At the same time, the range of financiers is also very diverse: with different mandates, investment objectives, risk appetites and liquidity needs. Additional classifiers for water investments include scale (from watershed to household); function (water supply, wastewater management, flood protection, etc.); and operating environment (ownership, governance and regulation) (Money, 2017[1]).

Beyond investments in the water sector, water-related investments connect multiple sectors and policy agendas, including agriculture, energy, urban development and public health, among others. Box 2.1 provides a view of the range of water-related investments and description of sub-sectors. The Glossary provides definitions of key terms.

Box 2.1. Water-related investments: Description of sub-sectors

- **Water resources management**: Conservation and rehabilitation of inland surface waters (rivers, lakes etc.), ground water and coastal waters; prevention of water contamination.
- **Bulk water supply**: The production of water to be distributed to various end-users, including drinking water supply. Bulk water supply may be produced from the abstraction of surface or groundwater or through non-conventional sources, such as desalination or wastewater reuse.
- **Storage and conveyance**: The infrastructure required to store and transport bulk water supply to various end-users. This includes reservoirs, pipelines, channels and other forms of water supply distribution.
- **Water supply services**: The production and distribution of high quality water at standards required for consumption as drinking.
- **Sanitation services**: Sanitation services consist of the provision of facilities and services for the safe disposal of human urine and faeces.
- **Wastewater collection and treatment**: refers to the safe collection and treatment of sewage and wastewater. The treatment can be executed on several different levels: preliminary, primary, secondary and tertiary. May include waste to energy activities.
- **Irrigation**: The production, distribution and application of water to land in support of agricultural production.
- **Flood protection (riverine, coastal)**: Interventions intended to manage the risk of flooding caused by coastal and river flooding. Flood is defined as the overflowing of the normal confines of a stream or other body of water, or the accumulation of water over areas that are not normally submerged.
- **Urban drainage**: Interventions to manage runoff from storm water.

- **Multipurpose infrastructure**: encompasses all constructed water systems, including dams, dykes, reservoirs, hydropower and associated irrigation canals and water supply networks, which may be used for more than one purpose for economic, social and environmental activities

Source: (Dominique and Bartz-Zuccala, 2018[2])

2.2. Why financing water security is a policy issue

2.2.1. Water-related investments deliver substantial benefits for water security and sustainable development

The global benefits from strategic investment in water security could exceed hundreds of billions of dollars annually. A partial estimate of the scale of global economic losses related to water insecurity include: USD 260 billion per year from inadequate water supply and sanitation, USD 120 billion per year from urban property flood damages, and USD 94 billion per year of water insecurity to existing irrigators (Sadoff, et al., 2015[3]). As of 2020, 2 billion people around the world do not have access to safely managed drinking water, while 3.6 billion people lack safely managed sanitation services and 2.3 billion lack basic hand washing facilities (UN-Water, 2021[4]).

The impacts of water-related risks can propagate through multiple channels, such as through impacts on human health from increased disease and morbidity due to poor drinking water quality and lack of access to safely managed sanitation; disruptions in industrial operations or supply chains due to water-related disasters; impacts on agricultural production and commodity markets due to water scarcity and droughts. These impacts could translate into a material financial risk for sovereigns and local governments, corporates, insurers and financiers. These risks can materialise at multiple scales, from the household to corporate level, to industry and sector scale to systemic risk. For example, a recent study by the Dutch Central Bank estimated that the financial sector in the Netherlands has a combined exposure of EUR 83 billion to facilities located in extremely water-stressed regions in its equity portfolios (amounting to approximately 17% of all equity holdings). Pension funds account for 94% of this exposure, given their relatively large equity holdings (De Nederlandsche Bank (DNB), 2019[5]). Looking only at specific sectors for which water is considered "vitally important" (such as agriculture, mining and energy production) the exposure to businesses operating in extremely water-scarce regions remains significant, at EUR 37 billion (De Nederlandsche Bank (DNB), 2019[5]).

2.2.2. A strong economic case for water-related investments does not translate into financing flows commensurate with needs

Pervasive under-valuing of the resource and benefits associated with investment by both public and private actors constrains water financing opportunities. Water-related investments generate a mix of public and private benefits in terms of valued goods and services as well as reduced water-related risks. For example, public benefits of water supply, sanitation and wastewater treatment include improved public health and ecosystem functioning. Private benefits of water resource use may include good health, better incomes and livelihoods, improved education outcomes, along with financial returns on industrial or agricultural production that rely on water use. Many of the benefits from water-related investments cannot be easily monetised, undermining potential revenue flows (OECD, 2017[6]).

Due to the nature of local service delivery and resource management, water-related investments are often relatively small-scale and fragmented. Water and sanitation services are, by definition, locally sourced and provided. At the same time, the sector requires strong public regulation due to the public good dimension of a number of benefits delivered by such services as well as due to its monopolistic market structure

(OECD, 2019[7]). For the management of water resources, well-designed allocation regimes are essential to avoid over exploitation (OECD, 2015[8]). Appropriate financing approaches for water-related investments would account for and help address the specificities of water-related investments, such as the need for long tenors, small ticket sizes, limited creditworthiness and the lack of clearly defined revenue streams. Financing terms should be commensurate with the useful life of the project. Long tenor financing of long-lived projects is also attractive because it spreads cost recovery over time, which is more equitable for rate payers, where applicable (Baker, 2022[9]). At the same time, different types of financiers will have different risk-return appetites, which can be suitable along distinct phases of the project cycle (development, construction and operation) (Gietema, 2022[10]).

While investment in water security makes economic sense, this does not always translate into investment at scale. “Water-related investments” refer to a broad range of distinct investments in a very heterogeneous landscape. “Water infrastructure” is a broad term that encompasses a wide range of activities – from the river basin or catchment scale to the household tap, traversing projects as diverse as water supply and sanitation, flood protection, irrigation and reservoirs (Money, 2017[11]). Water projects with such disparate scales and purposes entail different levels of capital intensity and repayment periods, distinct credit, commercial and legal risks, and varied economic, financial and social returns (Money, 2017[11]). These investments reflect distinct risk-return profiles and project attributes, which influence the suitability of various financing approaches (Money, 2017[11]; OECD, 2019[12]).

As water-related investments vary widely across sub-sectors and according to a country’s policy and institutional settings, it is important to note that the options for securing financing from public or private (concessional or commercial) sources present different opportunities, advantages and disadvantages. For example, short-term investments (e.g. to reduce non-revenue water, or expand water supply and sanitation (WSS) service coverage) may be more appealing and better suited to commercial financiers, while larger, longer-term investments (e.g. water network extensions with long repayment periods) may be better suited to concessional finance or blended finance involving institutional investors (World Bank, 2017[13]). This reflects the diverse typology of both projects, the diverse nature of the benefits delivered and potential investors across the water sector (OECD, 2019[12]).

Similarly, financiers vary widely in their extent of knowledge of the water sector, performance objectives, tolerance of risk, income objectives and time horizon (Money, 2017[11]; OECD, 2019[12]). For most types of financiers, interest is primarily driven by the attractiveness of the risk-return profile, which depends on i) a stable revenue stream and ii) how the range of risks and returns related to water security investments are shared between public and private actors (OECD, 2018[14]). Due to the sector’s inherent complexity and distinct characteristics, investors might perceive water-related investments as more risky and generally less attractive than other sectors (Streeter, 2017[15]; OECD, 2010[16]). Features of water-related investments that pose challenges for financing are summarised below.

Lack of clearly defined revenue streams and weak enabling environment for investment

The management of water resources and delivery of water and sanitation services provide a mix of public and private benefits, with many benefits (e.g. improved public heath, improved ecosystem functioning) not easily quantified and monetised (OECD, 2016[17]). This makes it difficult to translate benefits of investments that contribute to water security into revenue flows, particularly for avoided costs or cross-sectoral benefits. (OECD, 2018[14]) A weak or poorly designed enabling environment that fails to clearly define and provide a framework for the appropriate valuing and pricing of water resources and services can limit the scope of governments and service providers to access critical sources of revenue and finance.

Water investments are typically different from infrastructure projects for which common project financing techniques are used. In infrastructure financing, such projects have direct revenues that can be ring-fenced, such as landing fees at airports and tolls on highways. In these cases, the project’s revenue is usually the credit for the financing. Only rarely does a water ”project” have a distinct revenue associated with it, such as a desalination project which involves a high-tech desalination plant that typically falls outside routine technical competence of a water utility or where the water is used by a specific user which pays directly for the water produced (Baker, 2022[9]).

Water and sanitation projects are usually part of systems for the delivery of water supply and sanitation services to an area, normally an administrative division like a village, a town or a city. As such, they must be recognised as part of the whole water system, and be financed in the context of the whole system. That is, they are not financed on the revenue generated solely by the project itself because there is none, but by the revenue of the whole system. That revenue might be from tariffs, from general taxes or from transfers from national governments to local governments or to water utilities. Further, the way the scope of an investment is defined or designed drives financing options. This is consequential for financing collateral projects. For example, the delineation of an urban area by a legal definition or regulation influences the definition of nearby rural areas. A more expansive definition of an urban area might permit adjacent areas to be incorporated into a development financing program (Baker, 2022[9]).

In the case of water supply and sanitation services, utilities often do not succeed in collecting enough revenue through tariffs to cover operational and capital expenditure (Alaerts, 2019[18]). According to the UN-Water Global Analysis and Assessment of Sanitation and Drinking Water (GLAAS) report, over half of countries surveyed stated that water tariffs are at a level which allows the recovery of only 80% of operating costs (O&M), to say nothing of capital costs (UN-Water, 2019[19]). A lack of creditworthiness constrains their ability to obtain finance and they are often perceived as high-risk borrowers (OECD, 2019[7]); notable exceptions suggest this does not need to be the case. Raising water tariffs to achieve cost-recovery can face constraints in terms of affordability and political feasibility (Leflaive and Hjort, 2019[20]). Issues such as underdeveloped financial sectors, ineffective or absent regulation, operational inefficiency or low rates of cost recovery in water services provision can all undermine the sector's potential to secure finance (Pories, Fonseca and Delmon, 2019[21]).

Flood protection, as another example, is usually spatially distributed and not associated with a specific revenue stream. Costs are typically borne through taxes. Governmental revenue flows can pose additional risks for investors, especially in politically or economically less stable countries, or where water budgets are not ring-fenced (Alaerts, 2019[18]). Due to the benefits in terms of risk reduction, investments to manage water-related risks, such as floods or drought, could provide an opportunity to mobilise the insurance sector.

Mismatch between the needs and characteristics of the supply and demand side of finance

Water infrastructure is typically capital intensive, long-lived with high sunk costs. This calls for a high initial investment followed by a long pay-back period (of about 20 to 30 years) (OECD, 2018[14]; Cardascia, 2019[22]). . However, commercial banks principally finance projects with short-term horizons, seeking quick returns (Cardascia, 2019[22]). Long tenor finance on affordable terms is often unavailable. Borrowers may lack marketable collateral. Risks and associated expected financial returns shift over time according to the phase of the project cycle. They are lowered when a project is maturing and/or due to appropriate blending with public support instruments. Different types of financiers and financial instruments in one phase can replace or add to instruments deployed in earlier phases (Gietema, 2022[10]).

Further, water projects, often developed at the local level, tend to be small compared to the size of deals sought by financial providers (whether commercial investors or development finance providers). Investors prefer transactions in the range of USD 20 to 1000 million and thus avoid small and context specific investment classes (Alaerts, 2019[18]; OECD, 2018[14]). The limited size of projects and modest financing needs raise the transaction costs due to the lack of scale.

Finally, inconsistency of water-related policies across sectors impedes efficient cross-sector planning and capturing potential synergies. Infrastructure interventions usually fall under different administrative authorities and ministries (environment, health, agriculture, urban planning, etc.), raising challenges for policy coherence and requiring different approaches for cost-recovery and financing. Often, relevant stakeholders operate in single-disciplinary silos, resulting in overlapping roles and inefficiencies and undermining additional sources of funding (Alaerts, 2019[18]; Cardascia, 2019[22]). Existing financing mechanisms are usually unable to support the design and implementation of cross-cutting interventions.

The emergence of taxonomies seek to provide more clarity to the market about what is considered "sustainable" by providing definitions of investment opportunities that contribute to low carbon, climate resilience or environmentally beneficial investments. Taxonomies may also screen out investments in relation to a given environmental goal that impact negatively on one or more other such goals. Such tools can potentially direct significant volumes of finance towards projects screened against pre-defined and agreed upon criteria. While these taxonomies may be a powerful tool to channel public and private funds towards sustainable activities, the extent to which the taxonomy may support environmental objectives will depend on how the technical criteria and thresholds are defined (OECD, 2021[23]).

The protection of water resources is an explicit objective of the EU taxonomy, which could raise awareness of investment opportunities in the water sector. 'Do No Significant Harm' criteria could help to better protect water resources, for example via reduced pressure on the water resource through changes in agricultural practices. Other water-related investments, which may not be considered as "sustainable activities" under the taxonomy's criteria, e.g. supporting access to water supply to previously underserved communities, could lose visibility and attractiveness for investors seeking sustainable finance opportunities, depending on how these activities are categorised (OECD, 2021[23]).

Lack of data and limited sector knowledge

The risk-return profile, and thus the attractiveness of an investment, depends crucially on financiers' ability to assess investment and operation risks. However, there is a lack of appropriate analytical tools and data to assess complex water-related investments and to track records (OECD, 2018[14]). Regulatory requirements for water risks disclosure and reporting by financial institutions are broadly lacking (Cardascia, 2019[22]). A lack of credit ratings and limited information about the creditworthiness and performance of borrowers deters financiers.

Overall, lenders have limited experience with the water sector and the related risks. Financial products often do not match the characteristics of the sector. At the same time, project developers often have limited capacity to prepare bankable proposals. Water infrastructure projects often suffer from poor preparation of project pre-feasibility and design, weak pipeline identification structuring and implementation (Cardascia, 2019[22]). There is hence a mismatch in knowledge and capacity between stakeholder groups (Alaerts, 2019[18]). Since investments in water security are often context specific, it is challenging to scale up financing models or to replicate lessons-learnt from previous projects; this adds transaction costs that can deter financiers' interest (OECD, 2020[24]). Table 2.1. provides a summary of risks related to water-related investments.

