7th Roundtable on Financing Agricultural Water, Sustainable use of water for agriculture - Co-convened with FAO
27-28 January 2021
The case for action on financing agricultural water

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BACKGROUND PAPER

Introduction

Agricultural production critically depends on water access and availability and is among the sectors most vulnerable to climate-related water risks. Agriculture production constitutes the largest consumer of freshwater globally. In many semi-arid countries, advanced rain fed management or agriculture irrigation is not available to millions of smallholder farmers in relatively well water-endowed African countries, reducing their production potential, livelihood, resilience to shocks and local food security.

This paper provides background information to support the discussion on agricultural water financing at the meeting of the Roundtable on Financing Water on 27-28 January 2021. 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 improve global food and water security, reduce poverty and shift towards more sustainable and resilient food systems, in line with the UN Sustainable Development Goals (SDGs). Furthermore, responsible investment in agriculture and water is key to support economic growth, reduce poverty and food insecurity, proving a foundation to help countries recover from the global COVID-19 pandemic. Challenges and opportunities for a green and resilient recovery will be further discussed in Background paper 2 of the Roundtable on Financing Agricultural Water.

Scaled up efforts on financing are needed for agricultural water if the sector is to meet growing food demand in the context of growing water-related and climate change risks, respond to societal objectives, and increase the sustainability of food systems. However, it is not simply a matter of scaling up the quantity of finance flowing to the sector, but ensuring that investments are responsible, targeted and coupled with improved policies to ensure that they lead to responsible and sustainable outcomes.

Responsible investment in agricultural water includes priority investments in, by, and with smallholders, including a vast range of stakeholders from small-scale producers and processors, to indigenous peoples and agricultural workers. It is defined as making a "significant contribution to enhancing sustainable livelihoods, in particular for smallholders, and members of marginalized and vulnerable groups, creating decent work for all agricultural and food workers, eradicating poverty, fostering social and gender equality, eliminating the worst forms of child labour, promoting social participation and inclusiveness, increasing economic growth, and therefore achieving sustainable development" (CFS, 2014[1]).

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Historically, irrigation development and agricultural water infrastructure have been supported by governments, multilateral banking institutions and private entities. However, many of the investments do not account for sustainable environmental flows and uses. Thus, it is necessary to ensure a better use of existing financial flows to ensure they contribute to sustainable water use. As illustrated further in the paper, total public agriculture related support for water in 54 countries have decline from 2011 to 2019 (Figure 3). Challenges remain in many countries and grow in others, with water overexploited by agriculture in some regions and underexploited elsewhere, calling for better policies and responsible and targeted financing efforts customised to local contexts to match local needs for investment.

The paper is structured as follows: Section 1 presents the rationale for financing water in agriculture. Section 2 reviews existing sources and projected needs for water financing in the agricultural sector. Section 3 briefly discusses the necessary modalities for effective agricultural water financing that enables sustainable agriculture irrigation systems, as well as policy objectives.

Questions for discussion

- What policies and other efforts are necessary to make better use of existing financial flows in agricultural water investment going forward?
- What are effective approached to prioritise investments that modernise existing water infrastructure over investing in new infrastructure? How can policymakers help ensure that these investments consider trade-offs and ensure that they are sustainable?
- What could be done to address the lingering data gaps necessary to identify investment needs in agricultural water and target the scaling up of financing?