Table 2.1. Summary of risks related to water-related investments

Type of risk	Specifications and examples
Macroeconomic and business risks	**Transfer risk:** due to mismatch between revenue and debt servicing currency **Operating and construction risk** including: • weak performance of utilities • risks related to a variety of technologies and innovative approaches (e.g. nature-based solutions [NbS]) **Credit risk**: inability of counterparty to honour contractual arrangements **Termination risk:** risk of early termination of long-term contracts **Market risk:** demand for service
Regulatory and political risks	**Regulatory risk** including: • change in tariffs • economic regulation may be weak or absent • regulation on private participation in infrastructure **Political risk:** • in the case of government procurement contracts • due to potential for political interference in the tariff setting process
Technical risks	**Performance risks:** • due to lack of experience and data for innovative approaches (e.g. NbS) • due to obsolesce of utilised technologies given the long-term nature of contracts and multitude of technologies applied. • in the case of WSS investments: performance risks can also arise due to aging infrastructure and leakage
Commercial risks	Risks affecting the revenues from a particular project (affordability, willingness to charge, willingness to pay)
Environmental/ social risk	**Environmental risk:** • variability of water resources availability due to climate change can reduce performance of water infrastructure, for example hydropower production • increasing water scarcity can lead to increase of cost of bulk water supply; • potential negative environmental impacts of large multi-purpose water infrastructure **Social risks** including: • resettlement of households that will be flooded down stream of dams • affordability constrains related to tariff increases

Source: Authors, based on (OECD, 2019[7])

Increasing pressures and growing uncertainty due to climate change

Many of the impacts of climate change manifest through disruptions to the hydrological cycle, such as increased frequency of floods (coastal, riverine and storm-driven) and droughts, increased variability and intensity of rainfall, and reduced snowpack feeding headwaters of major rivers, among others (Masson-Delmotte et al., 2018[25]; Bates et al., 2008[26]). Observed warming has been linked to changing precipitation patterns, intensity and extremes, and to changes in runoff to rivers, lakes and wetlands, in addition to melting of ice and reduced snow cover (Bates et al., 2008[26]). Over varying timescales, these changes in the global hydrological cycle impact water resource availability and quality (Huntington, 2006[27]). Climate change also affects demand for water (for irrigation, or for cooling heat island effects in cities, for instance).

Decisions regarding water infrastructure typically rely on engineering, modelling and planning that base projections of future needs on historical patterns of water availability and use. For example, infrastructure design, planning and operating procedures are often based on the assumption that future climatic and hydrological conditions will be broadly similar to those of the past (Haasnoot et al., 2019[28]; OECD, 2013[29]). However, these assumptions are an increasingly unreliable guide to future conditions. Approaches for decision making under uncertainty are increasingly relevant to ensure robustness and flexibility to uncertain future conditions (OECD, 2021[30]).

As old assumptions about a stable climate are replaced by dynamic and changing climatic uncertainty, new approaches to policy frameworks, institutional arrangements and investment planning are needed. Climate change is one of a range of uncertainties, which also include demographic, economic and urban settlement trends, among others. This requires recognizing that water infrastructure built today will effectively lock in our choices for decades or centuries while the global climate continues to change, and that regulatory frameworks and water allocation regimes, if not flexible, will make water management rigid when it needs to be adaptive and agile (Smith et al., 2019[31]). Emerging and systemic threats, including the impacts of climate change, intensify the challenge of financing water-related investments and underscore the value of flexible and robust approaches to financing long-lived capital intensive infrastructure (Box 2.2).

Box 2.2. Systemic threats intensify the financing challenge

Emerging and systemic threats intensify the challenge of financing water-related investments. Incorporating resilience into water-related investments is needed to ensure that system-wide enhancements are made to help absorb and rebound from residual risks (for which further risk reduction is prohibitively expensive) as well as events that may be difficult to predict. These may include pandemics, social change, political disruption, landslides, cyber-attacks, climate and weather-related challenges such as droughts, storms, floods, wildfires, etc. Combined with optimal investment in risk reduction measures, resilience can minimise the costs of recovery in the event that threats materialise.

Climate change poses a systemic threat to the reliable provision of water services, the management of water resources and water-related risks, which will vary across regions in terms of the nature and magnitude of impacts (Linkov et al., 2019[32]). Temporal and spatial climate patterns are changing and, in some cases, projections are highly uncertain, rendering historical trends an inadequate basis for decision-making. Water-intensive assets that have operational lifetimes of many decades, even centuries, need to take a forward-looking approach to investment that address the novel challenges associated with a shifting water cycle (Matthews, 2019[33]). Project developers are only beginning to explore how to use new metrics, such as the value of resilience in the context of disruption, climate transformation, and high levels of uncertainty about the pace, direction, and types of impacts we can expect (Haasnoot et al., 2019[34]).

Experience to date with water-related investments suggests that many investors are forward-looking, strongly recognise the value of policy coherence in supporting investment conditions, and are actively interested in investment opportunities that fulfil objectives across multiple policy domains (OECD, 2018[35]).

Over recent years there has been a growing effort to situate water-related priorities and investments within a broader resilience paradigm, to promote a “new way of thinking about risk so that we can make wise financial decisions” (Linkov et al., 2019[32]). A resilience-led way of thinking would entail a shift in water sector financing norms for vulnerable countries and populations, and could help to trigger financial and technological innovation for the water systems of the future (Linkov et al., 2019[32]).

Source: (Linkov et al., 2019[32]), (Matthews, 2019[33]), (Haasnoot et al., 2019[34]), (OECD, 2018[35]).

2.3. Exacerbated challenges related to the COVID-19 crisis and opportunities related to the recovery

The COVID-19 pandemic has starkly demonstrated the importance of access to safe drinking water, sanitation and hygiene for human health. At the same time, the related economic and social consequences of the crisis have intensified financial pressure on water and sanitation service providers. During the first wave of the COVID-19 outbreak, water demand decreased significantly in multiple contexts. While domestic water use increased slightly, industrial and commercial water consumption dropped by 27% on average during the first months of the COVID-19 outbreak in 2020 (GWI, 2020[36]). In some areas industrial and commercial water consumption dropped by significantly higher percentages of up to 75%, e.g. in Kampala, Uganda (Danilenko, 2020[37]). While utilities in North America, Europe, Japan and Australia are likely to be more financially resilient than those in other regions, the financial impacts of the pandemic have impacted utilities in both OECD and non-OECD countries (GWI, 2020[36]). In addition to impacts on WSS service providers, the crisis contributed to numerous impacts on irrigation services due to fiscal constraints, interruptions of supply chains and lack of availability of labour (Waalewijn et al., 2020[38])

Revenue falls for utilities were also caused by suspended action against non-payers or tariff discounts in response to the COVID-19 crisis. Over 75% of the reviewed utilities of a global survey[1] waived measures against non-payers during the first months of the first wave of the pandemic (GWI, 2020[36]). As a consequence, in Sub-Saharan Africa, for example, utilities collected only 35% of their billing during the first months of the COVID-19 crises, compared to 69% before the pandemic (Gasson, 2020[39]). In Osaka in Japan, the Municipal Waterworks Bureau waived the fixed charges for water and wastewater for July to September 2020, resulting in a reduction of the combined tariff by 60.4%. The COVID-19 outbreak was also a reason for the 15.3% tariff decrease in Adelaide in Australia in 2020 (GWI, 2020[40]). Overall, falling collection rates from residential customers and reduced billings from industrial water users created significant financing challenges for water utilities.

The pandemic also postponed or stopped planned or on-going water infrastructure projects due to travel restrictions and supply chain disruptions. As one example, the procurement process of an advanced water purification plant in Los Angeles was held up as a result of the pandemic (GWI, 2021[41]). In the Philippines, the water investment program for Manila was suspended in 2020 due to COVID-19 (GWI, 2021[42]). Globally, the number of finished water infrastructure projects dropped in 2020. Not only project implementation but also project preparation slowed down in that year, with utilities focusing on operational priorities rather than capital ones (Scotney, 2021[43]).

In 2021, water tariffs rose again by an average of 3.7% year-on-year (GWI, 2021[44]). This helped ease the financial situation of water utilities. Overall, the impacts of the pandemic on water utilities' finances differ globally, depending on their resilience to financial shocks and changes in water demand.

While the water sector was hit by the pandemic, it also benefitted from immediate relief measures launched by governments and development banks and it continues to benefit from recovery packages in the future. For example, EBRD put together the Vital Infrastructure Support Programme, which provides bridging loans for municipalities that deal with liquidity shortages due to lockdowns. The largest recipient is Morocco's national water utility with EUR 50 million (GWI, 2021[45]). In Europe, the European Commission aims at allocating 30% of their EUR 1.85 trillion recovery budget[2] to sustainable investments, which can potentially contain water-related investments (European Council, 2020[46]). Over the next decade this would amount to over EUR 503 billion, as laid out in the EU Green Deal, which will mobilise at least EUR 1 trillion of sustainable investments (European Commission, 2020[47]). Further, the French recovery program *France Relance* includes the pillar 'Ecological development' which suggests several water-related infrastructure investments (see Box 2.3).

From a macro-economic view point, public budgets have been negatively affected by the pandemic. Government deficits and debt increased sharply in many emerging-market economies in 2020 (OECD, 2021[48]) and by 2023, public debt ratios are likely to exceed 2019 levels by 14 percentage points in the median OECD economy (OECD, 2021[49]). These developments could reduce governments' capacity to provide funding for water-related investments and could postpone necessary infrastructure projects in the water sector.

Box 2.3. COVID-19 recovery packages and their role for water-related investments

The EU's recovery instrument *Next Generation EU*

In July 2020, the European Council agreed to the EUR 750 billion recovery instrument *Next Generation EU*, aiming at boosting private investment, supporting ailing companies and accelerating the green and digital transitions.

The following selected elements could potentially provide funding for the water-related investment projects:

- The Recovery and Resilience Facility of EUR 560 billion provides loans and grants to EU member states and defines that the according plans need to "significantly contribute to addressing the green and the digital transitions" and the supported measures should "avoid adverse impacts in climate and the environment" (European Commission, 2020[50]).
- EUR 15.3 billion have been made available to upgrade the programme InvestEU, containing the new Strategic Investment Facility, which, with the upgrade, aims to generate up to EUR 150 billion of investments for the green and digital transitions.
- In the past, the European Fund for Strategic Investment has supported water-related projects, for example through a EUR 330 million loan for a flood defence project in the Netherlands or a EUR 200 million loan for a water and waste water infrastructure project in Italy (EIB, 2019[51]; EIB, 2018[52]). A top up could allow similar water-related investments in the future.
- The European Agricultural Fund for Rural Development (EAFRD) has been reinforced with EUR 15 billion to support structural changes necessary in line with the European Green Deal.

  One of the aims of the EAFRD is the support of agri-environmental farming practices, which can include measures to improve water quality or water resource management.
- The cohesion policy programmes will be topped up by EUR 55 billion between now and 2022.

  One of the Cohesion Policy's objectives is to support regions to preserve their natural environment and to finance water and waste-water infrastructure. 13% of its funds between 2014 and 2020 were dedicated to the environment and resource efficiency and 6% to climate change adaptation and risk prevention (European Commission, 2020[53]). The financial reinforcement of the programme could support water-related projects in the future.

Source: (European Commission, 2020[54])

The French Recovery Package *France Relance*

In 2020, the French Government launched the recovery plan *France Relance* in response to the COVID-19 crisis. The recovery package aims at creating jobs and relaunching the French economy to 2019 growth levels by 2022, focussing on the three pillars: 'ecological development', 'competitiveness' and 'cohesion'. Under the pillar 'ecological development', endowed with a budget of EUR 30 billion, several categories and proposed investments include water-related investments. These include:

- EUR 300 million to support the revival of biodiversity and the prevention of risks, notably to adapt to the effects of climate change and to strengthen resilience. This includes financing projects to manage and restore coastal, maritime and aquatic ecosystems and dam reinforcement to improve the safety of people and goods downstream and the capacity for use by or for the public of these structures.

- EUR 250 million in metropolitan France to strengthen investments in the modernization of drinking water and sanitation networks as well as treatment plants, with a focus on the treatment of sludge in rural areas. This aims to improve the resilience of the drinking water supply to the risk of drought and to mitigate water contamination through more effective treatment in wastewater treatment plants.
- EUR 50 million will be allocated specifically to accelerate the implementation of the “Overseas Water Plan” for overseas territories.

Source: (French Government, 2020[55])

2.4. Orders of magnitude of water-related financing needs and capacities

2.4.1. Investment needs are massive and the gap is persistent

Beyond this backdrop of systemic change and growing pressures, sound investment planning for financing water-related investments is impeded by a robust projections on investment needs and the state of existing assets. Projections on financing needs are diverse and can vary by several orders of magnitude. Estimates for investment needs vary widely due to data limitations and different methodological approaches. Estimated global costs of achieving SDG 6 exceed USD 1 trillion per year, or 1.21% of global gross product (Strong et al., 2020[56]). To achieve universal and equitable access to safe and affordable drinking water for all by 2030, the present value of the additional investment needed is around USD 1.7 trillion (Hutton and Varughese, 2016[57]), which is about three times the current investment levels. Looking at food production and agriculture, at least USD 300 billion are estimated to be required annually to meet the SDGs related to food security (UNCTAD and Convergence, 2020[58]).

2.4.2. Regional perspective – Europe

In Europe, a regional perspective is particularly relevant because EU member states share a common level of ambition. They enjoy financial and technical support from the European Commission. The EU water *acquis* and similar policies contribute to (comparatively) robust monitoring and data collection, which support cross-country comparison and peer learning.

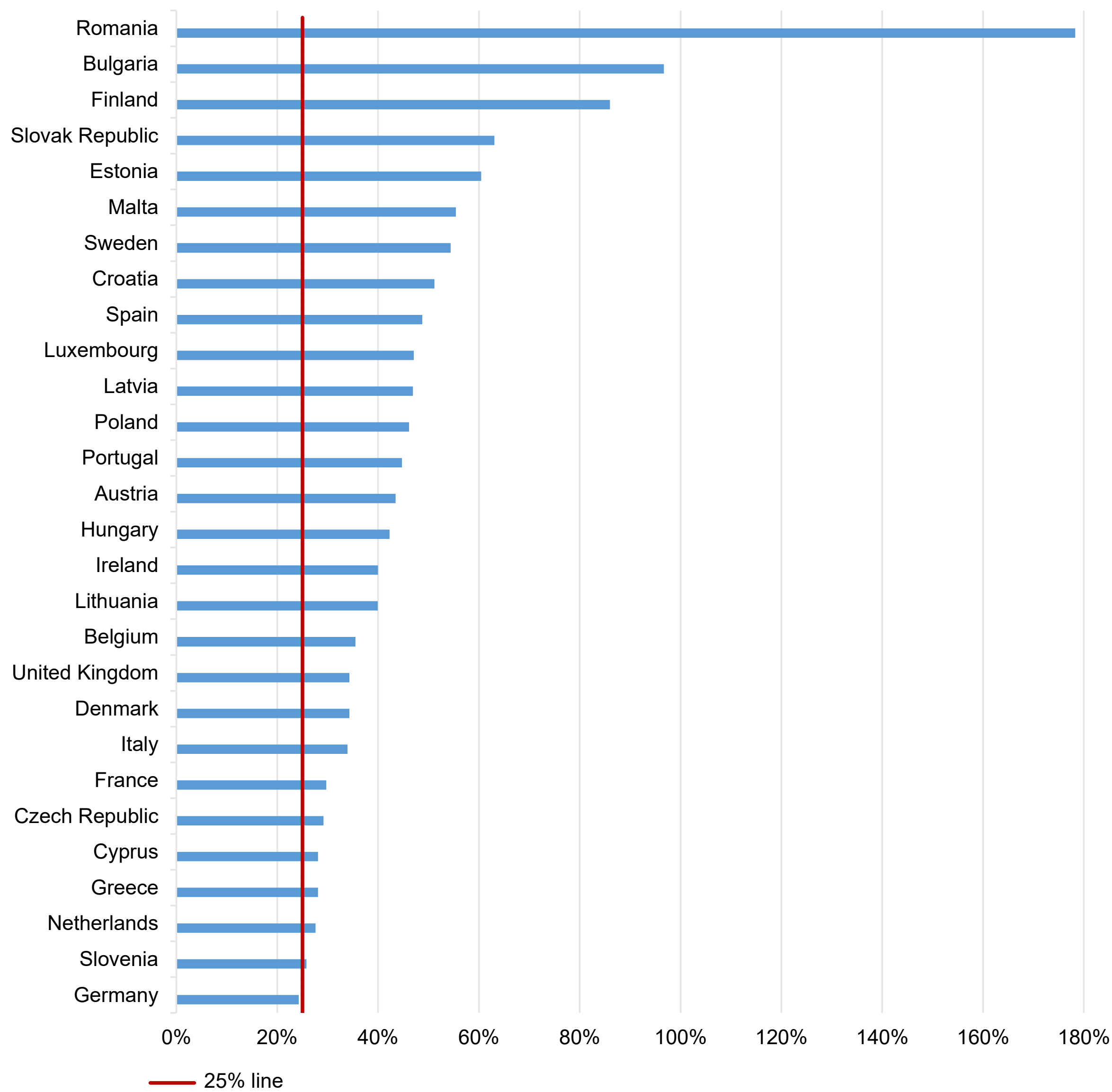
Investment needs

Current annual average expenditures on water supply and sanitation are estimated at a total of EUR 100 billion across EU member states, with large variations across countries. Eight member states spend less than EUR 100 per capita each year, while six countries allocate more than EUR 250 per capita annually on WSS services (OECD, 2020[24]).

Investments in WSS need to increase significantly in order to reach and maintain compliance with common European standards (OECD, 2020[24]). OECD analysis provides estimates for the additional investment needs, including compliance with selected water directives[3] and to achieve required efficiency improvements. Sanitation represents the lion’s share of the total additional expenditures, while urban growth plays a minor role in driving additional needs in the future. On a country level, all member states with the exception of Germany will need to increase annual expenditures for water supply and sanitation by more than 25% in order to reach and maintain compliance with the selected directives. At the higher end of additional investment needs, Romania and Bulgaria need to double (or more) the current level of expenditures (OECD, 2020[24]). Figure 2.1. depicts the additional expenditures per annum required by 2030. The estimates for the additional yearly expenditures are a sum of the expenditures of a business as usual scenario (reflecting the costs of connecting new city dwellers, driven by urban dynamics with no new policies), the costs of maintaining and reaching compliance with selected directives and efficiency improvements, required under the revised Drinking Water Directive, compared to a baseline of estimated current expenditures on WSS.

Figure 2.1. Per Annum additional expenditures by 2030

Business as usual (BAU) + Compliance + Efficiency vs. baseline



Source: (OECD, 2020[24])

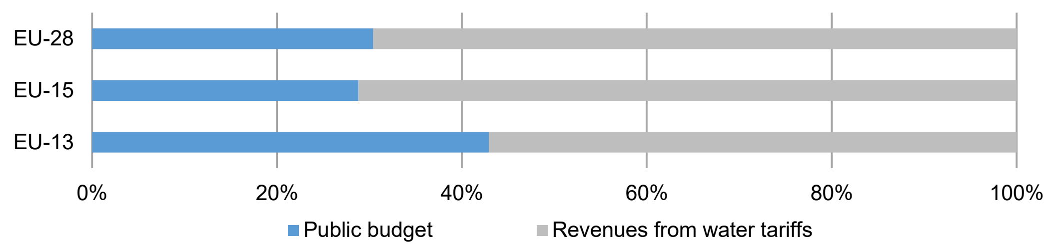
Note: BAU (business as usual) scenario (same level of effort with no new policies, driven by urban population growth) and estimated costs to reach efficiency and compliance with DWD and UWWTD compared to the costs of the baseline scenario (member states' current expenditure level on WSS and flood protection).

Sources of funding

EU members vary in terms of the combination of sources of finance used for water supply and sanitation. Figure 2.2. visualises the shares of public spending and revenues from water tariffs as sources of finance for water supply and sanitation services. Close to 100% share of public spending implies the absence of water pricing, while a high percentage of revenue from water tariffs, on the other extreme, means that the majority of capital and operational expenditures are financed by the consumer. In the EU-13[4], public budgets cover 43% of the funding for WSS services and 29% in the EU-15.

Figure 2.2. Sources of finance for water supply and sanitation services for the EU-28

(2011-2015 annual average)



Source: (OECD, 2020[24]), based on EUROSTAT (General government expenditure by function, Final consumption expenditure on environmental protection services by institutional sector, Final consumption expenditure of households by consumption purpose, Mean consumption expenditure by detailed COICOP level).

In some countries, public budgets for WSS heavily rely on EU funding (notably the EU-13), some states rely essentially on water tariffs (Denmark, England and Wales), while others cover the costs through taxation (Ireland), which here is presented as part of public budget. The three main sources of funding and their potential use in the future are summarised below:

- ***EU transfers*** play an important role in the EU-13 countries, covering up to 17% of estimated total expenditures for WSS and in some countries, the lion's share of public funding (e.g. in Estonia). However, EU support through cohesion funds is projected to decrease in the future, further widening the financing gap and intensifying the need to mobilise alternative sources of finance.
- Water ***tariffs*** contribute to cost recovery and provide a source of revenue for water providers. Increasing tariffs is a potential option for a number of member states. The OECD analysis (2020[24]) found that in 24 EU member states, more than 95% of the population could pay more for water services without facing affordability constraints[5] on 2011-2015 average. Figure 2.3 gives an overview of the share of households' expenditure on water supply and sanitation in their overall disposable income per country. Some countries, however, face significant affordability constraints, especially when looking at the lowest quintile. Social tariffs or income support measures could be useful tools to address these issues. A caveat arising from data analysis for Figure 2.3 is that the statistics might fail to fully capture the complexity of affordability issues. Typically, poorest and most vulnerable households may not pay for public water supply and sanitation, because they are deprived from access to any service. This is typically the case for migrants, homeless, or remote and rural communities. A second caveat is that estimates presented in the figure remain dependent on current level of household expenditures, which in turn very much depends on the extent to which water is actually priced. Hence, affordability issues will be underestimated or may even go unnoticed in countries with a combination of low overall expenditure levels and low to no pricing. On the other hand, countries with reasonably low affordability concerns despite relatively high water prices are in principle in a better position.

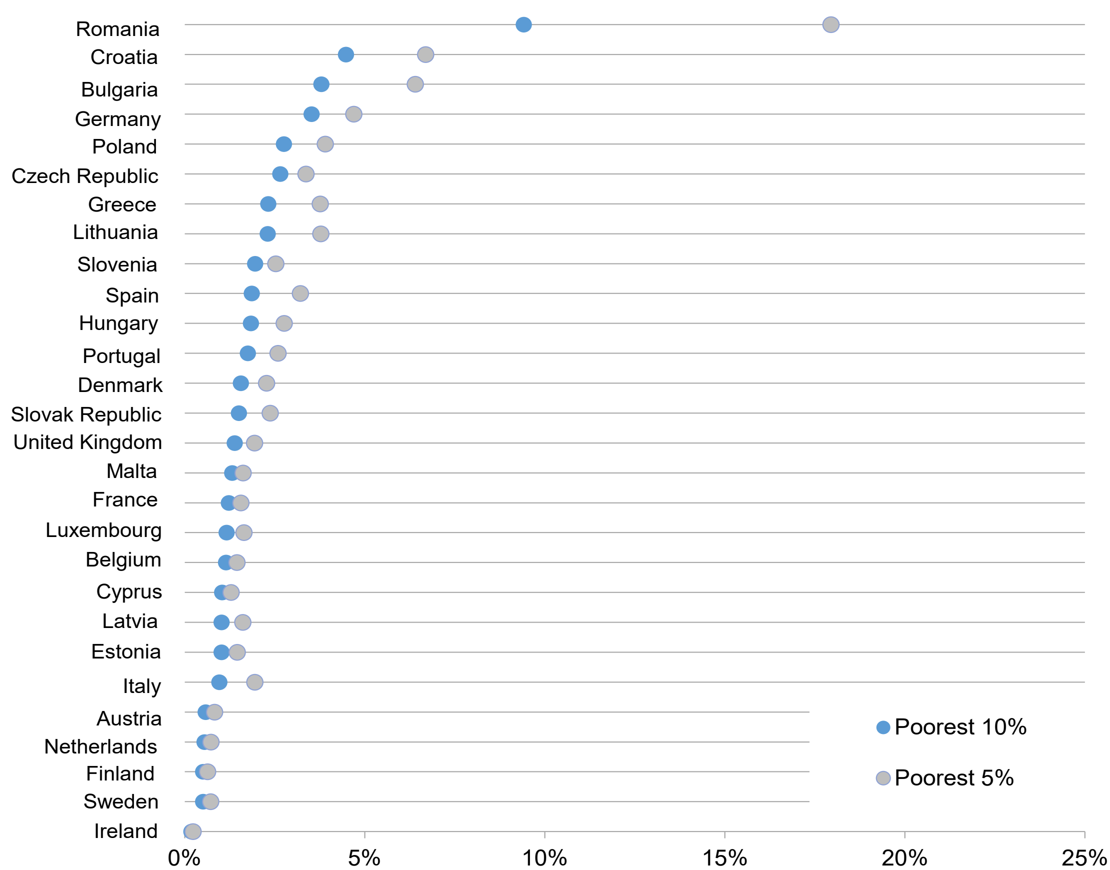
- The ability to raise ***public spending*** depends on current tax income and public debt levels and varies significantly among member states. Countries with a high ratio of debt to GDP, such as Greece, Italy and Portugal, have limited room to increase public budgets for water-related investments. More disaggregated analysis is required to specify financing capacity of local authorities, which cover over 50% of public investment in the EU member states.

These findings might need to be reconsidered in light of the COVID-19 crisis, which has negatively affected both public and household budgets (as discussed above). Countries would benefit from a systematic assessment of the state of existing WSS infrastructure and needs for renewal.

Commercial finance could play a role in bridging the financing gap in European member states, including in response to declining availability of EU Funds, as it is accessible in all member countries.[6] So far, it has only marginally been used for water-related investments, representing roughly 6% of total expenditures on WSS (and only 1% in the EU-13). Especially for creditworthy and near-creditworthy borrowers, there is room to scale up commercial investments in the sector. Of course, as discussed below, commercial finance needs to be paid back, through a combination of revenues from tariffs, or (domestic or international) public funding.

Figure 2.3. Share of water supply and sanitation expenditures in households' disposable income

2015-2019 average



Note: Lack of household expenditure data for Sweden
Source: Authors, based on EUROSTAT (household expenditure and income data)

Estimates on current expenditures on **flood protection** are not available for most of the countries. Additional work is required to assess financing needs and capacities for water resources management to address risks of floods and droughts. Investment needs for flood protection are based on changes in the exposure of flood risks, relying on the development of indicators such as the value of assets at risk, the number of people affected and value of GDP affected. Some countries (Austria, Luxembourg and the Netherlands) face high growth factors for expenditure needs on flood protection, while others (Belgium, Czech Republic, Denmark, France, Germany, Hungary, Ireland, Poland, Romania, Slovak Republic and Sweden) are affected by moderate growth factors. Cyprus[7], Greece, Malta, Portugal and Spain benefit from low or negative growth factors, reducing the necessity to scale up investment in flood protection. (OECD, 2020[24])