1. Looming agriculture and water challenges call for responsible investment and sustainable water management

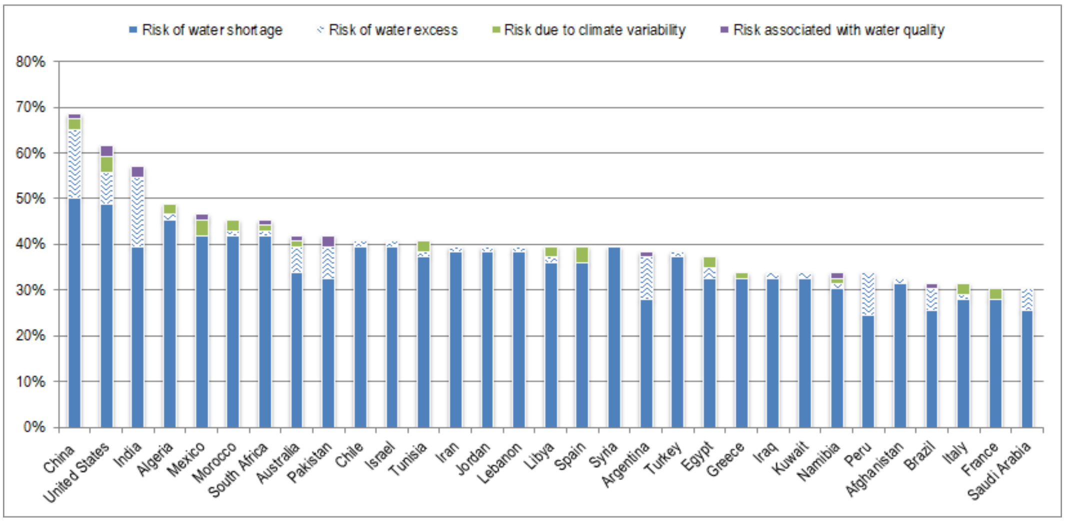
Agriculture production is critically dependent on water resources. Field crops and livestock production at any scale can only be sustained with access to water. While rain fed agriculture still covers 80% of global cultivated land (and 60% of production), much of the expansion of land and production in the past fifty years is attributable to the development of more productive irrigated cropland (Rosegrant, Ringler and Zhu, 2009[2]). Irrigated agriculture covers 275 million hectares – covering the remaining 20% of cultivated land– and accounts for 40% of global food production (UNESCO, 2020[3]).

Ensuring adequate water access for the agriculture sector is therefore critical to ensure global food security, with a growing population and changes of diets that will lead to increases in agriculture requirements. Accounting for increasing agriculture productivity, food production will need to use more water, with a growing population particularly in the Sub-Saharan African continent. These future challenges present the opportunity to address financing needs, in a responsible and sustainable manner.

However, the sector is facing growing water risks; extreme weather events (such as floods and droughts) are increasing in frequency and intensity as climate change progresses (Intergovernmental Panel on Climate Change, 2019[4]). At the same time, the sector is facing increased competition with other water users in growing economies (Rosegrant, Ringler and Zhu, 2009[2]) (see Figure 1). In many regions, agriculture is increasingly affected by droughts, floods, storms and sea-level rise (OECD, 2017[5]), with significant economic consequences.

Several examples illustrate these costs. For instance, approximately three quarters of the key global staple crop areas of maize, rice, soy and wheat experienced drought-induced production losses in the period 1983 to 2009 which were estimated to amount to USD 166 billion (Kim, Iizumi and Nishimori, 2019[6]). The extreme drought event that affected Europe in 2018 resulted in cereal yields declining by up to 50% for certain crops, while Japan's 2018 heavy rainstorms led to damage valued at USD 4 billion for the agricultural sector (MAFF, 2019[7]; Gruère, Shigemitsu and Crawford, 2020[8]). Beyond increasing the intensity and frequency of extreme events, climate change is expected to raise global irrigation requirements by up to 20% according to some estimates (Hertel and Liu, 2016[9]). These risks are compounded by increased water competition with other users and sectors, particularly in some countries (OECD, 2017[5]).

Figure 1. Water shortage risk projected as the most predominate future water risk, possibly threatening agricultural development