2.4.3. Regional perspective - The Asia-Pacific region

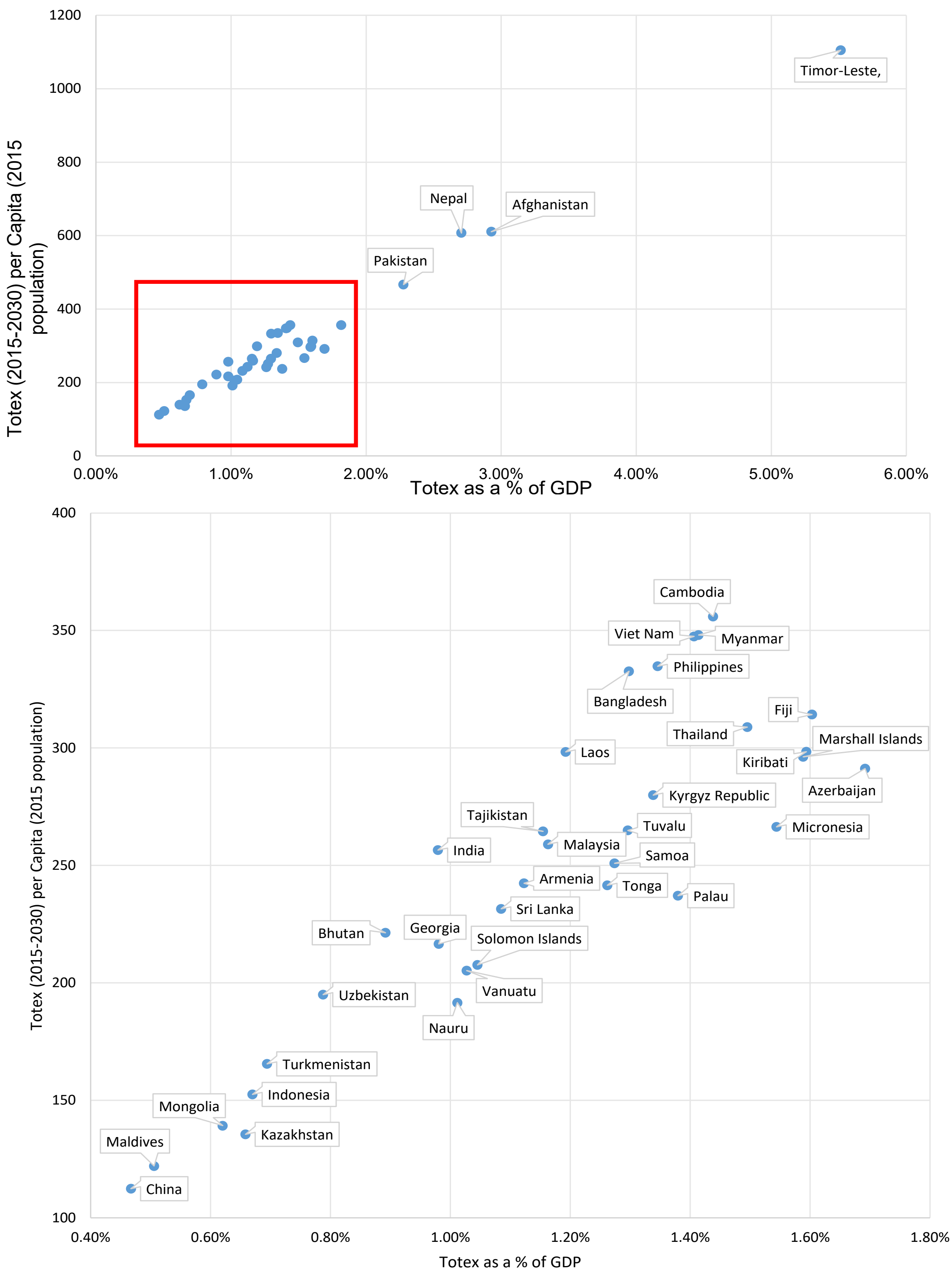
In contrast to European member states, countries in the Asia Pacific region do not share a common ambition or set of regulations for water security. While the SDGs, and notably the targets under SDG 6, provide a common guideline, there is a lack of comparable data on water-related expenditure, making it challenging to estimate investment needs and financing capacities for water security at regional and national levels. Nonetheless, OECD analysis provides a broad order of magnitude of financing needs for water in the region.

Investment needs

Overall projections indicate that most countries in the Asia-Pacific region will need to allocate between 1% and 2% of GDP for ***water supply and sanitation infrastructure*** over the 2015-2030 period to achieve universal access to safely managed water supply and sanitation services for all[8]. Countries with investment needs of less than 2% of GDP, such as Timor Leste, Afghanistan, Nepal and Pakistan, can expect to face greater challenges to meet these investment needs. The largest share of the USD 198 billion total annual estimated investment needs in the Asia Pacific region fall to the People's Republic of China (hereafter 'China') (USD 60 billion/year) and India (USD 22 billion/year). At the same time large investment needs compared to GDP are concentrated in low- and middle-income countries. Several countries have water supply and sanitation investment needs of greater than USD 20 per capita per year (ADB, 2020[59]). Figure 2.4 compares countries in the region in terms of total investment needs as both a share of GDP and per capita between 2015 and 2030.

Figure 2.4. Comparative expenditure gap of water supply and sanitation infrastructure required by 2030 to achieve SDGs 6.1 and 6.2

Cost per capita (USD) and as a percentage of GDP



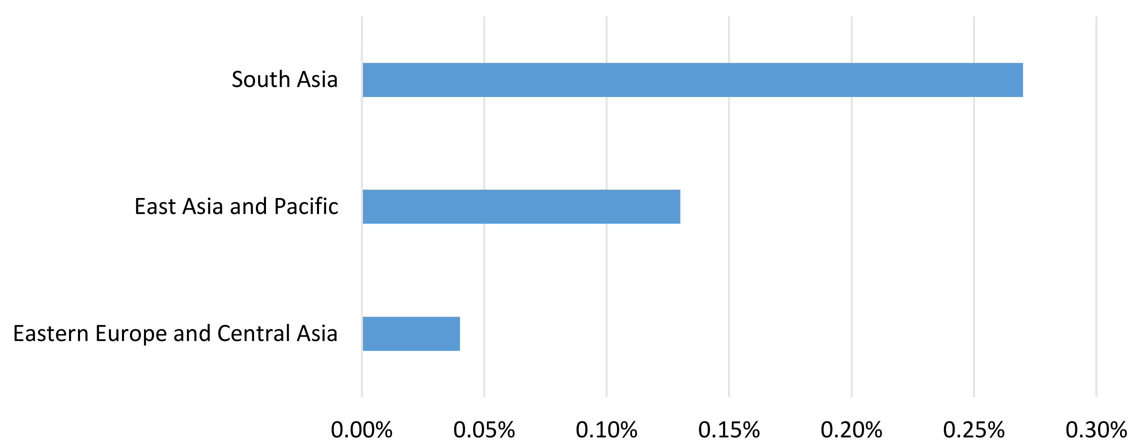
Note: No data for Australia, Singapore, New Zealand, Brunei, South Korea, Japan, Hong Kong (SAR China), Niue, Cook Islands.
Source: OECD calculations based on (Rozenberg and Fay, 2019[60])

Investment needs for flood protection are difficult to quantify and depend on both population and assets at risk of flooding. Like water supply and sanitation, the impacts on people and the magnitude of investment needs in flood protection are, for the most part, concentrated in low- and middle-income countries. Note that this is not the case for the value of assets at risk of flooding. Bangladesh, in particular, is a hotspot for flood risk in the Asia-Pacific region with over 11% of the population projected to be exposed in 2030. India is expected to experience the greatest increase in absolute numbers of people exposed to flood risks between 2010 and 2030 (over 20 million additional people). In terms of GDP affected by floods, the exposure is substantial in some countries, most notably in India (over USD 280 billion), China (USD 220 billion) and Indonesia (over USD 100 billion). In several countries, flood risks will exceed 6% of GDP in 2030. (ADB, 2020[59])

Further, ***irrigation*** needs will increase in Asia and with it investment needs. While data on current expenditure on irrigation or investment needs is not available on a country-level, regional estimates project total annual investments in irrigation to USD 6.8 billion for East Asia and Pacific and USD 5.1 billion for South Asia between 2015-2030 (Rosegrant et al., 2017[61]). Figure 2.5. presents regional estimates of annual irrigation investment needs from 2015-2030 as a percentage of GDP. The following section will give further insights into the topic of agricultural water financing.

Figure 2.5. Annual irrigation investment needs 2015-2030 in Asia-Pacific sub-regions

Percentage of GDP / year



Note: EECA region includes 13 ADB countries, as well as 10 non-ADB countries.
Source: (Rozenberg and Fay, 2019[60])

Sources of funding

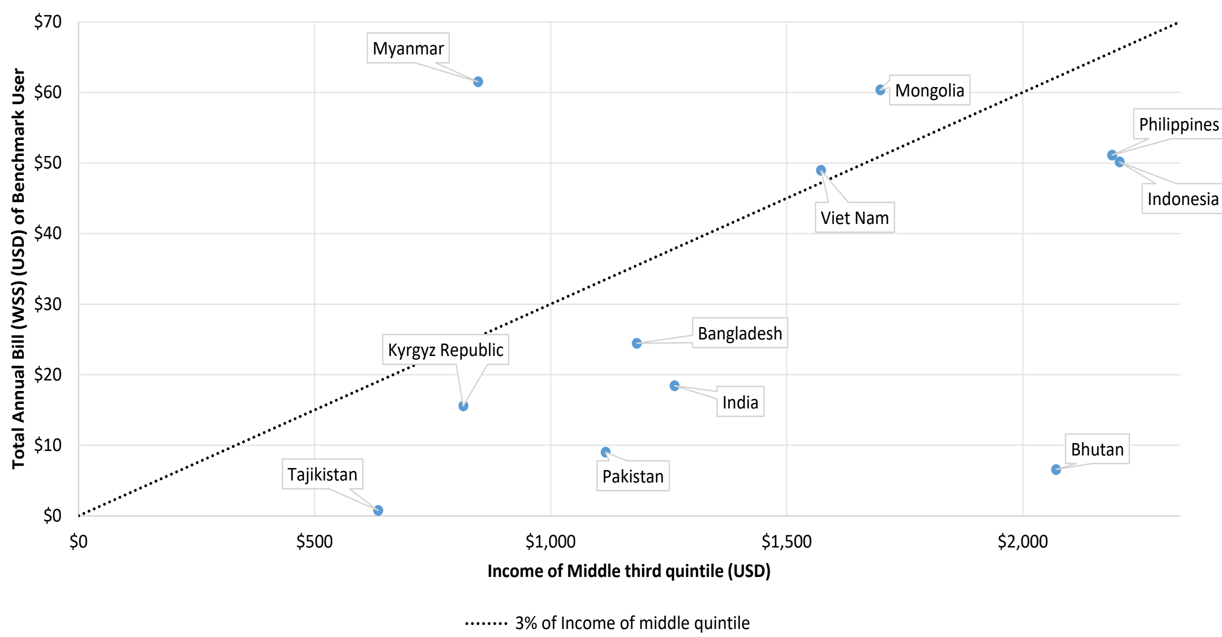
- ***Public budgets*** are the dominant funding source for water supply and sanitation infrastructure in countries for which data is available. Significant levels of public expenditure (more than 5% of GDP) have occurred in several countries, notably China, Bhutan, Viet Nam, India and the Maldives over selected time periods. However, the potential of taxes and surcharges to increase public funds allocated to the water sector remains generally underexplored. (ADB, 2020[59])
- ***Water tariffs*** are often relatively low and half of responding countries in the latest GLAAS survey indicated that water supply and sanitation tariffs are insufficient to recover 80% of operation and maintenance costs, let alone capital (refurbishment and replacement) costs (UN Water and WHO, 2019[62]). Many countries have limited ability to raise water prices because of affordability constraints for parts of the population. In some countries the annual tariffs in selected cities

currently represent more than 10% of the annual income of the middle quintile household. Conversely, there may also be scope to increase water supply and sanitation tariffs in a number of countries, such as Tajikistan, Armenia, Kazakhstan and others. (See Figure 2.6.) (ADB, 2020[59])

- ***Official development aid*** represents a small proportion of total expenditure on water infrastructure. In comparison to other countries, India and Indonesia received considerable amounts (on average USD 257 and 189 million per year) and data suggests that ODA may not be reaching some of the countries that most need it, such as Timor-Leste, Bangladesh, Myanmar, Afghanistan and Papua New Guinea. (ADB, 2020[59])

Although domestic ***commercial finance*** is available across Asia-Pacific countries, private investment is concentrated in only a few of Asia's lower-risk economies and few countries have gained experience in mobilising it for water-related expenditures to date. A few transactions have been supported by international donors, but these have mostly been in middle-income countries, and they have so far failed to be replicated at scale (AIIB, 2019[63]).

Figure 2.6. Microeconomic affordability: Average city water supply and sanitation tariffs as a share of annual disposable middle-quintile household income



Note: Average city tariff represents year 2017, and based on available data for select cities from GWI. Annual disposable income of households is based on the middle quintile of income.
Data for tariffs from 108 cities, in 20 countries.
Source: OECD calculations based on (GWI, 2019[64]) and (World Bank, 2019[65])

Overall, tracking and projecting financing flows for water security in Asia is compounded by a significant lack of available data. Additional coordinated efforts to monitor financing flows at regional level would provide invaluable support to policy making and to the design of financial mechanism that are up to challenge and tailored to regional and country needs. Regional financial institutions have a role to play, at least to compile information on the projects and financing mechanisms they contribute to. Further coordination could also be considered through thematic regional platforms in place (the Asia Pacific Water Forum, the Asia Water Council) or regional political fora (e.g. APEC, already active on related issues such as food security).

2.4.4. Sectorial perspective – Financing Agricultural Water

Water resources are critical for agricultural production and food security. The agricultural sector is a major consumer of freshwater, accounting for 70% of the world's water withdrawals and 85% of global freshwater consumption (OECD, 2017[66]). These water needs will rise in the future and climate change will cause additional water-related pressure on the sector. Forty percent of global food production depends on irrigated agriculture, covering 20% of the world's cultivated land. The remaining 80% rely on rain fed agriculture with greater vulnerability to changing precipitation patterns (UNESCO, 2020[67]; World Bank, 2020[68]). Irrigated agriculture is at least twice as productive per unit of land as rain fed agriculture, on average, and could improve resource efficiency and intensify production (World Bank, 2020[68]).

Population growth and changing diets will lead to increased demands on agricultural productivity and efficiency. These are key drivers for freshwater scarcity. In sub-Saharan Africa and Northern and Western Africa, annual total renewable water resources per capita declined by 41% and 32% respectively between 1997 and 2017 (FAO, 2020[69]) and trends will exacerbate in the future. Climate change poses an additional layer of pressures on the sector. According to the IPCC (2021[70]), drought events are 1.7 times more likely today than on 1850-1950 average, and will further increase in frequency and intensity, particularly in Africa, South America and Europe.

The projected impact of climate change on agriculture is expected to be severe both for the sector and in terms of reduced economic growth (OECD, 2015[71]; OECD, 2014[72]). Recent events illustrate the type of impacts foreseen. For instance, the extreme drought in Europe in 2018 resulted in cereal yields declining by up to 50% for certain crops, and the heavy rainstorms in Japan in the same year led to damage for the agricultural sector valued at USD 4 billion (MAFF, 2029[73]; Gruère, Shigemitsu and Crawford, 2020[74]). In India, productivity of most crops is projected to decline by 10 to 40% by the end of the century due to higher temperatures, rainfall variability and decreasing access to freshwater for irrigation (Shrivastava, 2016[75]). Beyond increasing the intensity and frequency of extreme events, some estimates project climate change to raise global irrigation requirements by up to 20% (Hertel and Liu, 2016[76]).

The agricultural sector contributes to increased water competition with other users and sectors, particularly in some countries (OECD, 2017[66]). Due to its high consumptive water use, irrigated agriculture can have significant consequences for water resources, economic activities and ecosystem services. An estimated 41% of current irrigation water use occurs at the expense of environmental flow requirements (FAO, 2020[69]) and in some regions, intense groundwater use for irrigation have resulted in declining groundwater tables, contributing to environmental degradation and putting in question the sustainability of groundwater-irrigated food production (OECD, 2015[77]). Additionally, agriculture contributes largely to water pollution mainly through organic matter and nutrient runoffs from agricultural inputs (e.g., pesticides, herbicides or fertilisers), resulting in contamination or eutrophication (OECD, 2017[78]).

Investment needs for agricultural water

Ensuring that agriculture and food systems meet the needs of a rising population and are able to withstand, recover from and anticipate the impacts of climate change will require significant investments in agricultural systems. This will encompass investing in innovation for sustainable, productive and resilience agriculture and food systems (OECD, 2021[79]), and in particular improving the management of irrigated areas, as well as water management in rain fed cropland and pastureland areas.

There is currently no unified consistent, longitudinal or cross-sectoral database with cost or investment data on irrigation or agricultural water. The data availability for this sector is exceedingly sparse compared to other sectors and makes constructing projections on current investment levels and needs now and in the future a challenge.

Globally, about 1.2 billion people live in extremely water scarce irrigated or rain-fed areas affected by water shortages, of which 520 million live in rural areas. According to FAO (2020[69]), more than 275 million hectares of irrigated cropland would benefit from improved water management, 171 million hectares of which are under high to very high water stress and require urgent action, with regional differences. In developing countries in the sub-regions of East Asia, the Pacific and South Asia, for example, required investments to meet the projected irrigation expansion may cost an estimated average of USD 3.1 billion annually between 2015 and 2030, of which USD 1.7 billion are required to improve water-use efficiency. Soil and water management technologies have baseline investment estimates of USD 500 million per year across the three regions. Combining the acceleration of irrigation expansion[9] and improvement of both irrigation efficiency and soil and water management would require an estimated USD 6.8 billion per year in East Asia and the Pacific and USD 5.1 billion per year in South Asia. (Asian Development Bank, 2020[80]) In the Arab region, annual irrigation replacement costs of existing capital, upgrade, efficiency, and new capital investments in Arab countries in North Africa and the Maghreb are estimated to average between 0.08 - 0.16% of regional GDP. (Rozenberg and Fay, 2019[60])

Investments in water productivity need to be accompanied with investments in water allocation policies, governance and institutions to ensure that investments deliver the benefits for sustainable management of water resources (Gruère and Shigemitsu, 2021[81]; Yu et al., 2021[82]). Together with investments in innovation, infrastructure, including transportation and the provision of information and communication technologies, they are critical for improving sustainable water management and for strengthening the resilience of the sector.

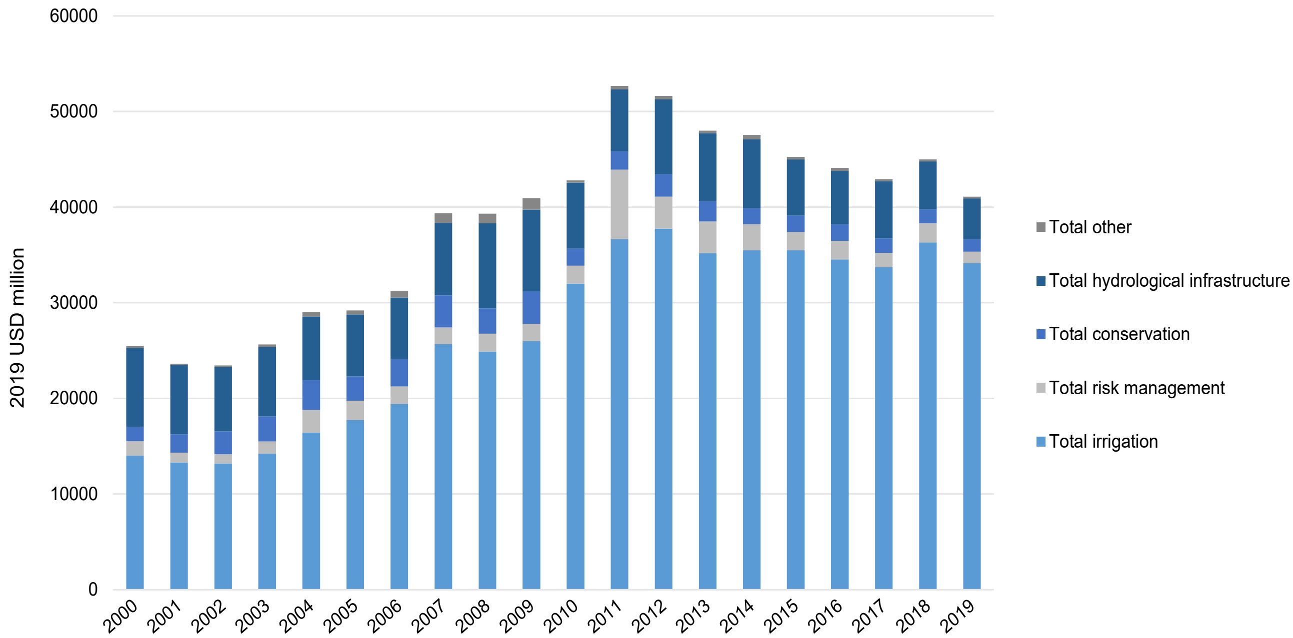
Sources of funding for agricultural water

This section[10] provides estimates of funding for agricultural water, including from governments, official development assistance and other sources based on available OECD data and additional sources. These estimates are derived from an OECD analysis (Ashley and Gruère, 2021[83]) in preparation of the Roundtable on Financing Agricultural water in January 2021.

Government water-related agricultural support

Total public agriculture related support for water in 54 countries - the 28 EU member states[11] (aggregated), other OECD member countries, and 11 emerging economies[12] - increased from USD 25.9 billion in 2000 to USD 54.2 billion in 2011 and then declined to USD 41.6 billion in 2019 (see Figure 2.7.). Close to three quarter of total support was provided in non-OECD emerging countries, especially India and China (58% of total support).

Figure 2.7. Total water-related agriculture support in 54 countries



Note: Hydrological infrastructure relates to all expenses to support water use related infrastructure related to agriculture, conservation includes measure towards the conservation of water ecosystems and payment for sustainable water use, risk management includes measures to manage water risks, particularly flooding, scarcity or salinity, irrigation covers payments to encourage irrigation and development of irrigation on farm.
Source: (Ashley and Gruère, 2021[83]) based on (OECD, 2020[84]).

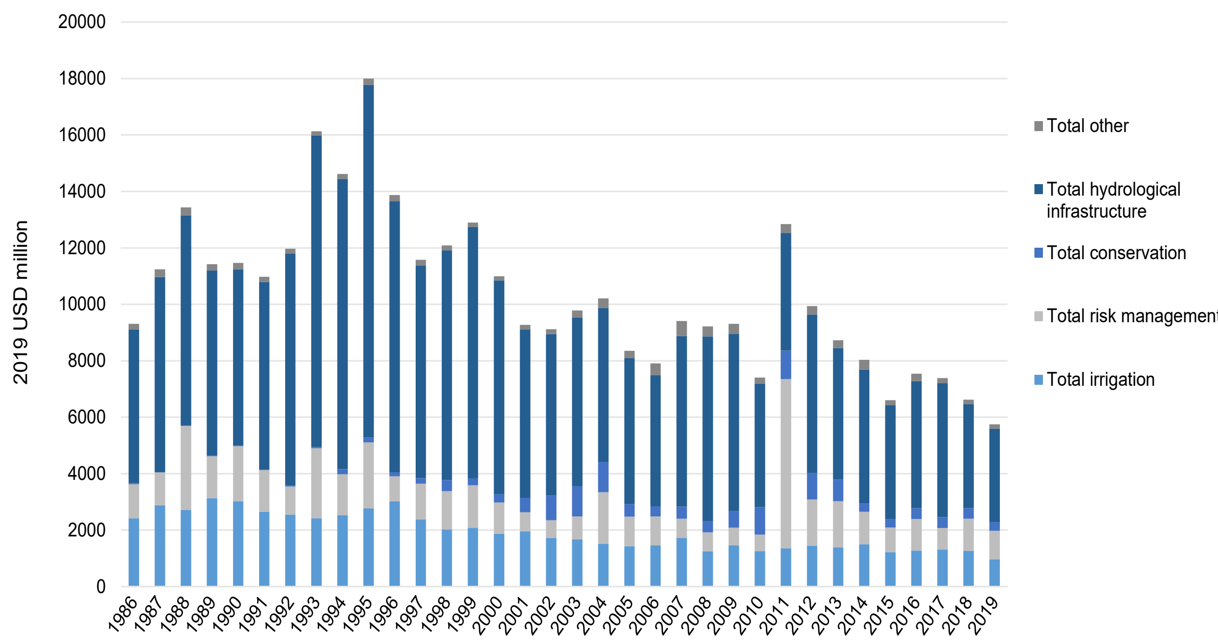
Seventy percent of total agricultural support for water was dedicated to irrigation (from irrigation development to support for water in irrigation), Eighteen percent of support went to agriculture-related hydrological infrastructure (comprising of all basin and sub-basin infrastructure work that may be related to agriculture water management) and the remaining part was split between conservation-related and water risk-related management expenditures. Between 2000 and 2019, governments of the covered countries spent between USD 10 and USD 20 billion per year on irrigation (USD 15.4 billion in 2019), the amounts almost entirely spent by India and China. Eight-two percent of production support for irrigation aimed at incentivising the use of water for irrigation via irrigation-related water or electricity subsidies (98% in non-OECD countries). This kind of support has the potential to encourage excessive use of water for irrigation and thus have harmful effects on surface and groundwater resources (Gruère and Le Boëdec, 2019[85]).

In terms of the activities targeted, 43% of total water-related agricultural support was related to production and 57% to enabling agricultural activities and functioning of the sector (general services). A contrasting picture emerges when looking only at OECD countries. In this case, only 24% of total support is linked to agricultural production while 86% are dedicated to enabling activities.

Similarly, irrigation investment trends differ from the 54-country-totals, when considering OECD countries only: total water-related agriculture support declined progressively from a peak in 1995 of USD 18.7 to USD 6.8 billion in 2019. Differently from the total of all covered countries, only 13% of these amounts focused on irrigation, while most of the support was dedicated to hydrological infrastructure. Domestic producer support for irrigation in OECD countries has declined from USD 2.5 billion in 1989 to close to USD 480 million in 2019. The share of support directly incentivising the use of water for irrigation declined from 88% in 1986 to 46% in 2019. Figure 2.8. and Figure 2.9. visualise these trends.

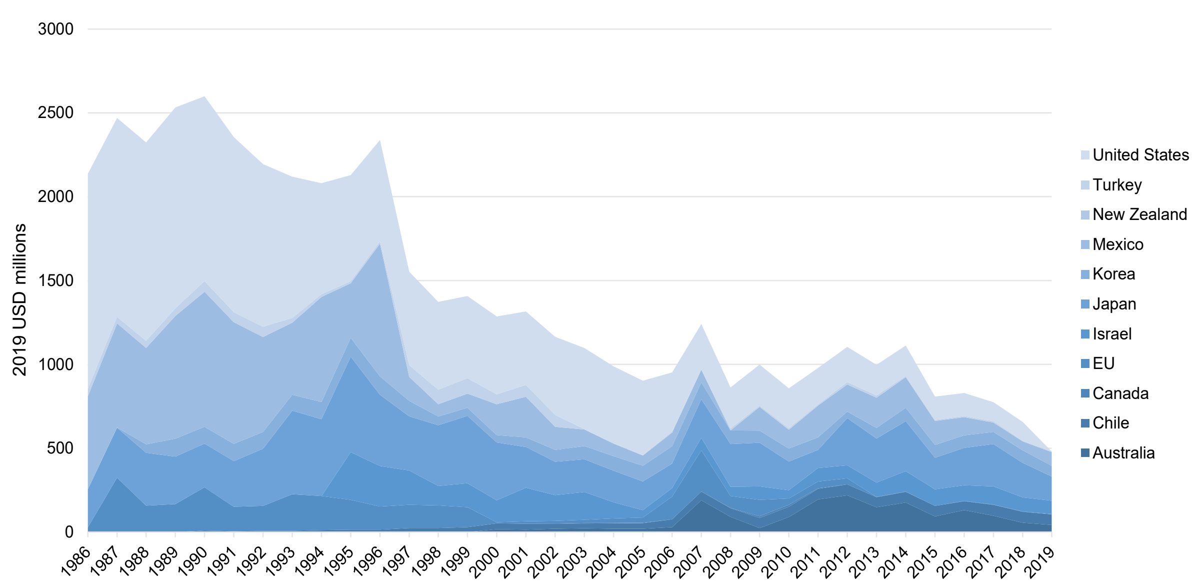
Overall, non-OECD emerging countries are spending much more on irrigation than other types of infrastructure related to agricultural water management, while the contrary is the case for OECD economies. These differences may underline varying government priorities, both related to food production and to irrigation sector specificities. However, no obvious trend of changing government support structure over time can be observed, even for rapidly growing emerging economies.

Figure 2.8. Total water-related agriculture support in OECD countries



Source: (Ashley and Gruère, 2021[83]) based on (OECD, 2020[84]).

Figure 2.9. Producer support estimates (PSE) related to irrigation by OECD country



Source: (Ashley and Gruère, 2021[83]) based on (OECD, 2020[84]).