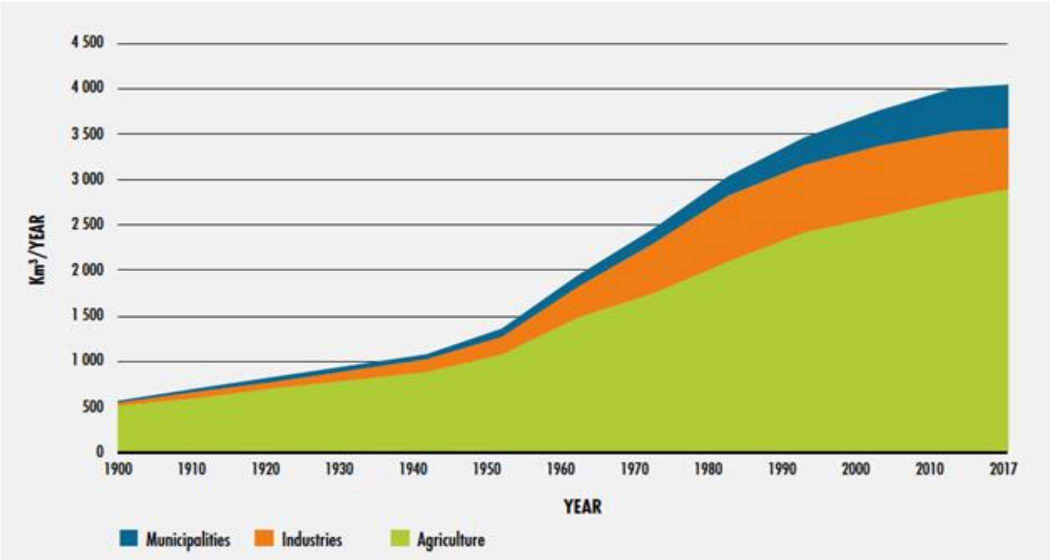


Note: Future water risks by country: Proportion of future water risks, by category, reported in 64 studies. The assessment relies on the geographical decomposition of results from 64 global-level studies with water risk measurements. These studies assess the different types of water risks associated with climate change and/or demand projections and focus on surface water and/or groundwater in the current, medium or long term, all at a global level. Most studies focus on likelihood and intensity of impacts. These risks are often quantitatively evaluated. A number of water stress indicators used in the studies rely on alternative versions of the withdrawal-to-availability ration, defined as the annual water withdrawal divided by annual water availability at the basin scale, W/Q, where W is annual freshwater off-stream withdrawal for agriculture, industrial and domestic sectors, and Q is annual renewable freshwater resources. Usually, the extent of water stress is categorised as no-stress (W/Q < 0.1), low stress (0.1<W/Q<0.2), moderate stress (0.2<W/Q<0.4), and high stress (W/Q>0.4).

Source: OECD (2017[5])

Agriculture also contributes to water challenges. Agriculture remains the largest user of withdrawn freshwater resources globally (Figure 2); accounting for about 70% of global freshwater withdrawals and around 90% of consumptive use, with important differences across countries and regions (Scheierling and Tréguer, 2018[10]). Due to its high consumptive water use, irrigated agriculture can have significant consequences for water resources, economic activities and ecosystem services. 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[11]).

Figure 2. Global water withdrawals have greatly increased since 1990, with agriculture accounting for the largest share



Notes: Agricultural water withdrawal refers to the annual quantity of self-supplied water for irrigation, livestock and aquaculture; industrial withdrawal is the annual quantity of self-supplied water for industrial uses, such as cooling thermoelectric and nuclear power plants (but excluding hydropower); and municipal withdrawal is water withdrawn for the direct use of the population.
Source: FAO (2020)

Additionally, agriculture is a major contributor 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[12]). In particular, agriculture is the primary source of pollution in rivers and streams in the United States (US EPA, 2016[13]) and 38% of water bodies face significant pressure from agricultural pollution in the European Union (WWAP, 2015[14]).

Improving agriculture's water management is therefore critical to improve water and food security (Gruère, Shigemitsu and Crawford, 2020[8]). In addition to improved policies, responsible investment is needed to drive economic and agricultural development, while ensuring sustainability of water use and environmental flows.

Responsible investment is needed:

- To improve water management practices and develop irrigation in relatively water abundant rain fed areas so they can be more productive and deliver food and income for growing population, particularly in Sub-Saharan Africa.
- To support the improved management of irrigation by farmers so they can adopt more sustainable practices, adapt to volatile climate conditions and increased water competition and preserve water resources for the future
- To improve management of water risks and fetch new demands within the agriculture sector as well as food production companies
- To support water managers so they can improve information on water resources, including groundwater resources and flows, consider possible new storage infrastructure, develop wastewater reuse or other alternative sources, and upgrade water allocation systems to increase water security.

Responsible investment can also contribute to improving sustainable livelihoods for smallholders, as well as members of marginalised and vulnerable groups. The inclusion of these groups has the potential to create labour, foster social and gender equality and promote social participation and inclusiveness to lead to increased economic growth and the path to sustainable development (FAO, 2020[15]).