Development Assistance on agriculture and water

About USD 1 billion of official development assistance[13] (ODA) was spent annually on water-related investments in recent years, the largest share originating from multilateral agencies. Almost all of the total ODA related to agricultural water was allocated to Asian (52%) and African (44%) countries. Other official assistance[14] amounts to an average of USD 381 million annually between 2014 and 2018, of which 85% were dedicated to Asian countries. Taking these sums together, official development flows amount to roughly USD 1.5 billion annually, which remains very limited given the wide geographical scope. To give a picture of order of magnitude, this only slightly exceeds Korea's total domestic support for agricultural water, at USD 1 -1.2 billion. Looking at a sectorial context, ODA dedicated to agriculture amounted to USD 7 to 7.5 billion annually, and USD 166 to 195 billion of ODA were spent on all sectors during the same time period.

In the Arab region, as regional example, international aid flows to the agricultural water sector account for around 1% of total aid to the region, with donors committing a total of USD 2.7 billion to this sub-sector between 2008 and 2017, out of 6.9 billion committed to the entire agriculture sector. Thirty-six percent of these flows related to agricultural water went to Egypt, followed by Morocco (30%) and Sudan (14%) (FAO IWMI, 2019[86]).

Other sources of finance

Private actors have an important role to contribute to finance agricultural water investments. *Individual and groups of farmers* play a key part in financing water-related investments. They can invest in irrigation equipment and maintenance and improved land use practices with the support of credit or banking institutions. Evidence shows that in India, 80% of all types of financing sources across modernising irrigation schemes stem from farmers' own savings and that farmer-led irrigation, business-to-business and business-to-consumer alliances could be promising financing models for agricultural water in the future (World Bank Group, 2020[87]). However, farmers often face considerable barriers to access finance. Large-scale farmers require finance with long maturities, while commercial lenders prefer shorter timelines. Medium and small-scale farmers face hurdles receiving loans since their risk profile is often difficult or costly to model, thus increasing transaction costs and risks for investors. Additionally, systemic risks, such as extreme weather events related to climate change, pose a particular challenge for sector financing. Chapter 3 discusses financing models which can overcome these challenges, such as microfinance for farmers, extended tenors with blended finance, or weather index-based crop insurance.

Other investors in the sector from the private sphere are *agro-food companies* or *technology providers*, which can provide finance for irrigation-related initiatives or projects to improve climate resilience. The agro-food company Mars, for example, estimates that by rolling out wet-dry rice farming, it could avoid supply shortages and thus reach savings of between USD 60 and 180 million (CDP, 2020[88]). *Water sector companies or other stakeholders* may also invest in technologies which they lease out or set up for remunerative use by farmers. Compensation schemes between stakeholders and farmers to promote more sustainable water resource use within a landscape, such as Water Funds (Box 4.1, can be another source of finance.

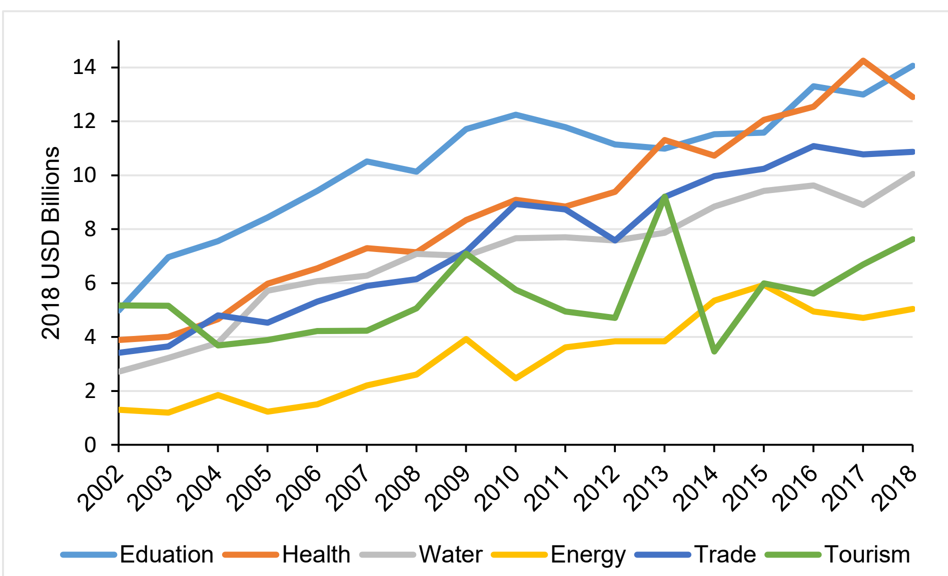
Globally, data on private financing flows to the agricultural water sector is largely absent and reliable estimates are lacking. In absence of such figures for private spending and on the basis of information on development assistance and government support, Ashley and Gruère (2021[83]) estimate that a minimum of USD 43 billion was used to support agricultural and water activities as of 2019 globally. As comparison, this amount is less than the minimum estimate of the spending on agriculture and food relief measures in response to COVID-19 during the first four months of 2020 (Gruère and Brooks, 2021[89]). A better understanding of where and how to best orient financing flows for agricultural water and water services in rural areas is needed in order to support a transition towards more sustainable agricultural and food systems.

2.5. Trends in development finance for water

Overall, official development assistance (ODA) flows have increased more than 2.5 times since 2002, with ODA for water generally increasing in line with the broader trends (Figure 2.10). Over the 2002-18 period, USD 120 billion have been allocated to water-related ODA (out of a total of USD 2.4 trillion for all sectors). "Water-related" ODA includes several sub-sectors including water supply and sanitation, waste management/disposal, hydro-electric power plants, agricultural water, and water resource conservation. The share of ODA allocated to water-related sub-sectors remains relatively stable at 4-5% over 2002-18, reaching 5.15% of total ODA in 2018 (Figure 2.10). During that time the split between ODA loans and ODA grants in the water sector is relatively even at 51% for grants and 49% for loans. There is a trend to move away from grants and towards loans. In 2002, loans accounted for 44% of water sector ODA flows and in 2018, they had reached 61% of water sector ODA flows.

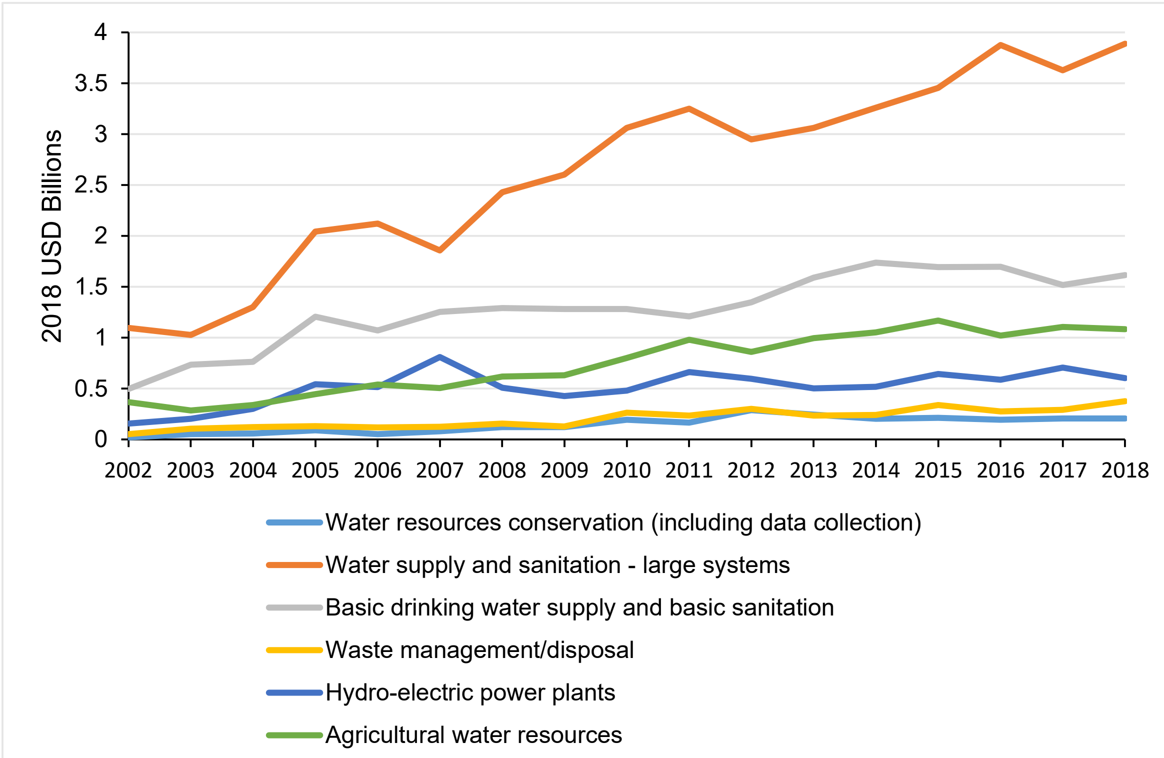
Among water-related ODA flows, water supply and sanitation (large systems) accounted for the largest share, capturing 21% of the total flows for water, amounting to USD 45 billion total value over the period 2002-18, followed by water supply and sanitation (basic systems) capturing a 10% of the total flows for water, amounting to USD 22 billion total value of the period (Figure 2.11). ODA for agricultural water amounts to 6% of total flows for water (USD 13 billion total value) and for hydro-electric plants amounts to 4% (USD 9 billion total value). ODA flows for waste management/ disposal and water resources conservation account for relatively small shares compared to other water-related sub-sectors. Box 2.4 provides details related to the largest ODA donor for water, Japan, and the largest ODA recipient, India.

Figure 2.10. ODA Flows by Selected Sectors, 2002-2018



Source: Authors, based on OECD Creditor Reporting System https://stats.oecd.org/Index.aspx?DataSetCode=CRS1

Figure 2.11. ODA Flow by Water Sub-sector

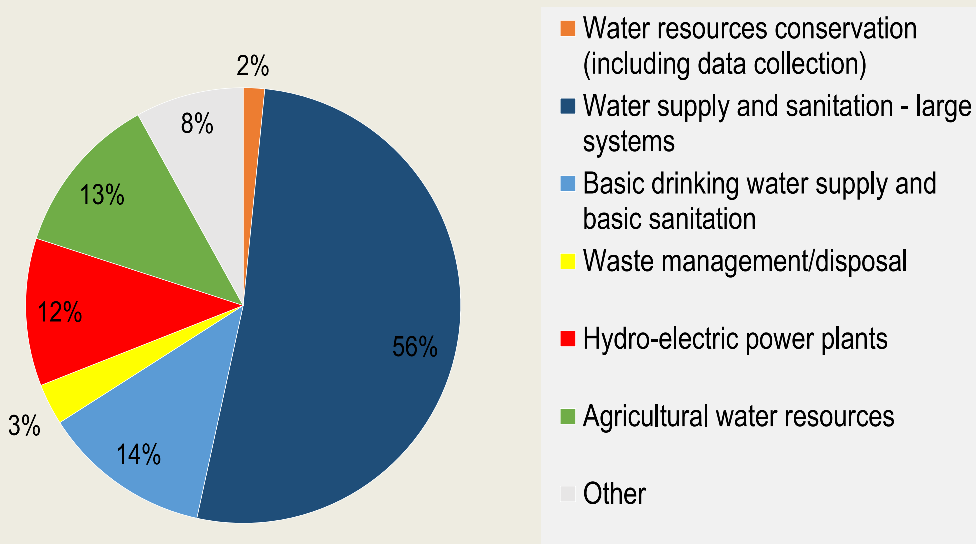


Source: Authors, based on OECD Creditor Reporting System https://stats.oecd.org/Index.aspx?DataSetCode=CRS1

Box 2.4. Largest donor and recipient for water-related ODA

Since from 2002 to 2018, Japan has been the largest ODA donor in the water sector contributing 21.5 billion in 2018 USD, 19% of all water ODA. Figure 2.12. illustrates the distribution across sub-sectors of Japan water-related ODA over the period. Water supply and sanitation accounts for the largest share of Japan’s ODA for the sector, reaching nearly 65% (including both large systems and basic systems).

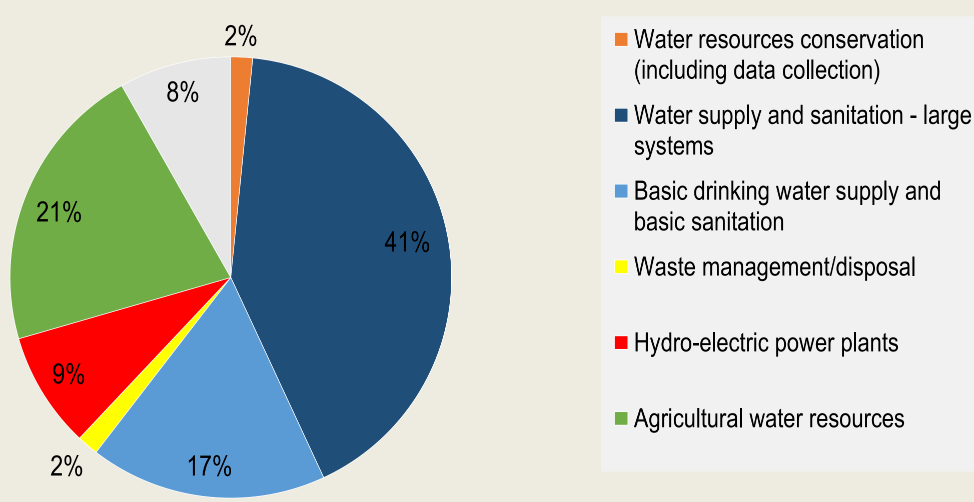
Figure 2.12. Distribution of Japan Donor ODA by Sector 2002-2018



Source: Authors, based on OECD Creditor Reporting System https://stats.oecd.org/Index.aspx?DataSetCode=CRS1

In terms of recipients, India has been the largest recipient of water-related ODA, receiving approximately USD 4.6 billion over 2002-18 (USD 2018 constant prices), amounting to 6% of all water-related ODA over the period. The largest share is allocated to water supply and sanitation, nearly 70% (including large systems and basic systems). The India Government launch of a major campaign in 2014 to improve WASH services may have contributed to attracting significant levels of ODA in recent years.

Figure 2.13. Distribution of India Received ODA by Sector, 2002-2018

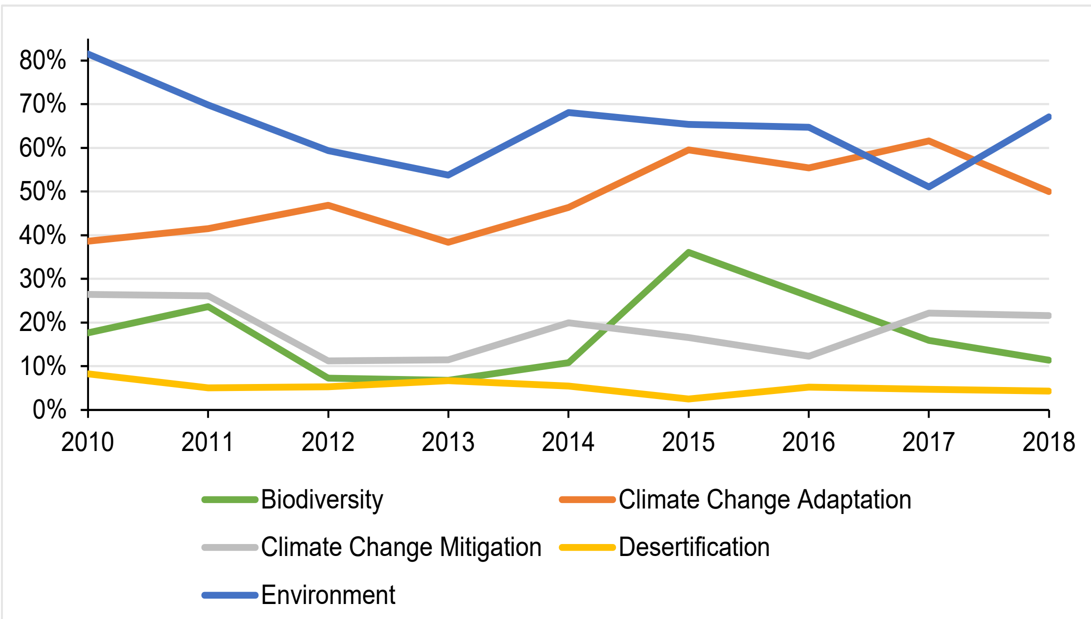


Source: Authors, based on OECD Creditor Reporting System https://stats.oecd.org/Index.aspx?DataSetCode=CRS1

2.5.1. Trends in development finance for water contributing to key environmental objectives

Water-related investments have a key role to play to contribute to climate change adaptation, mitigation and other environmental objectives. Figure 2.14. illustrates the share of ODA flows for water that are tagged as contributing to various environmental objectives[15]. Coherent with the importance of adaptation for ensuring resilient water management, in recent years, over 50% of ODA allocated for water is considered as contributing to adaptation.

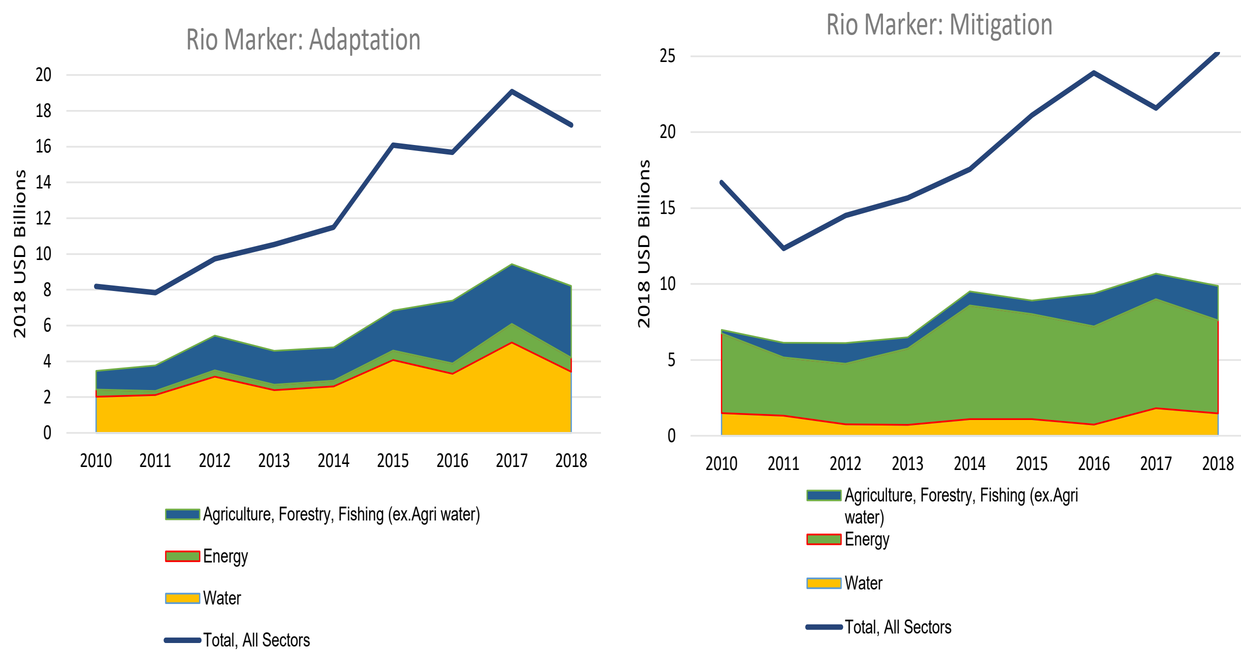
Figure 2.14. Water ODA by Rio Marker, Marked Principle or Significant



Note: Climate Change Adaptation coverage begins in 2010
Source: Authors, based on OECD Creditor Reporting System https://stats.oecd.org/Index.aspx?DataSetCode=CRS1

In terms of total ODA tagged for climate adaptation, just less than 1/4 flows to water-related subsectors amounting to USD 4 billion in 2018, a similar share flows to agriculture (Figure 2.15). In the case of ODA tagged for climate mitigation, water captures a much smaller share of the total allocated, amounting to USD 1.5 USD billion in 2018).

Figure 2.15. Screened ODA for Climate Adaptation and Mitigation, Select Sectors



Source: Authors, based on OECD Creditor Reporting System https://stats.oecd.org/Index.aspx?DataSetCode=CRS1

Similar figures can be observed when looking at climate finance from a wider angle, including both public and private investments dedicated to climate goals. Analysis from Climate Policy Initiative (Buchner et al., 2019[90]) shows that the water sector represents only a minor share in global climate finance, compared to other sectors. In 2017-18, only about 2% (USD 13 billion) out of USD 574 billion global climate finance were dedicated to water and waste, and about 3.6% (USD 20 billion) to agriculture, forestry and natural resource management, while the renewable energy sector accounted for the biggest share of 58%. When looking at adaptation finance only, the water sector plays a more prominent role: Similarly to ODA figures, the water sector is the first recipient of climate finance dedicated to adaptation (34%, USD 10 billion), followed by the agricultural, land-use and natural resource management sector, capturing 24% of global adaptation finance flows. This highlights the important role that water-related investments play in the transition towards resilient and adaptive systems and economies.

2.6. Transcending sectors: how water risks could translate into material financial risks

The impacts of water-related risks can propagate through multiple channels, such as through impacts on human health from disease and morbidity due to poor drinking water quality and lack of access to safely managed sanitation; disruptions to industrial operations or supply chains due to water-related disasters; impacts on agricultural commodity markets due to water scarcity and droughts impacts on production. These risks can materialise at multiple scales, from the household to corporate level, to industry and sector scale to systemic risk; they potentially cut across geographical scales, from local to basin, regional and global level. They may transmit into impacts on the financial system via a variety of impact points and transmission channels (OECD, 2021[91]). Further work is required to understand and document such transmission channels, the order of magnitude of financial material impacts and how policy makers and financial institutions can address them.[16] The following section focuses on financing impacts of water-related risks for corporates. However, it is worth noting that material financial risks could impact the financial sector not just via corporates, but also via insurance, sovereign bonds, real estate funds and other channels. These issues are being explored in ongoing OECD work.

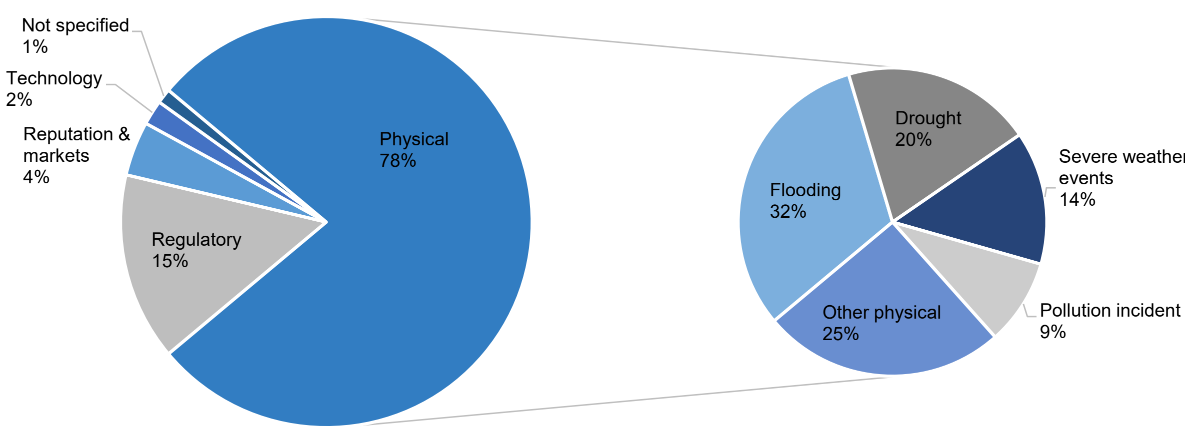
2.6.1. Financial impacts of water-related risks for corporates

Water-related risks can have significant impacts on business value, now and increasingly in the future. The financial value of water-related detrimental business impacts of over 2 900 corporates, disclosing information in the 2020 CDP survey on water security amounted to USD 16.7 billion. Companies also reported that currently identified water-related risks could potentially have impacts on business value of up to USD 336.3 billion in the future (CDP data, 2020[92]). The survey also revealed that, despite these considerable business impacts, only half of the responding companies are integrating water-related issues into their financial planning.

The CDP water security questionnaire covers corporates from various sectors, representing a quarter of global market capitalisation. Respondents report both on negative business impacts from water-related events that have occurred during the reporting period – typically the previous year - as well as potential business impacts from water-related risks that may occur in the future. The survey covers several types of water-related risks, such as physical, regulatory and technological risks as well as risks related to reputation and markets.

Looking at negative business impacts that have occurred in the last reporting period, over three quarters of the detrimental impacts reported by publically disclosing companies[17] were related to physical events, such as flooding, droughts or severe weather events (see Figure 2.16.).

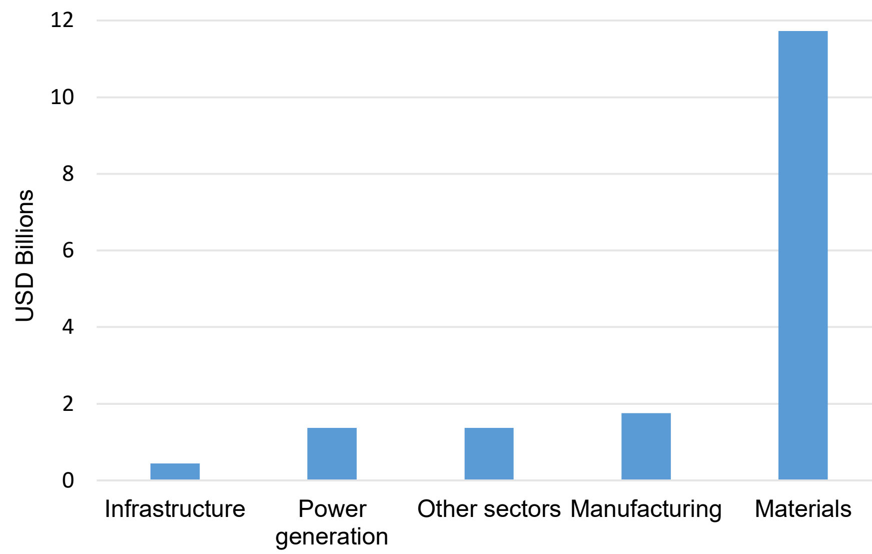
Figure 2.16. Drivers of detrimental water-related business impacts reported by corporates to CDP in 2020



Note: Includes only publically disclosing companies. ‘Other physical’ events include leaching of pollutants to groundwater bodies, soil degradation, rupture of tailings dams and toxic spills and acid rock drainage and metal leaching. ‘Reputation and markets’ include water-related litigation, changes in consumer behaviour, community opposition and negative stakeholder feedback and increased stakeholder concern.
Source: Authors, based on (CDP data, 2020[92])

Disaggregating by sectors, USD 11.7 billion of the total USD 16.7 billion of financial value of water-related detrimental business impacts fell on the materials sector (including mining)[18], followed by the manufacturing sector with USD 1.7 billion[19] (CDP data, 2020[92]). Figure 2.17. gives an overview of the total financial value of detrimental water-related business impacts during the reporting period per sector.

Figure 2.17. Total financial value of detrimental water-related business impacts per sector



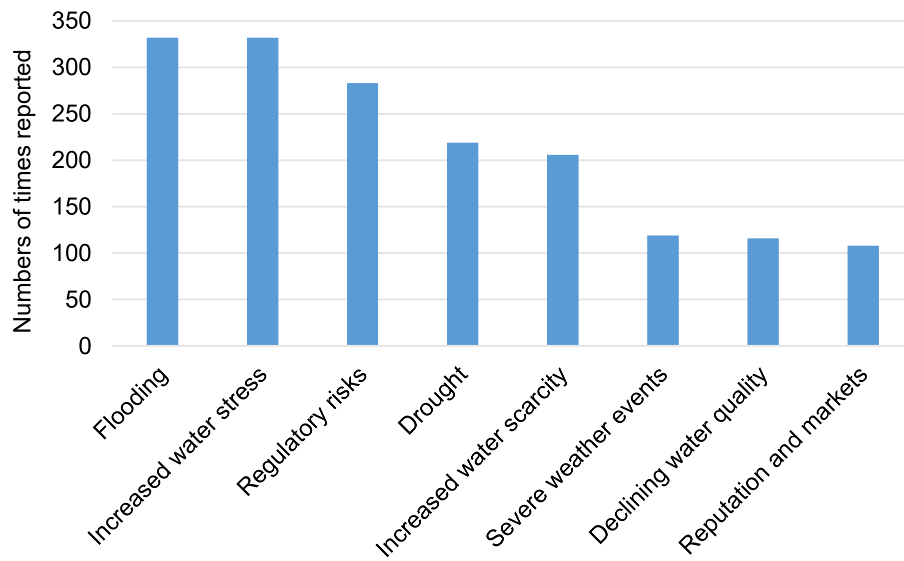
Note: Includes both publically and privately disclosing companies.
Source: Authors, based on (CDP data, 2020[92])

2.6.2. Water-related risks identified with the potential to have substantive financial or strategic business impacts

Almost half of the publically disclosing companies (44%) have identified water-related risks in their direct operations or value chains with the potential to have substantive financial or strategic business impacts now and in the future. Seventy-seven percent of the risks identified are physical risks, followed by regulatory risks (14%). Figure 2.18. gives an overview of the different types of risks and their frequency of identification. The five most frequently identified physical risks are flooding, increased water stress, drought, increased water scarcity and severe weather events. Companies report that these events could lead to reduction or disruption in production capacity, increased operating costs or supply chain disruptions. The identified regulatory risks include changes in regulations of discharge quality or volumes, higher water prices, tighter regulatory standards or mandatory water efficiency, conservation or process standards. The most frequently reported potential impacts triggered by those regulatory risks are increased operating costs for companies, reduction or disruption of production or imposed fines and penalties.