2. Understanding the financing challenge and investment gap

This section reviews data on existing support for agricultural water and attempts to identify gaps in investment needs. The development of irrigation and its progressive modernisation has been supported by large investments from public and private sources. Investments in agricultural irrigation increased rapidly in the 1960s and 1970s; during this period, it represented half of the agriculture budget of governments in certain Asian countries and a large share of the World Bank's agriculture lending to these countries (HLPE, 2015[16]). However, later, multilateral lending declined rapidly post 1985 (*Ibid)*. This explains the need for modernisation of water infrastructure that was perhaps put in place during times of peak investment, and for the consideration of costs for operations and maintenance going forward. Additionally, over time, the need to address changing needs in food production due to an increasing population and changing demand is even more pressing.

Discussed in this section is the current status of agricultural financing, including for agricultural water, from governments, official development assistance (ODA) and other sources. Notably, there has been a progressive decrease in water-related agricultural financial support from 1995 to 2019, partly due to a reduction in irrigation-related and total production support for agriculture. These figures, discussed in more detail in the following section, highlight the need for financing and the current gaps in investment.

2.1. Status of agricultural finance, including for agricultural water

2.1.1. Government water-related agricultural support

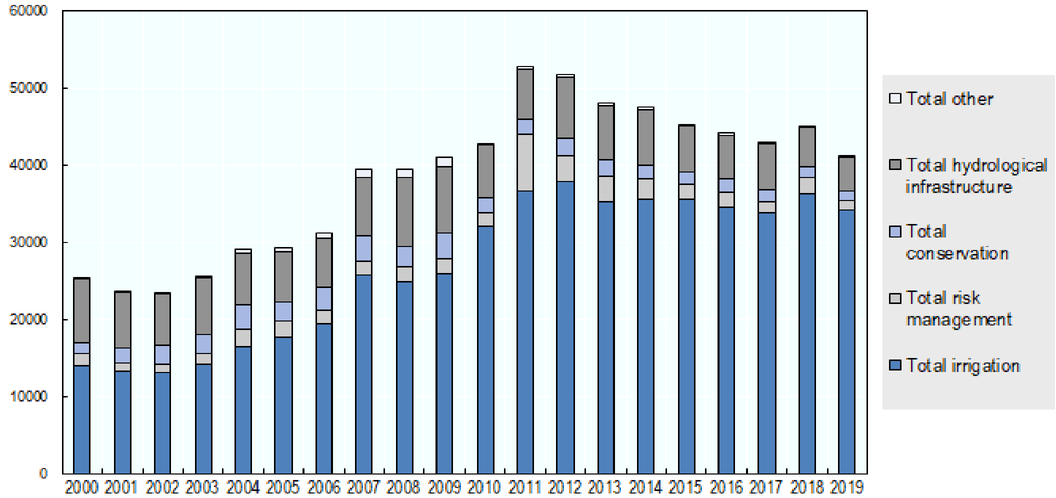
According to OECD (2020[17]) data, total public agriculture related support for water in 54 countries—the 28 EU member states (aggregated), other OECD member countries, as well as 13 emerging economies (Argentina, Brazil, China, Colombia Costa Rica, India, Indonesia, Kazakhstan, the Philippines, Russia, Ukraine, South Africa, and Viet Nam) — increased from 2000 (USD 25.9 billion) to 2011 (USD 54.2 billion) and then declined more slowly to USD 41.6 billion in 2019 (Figure 3).[3,4]

[3] As part of its effort to monitor agricultural policies, the OECD has developed and annually updated a comprehensive international database of all types of government support to the agricultural sector since 1986 for OECD countries and since 2000 for key agricultural producing emerging economies (mostly G20 members).

[4] While significant, these amounts remain limited compared to overall net agricultural support, which were estimated to reach USD 619 billion in the 54 countries in 2019.

On aggregate, 70% of that support focused on irrigation (from irrigation development to support for water in irrigation), 18% was dedicated 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 amount was split between conservation related and water risk related management expenditures.[5] At the same time, 57% of this support was dedicated to enabling agriculture activities (general services) and 43% was related to production. Close to three quarter of total support was provided in non-OECD emerging countries, especially India and China (58% of total support).