Figure 2.18. Top 8 water-related risks for corporates covered by the CDP survey

Risks identified in direct operations or within the value chain

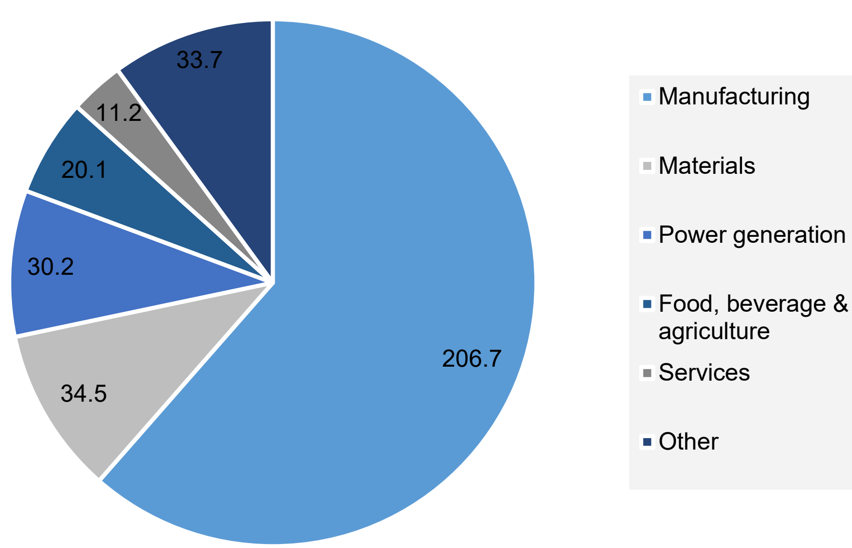


Note: Includes only publically disclosing companies
Source: Authors, based on (CDP data, 2020[92])

When looking at potential business impacts related to water, the manufacturing sector appears to be the most exposed[20], with an estimated business value at risk of up to USD 206.7 billion. Figure 2.19. gives an overview of the maximum estimated business value at risk per sector.

Figure 2.19. Maximum estimated business value at risk due to water issues per sector

USD Billions



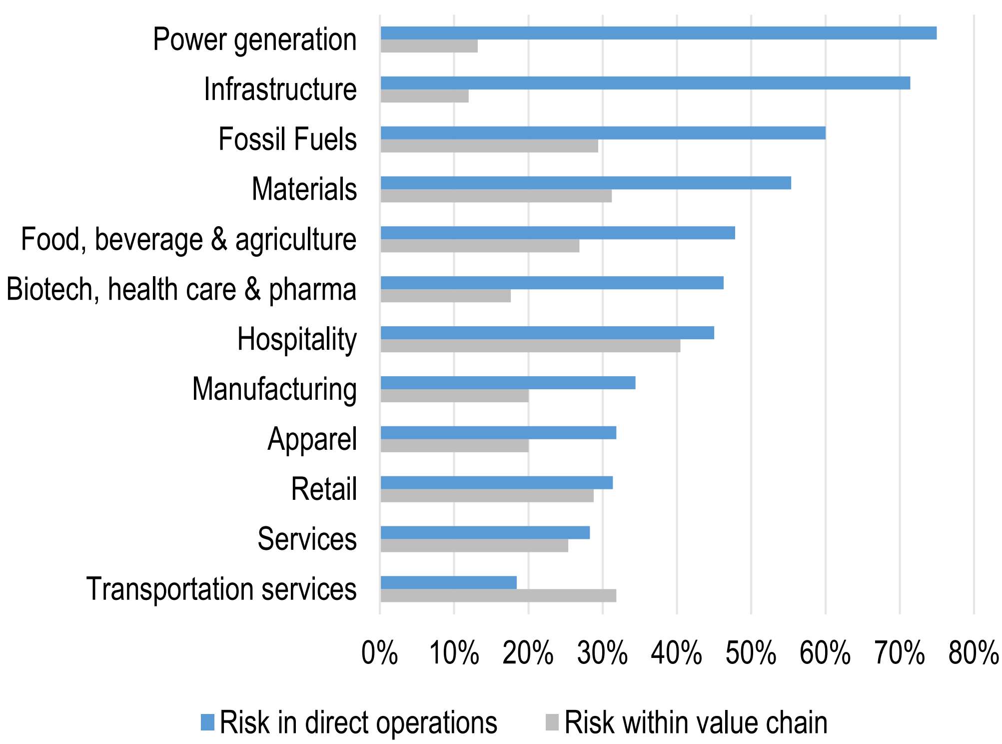
Note: Includes both publically and privately disclosing companies.
Source: Authors, based on (CDP data, 2020[92])

Further, over half of the publically responding companies from the fossil fuels, infrastructure, and power generation and materials sectors have identified water-related risks in their direct operations. Zooming into the materials sector, almost all metallic mineral mining companies have identified at least one water-related risk within their direct operations as well as over 60% of the companies from the wood and paper and metal smelting, refining and forming subsectors.

Beyond water-related risks in direct operations, roughly, one third of publically disclosing companies from the transportation service sector, hospitality and materials sectors have identified water-related risks within their value chains. Figure 2.20. visualises exposure to direct and indirect water-related risks per sector.

Figure 2.20. Exposure to water-related risks by sector

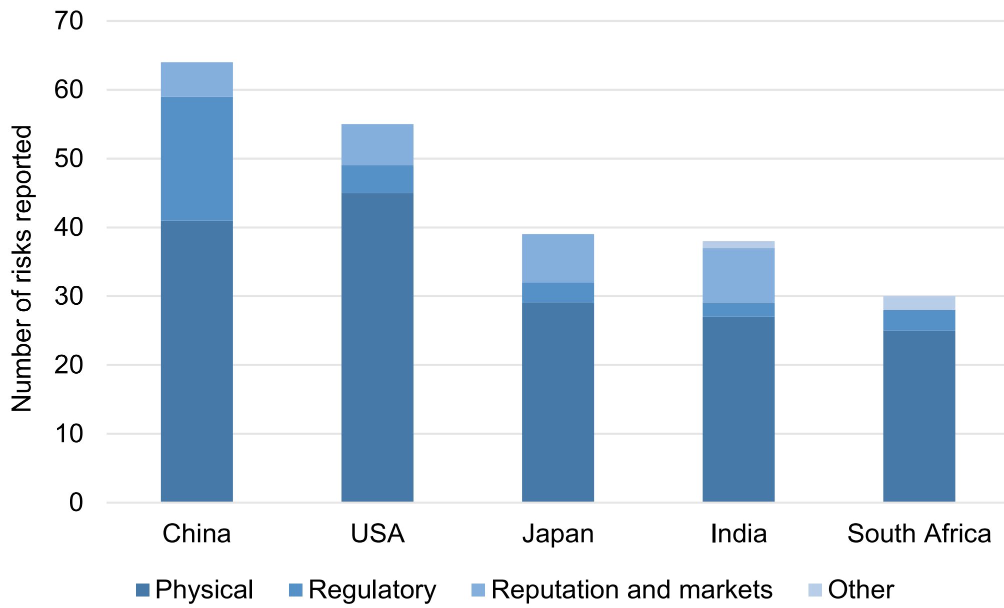
Percentage of companies per sector having identified inherent water-related risks with the potential to have substantive financial or strategic impacts on their business



Note: Includes only publically disclosing companies.
Source: Authors, based on (CDP data, 2020[92])

China, the United States and Japan are the countries with the highest number of identified risks within companies' value chains[21]. Physical events are the major source of risk in these three countries, while in China regulatory measures also contribute notably to value chain risks (see Figure 2.21.). In the US, the largest number of risks is centred around the Mississippi River, in China around the Yangtze River, Yellow River and Pearl River.

Figure 2.21. Top 5 countries with greatest numbers of risks reported within companies' value chains



Note: Includes only publically disclosing companies. Of all publically responding companies, 10% were located in China, 18% in the USA, 17% in Japan, 3% in India and 2% in South Africa.
Source: Authors, based on (CDP data, 2020[92])

This analysis highlights how water insecurity can pose business risks and can negatively influence corporates' profits. Regular assessment and disclosure of quantifiable and consistent information on water-related risks can support businesses to better identify risks across their value chains and to integrate them into corporate decision-making. Analysis has shown that the potential financial impact of water-related risks is over five times higher than the cost of addressing these risks – mitigating water-related risks hence makes business sense (CDP, 2021[93]). Regular risk assessment and disclosure can support companies to develop forward-looking and resilient business strategies. For example, they can bolster resilience by ensuring that investment is directed towards the parts of their business exposed to the greatest risk related to water.

A company's exposure to water-related risks and how it is addressing them, therefore is vital information for investors. Without comparable and consistent data, it is difficult to impossible for investors to evaluate a company's investment performance. Corporate water-related risk disclosure can hence inform decisions on potentially material financial risks related to water and provides greater certainty for investors. Further, more disclosure and transparency could trigger action, from both corporates and investors, to support the transition to a water-secure and net-zero world.

However, today, corporate water-related risk disclosure remains limited: From about 5 500 companies asked to provide data via the CDP water security questionnaire by their investors or business customers, just above half did so (CDP, 2021[93]). In the future, regulation on water-related and nature-related risk disclosure can contribute to greater transparency about the impact on corporates of water-related risks.

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Notes

1 The survey was carried out in May 2020 by the Global Water Leaders Group. It is based on responses from 44 utilities around the world.

2 Comprised of the recovery instrument *Next Generation EU* (EUR 750 billion) and the reinforced long-term budget for 2021-2027 (EUR 1,100 billion)

3 The selected directives are the Drinking Water Directive, the Urban Waste Water Treatment Directive and the Floods Directive.

4 EU-13 countries are Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovak Republic and Slovenia. EU-15 countries are Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden as well as the United Kingdom (which was part of the EU when the analysis was undertaken)

5 Considered as a situation when households spend more than 3-5% of their disposable income on water supply and sanitation

6 The impact of the pandemic on the financial health of WSS utilities may constrain opportunities to mobilise commercial finance for the sector in some member countries.

7 Note by Turkey: The information in this document with reference to "Cyprus" relates to the southern part of the Island. There is no single authority representing both Turkish and Greek Cypriot people on the Island. Turkey recognises the Turkish Republic of Northern Cyprus (TRNC). Until a lasting and equitable solution is found within the context of the United Nations, Turkey shall preserve its position concerning the "Cyprus issue". Note by all the European Union Member States of the OECD and the European Union The Republic of Cyprus is recognised by all members of the United Nations with the exception of Turkey. The information in this document relates to the area under the effective control of the Government of the Republic of Cyprus.

8 The estimate is derived from the gap in access to services as of 2015 and the cost of connecting those without access as well as improving level of service for those with access to reach SDG 6.1 and SDG 6.2 targets. It includes capital, maintenance and operation costs.

9 Note that irrigation expansion may not be suitable where irrigation is already taking place, calling for potentially significant and costly redirections of investment and finance.

10 Estimates provided in this section were derived from the OECD agriculture support database, updated until 2019 (OECD, 2020[84]). The full dataset is available at https://www.oecd.org/agriculture/topics/agricultural-policy-monitoring-and-evaluation/. Reported data only include water-related agricultural government expenditures in the covered countries and the EU. Support to agricultural production and price distorting measures that impact production choices and may indirectly affect water use, are not included. Implicit water price subsidies, such as pricing for water that does not cover fully irrigation costs, are not systematically reported, and may therefore not all be included.

[11] This analysis presents time series, which includes the United Kingdom prior to its withdrawal from the European Union on 31 January 2020 at 23:00 GMT. The EU aggregate presented here therefore refers to the EU including the UK.

[12] The 13 emerging economies include Argentina, Brazil, China, India, Indonesia, Kazakhstan, the Philippines, Russia, Ukraine, South Africa, and Viet Nam.

[13] Data presented in this section were compiled from the OECD QWIDS database, available at https://stats.oecd.org/qwids

[14] OOF includes official assistance that does not fit the ODA definition. For more information, please see: http://www.oecd.org/dac/financing-sustainable-development/development-finance-standards/officialdevelopmentassistancedefinitionandcoverage.htm

[15] "Rio makers" are used to determine if an ODA flow is designated for a specific objective. The emphasis of the markers is on the objective pursued in providing support for a particular activity, as described in the activity documentation (e.g. primarily the written material which forms the basis for the agreement to provide funding).
In this exercise, of the flows screened, we have presented the percentage of flows that were determined to be "principle" or "significant" in their respective marker.

[16] OECD work on the financial materiality of water-related risks is currently ongoing. A forthcoming paper will look at the framing of risks in the global financial sector and how it takes into account water related risks.

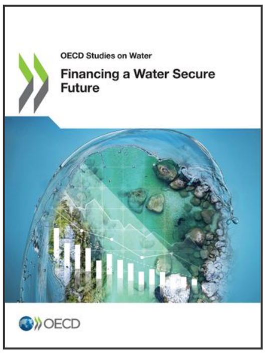
[17] From a total of 2 934 reporting companies, 1 471 companies disclosed their responses publically.

[18] Companies from the materials sector represent 15% of all responding companies.

[19] Companies from the manufacturing sector represent 47% of all responding companies.

[20] Note that neither agriculture nor housing are covered in the survey.

[21] Note that corporates in other countries could be exposed to high risks, where disclosure rates might be low.



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