Figure 3. Total water related agriculture support in 54 countries (2019 USD million)

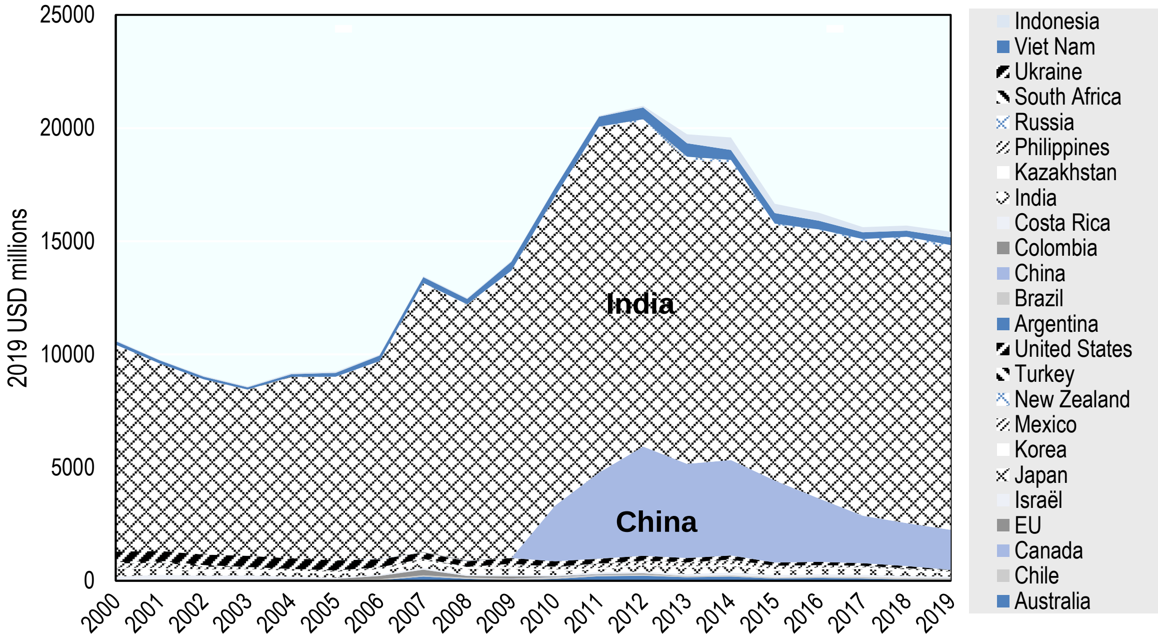


Source: Authors based on OECD (2020[17]).
Note: Hydrological infrastructure relates to all expenses to support water use related infrastructure related to agriculture, conservation includes measure towards the conservation of water ecosystems and payment for sustainable water use, risk management includes measures to manage water risks, particularly flooding, scarcity or salinity, irrigation covers payments to encourage irrigation and development of irrigation on farm.

Looking deeper into these estimates, governments of the covered countries spent between USD 10 and 20 billion per year between 2000 and 2019 to support irrigation (USD 15.4 billion in 2019) with this amount almost entirely spent by India and China (Figure 4). This amount is commensurate with the size of their production and the importance of irrigated agriculture. Still, 82% of production support for irrigation aimed to incentivise the use of water for irrigation via irrigation-related water or electricity subsidies (98% in non-OECD countries). Such support is potentially harmful to water resources, as it can encourage the excessive use of water for irrigation, deplete surface and groundwater and capture water at the expense of other users (Gruère and Le Boëdec, 2019[18]).

[5] This categorisation was made by the authors based on the description of expenditure programs provided by countries. The categorisation of some irrigated related programs, however, is debatable, as it may cover basin infrastructure investments like retention basins, canals or rural electrification, but also on farm access to water or wells and other expenses that could be considered irrigation development.

Figure 4. Producer support estimates (PSE) related to irrigation by country

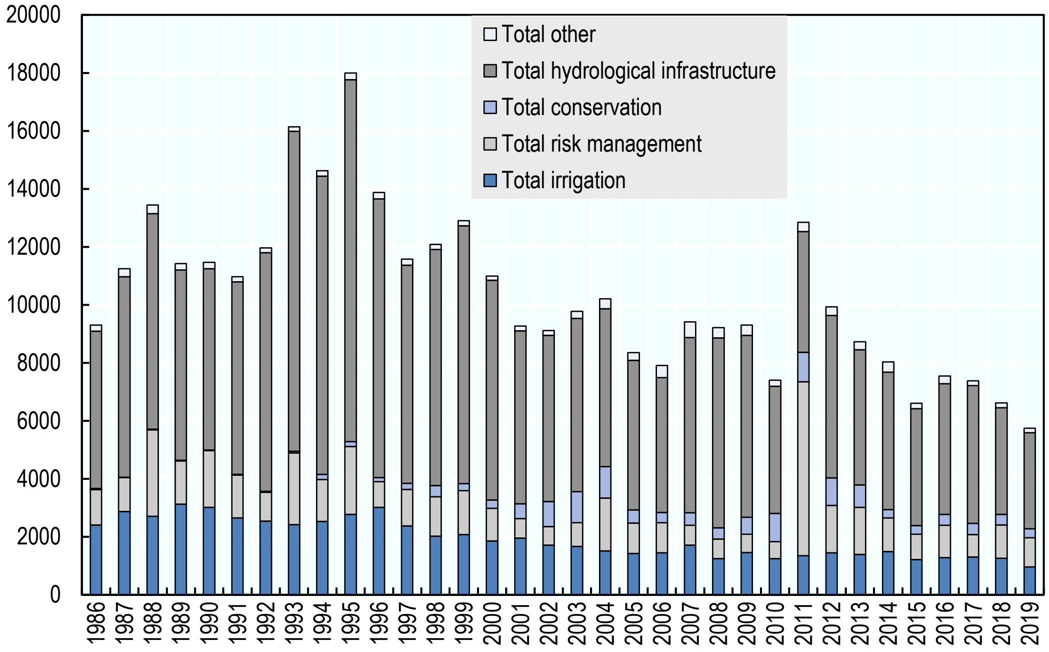


Source: Authors, based on OECD (2020[17]).
Note: The Producer Support Estimate (PSE) indicator estimates the annual monetary value of gross transfers from consumers and taxpayers to agricultural producers, measured at the farm-gate level, arising from policy measures that support agriculture, regardless of their nature, objectives or impacts on farm production or income. In this case figure, only water related PSE is reported.

In OECD countries, total water-related agriculture support declined progressively from USD 18.7 billion at the peak of the series in 1995 to USD 6.8 billion in 2019 (Figure 5), in part due to a reduction in irrigation-related and total production support for agriculture. 86% of total support is dedicated to investment enabling the functioning of the sector, with only 24% of total water-related support linked to agricultural production.

Unlike observed for the total, most support in OECD countries has been historically dedicated to hydrological infrastructure, with only 13% of total support related to irrigation (Figure 5). Non-OECD emerging countries are spending much more on irrigation than infrastructure, while the reverse is true for more developed OECD economies. These differences may underline different government priorities, both related to food production and to irrigation sector specificities. Still there is no obvious trend over time of changing government support structure, even in rapidly growing emerging economies.

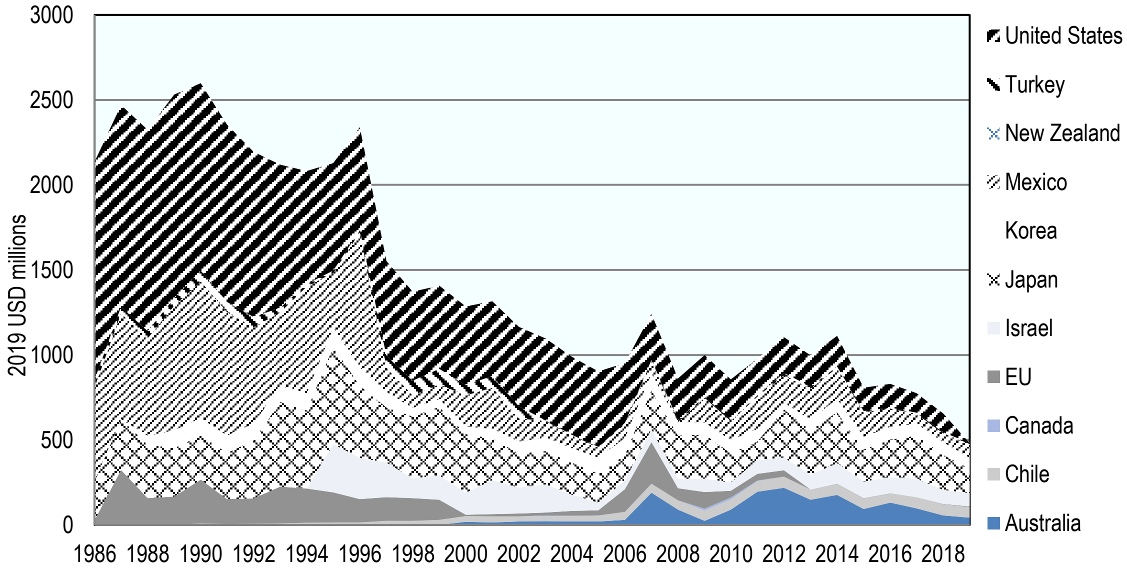
Figure 5. Total water-related agriculture support in OECD countries (2019 USD million)



Source: Authors, based on OECD (2020[17]).

Domestic producer support for irrigation in OECD countries has largely declined since 1998, from USD 2.5 billion in 1989 to close to USD 480 million in 2019 (Figure 6). While most of this support was going to measures directly incentivising the use of water in 1986 (88% of irrigation PSE), this proportion declined to 46% in 2019 (USD 220 million).

Figure 6. Producer support estimates (PSE) related to irrigation by OECD country



Source: Authors, based on OECD (2020[17]).

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2.1.2. Development Assistance on agriculture and water

The development of agricultural irrigation and related infrastructure has also been supported by development programs and loans in a number of countries. Table 1 shows recent official development assistance (ODA) and other official flows for agricultural water resource based on OECD data (2020[19]). According to these figures, about USD 1 billion was spent per annum on water-related agricultural investments in recent years, most of which originated from multilateral agencies. Almost all of the total ODA in this sub-sector was allocated to Asian (52%) and African countries (44%), with multilateral agencies allocating relatively more to Asian countries (60%) during this period. An average USD 387 million other official assistance[6] was made available by multilateral agencies during the same period, 85% of which (USD 329 million) was directed to Asian countries.

Table 1. Official development assistance: agricultural water resources (current USD)

	2014	2015	2016	2017	2018
Total ODA	**1 097**	**1 099**	**970**	**1 061**	**1 084**
From DAC countries	434	435	376	322	349
From Non-DAC countries	52	96	30	72	136
From Multilateral agencies	611	568	564	667	599
Other official flows	**406**	**303**	**408**	**452**	**368**

Note: DAC countries are countries members of the OECD Development Assistance Committee (for the list see http://www.oecd.org/dac/development-assistance-committee/).
Source: OECD (2020[19]).

Taken together, total official development flows of about USD 1.5 billion remain limited given their wide geographical scope. For comparison, the total ODA amount is slightly less than total domestic support for agriculture water in Korea (USD 1-1.2 billion), which was largely for hydrological infrastructure. During the same period, USD 7 to 7.5 billion per year of ODA was going to agriculture, and USD 166 to 195 billion per year of ODA went to all sectors.

2.1.3. Other sources of water and agriculture financing

[6] OOF includes official assistance that does not fit the ODA definition (for instance does not include the minimum level of granted money- which depends on the income level of countries). For more precise estimate, please see: http://www.oecd.org/dac/financing-sustainable-development/development-finance-standards/officialdevelopmentassistancedefinitionandcoverage.htm

Private actors are also key financing actors in the agriculture and water area. Individual and groups of farmers themselves invest in irrigation equipment and canal maintenance, with support of credit or banking institutions. Agro-food companies may finance irrigation-related initiatives as part of contracting schemes. Water sector companies may also be investing in technologies they lease out or set up for remunerative use by farmers. Unfortunately, data is much more difficult to track in this area.[7]

Absent any estimates of private financing, on the basis of information on development assistance and government support, this note estimates that a minimum of USD 43 billion was used to support agriculture and water activities as of 2019 globally.[8]

2.2. Investment needs and gaps

2.2.1. Increased demand for food and water

Population and economic growth are key determinants of total food use, as well as the need for food security. The United Nations projects world population growth to 9.7 billion in 2050, compared with about 7.8 billion people in 2020, which will have serious implications on water needs (FAO, 2020[15]). As the population grows, available freshwater resources per person will decline. Demand pressures on water also rise as per capita incomes grow and societies become more urban, which can lead to dietary changes and greater water demand from households, industry, energy and services (Hanjra and Qureshi, 2010[20]). These trends also imply mounting challenges for rain fed agriculture to meet greater demand (FAO, 2020[15]).

In terms of growing water demand, in sub-Saharan Africa and Northern Africa and Western Asia, annual total renewable water resources per capita declined by 41% and 32%, respectively, between 1997 and 2017 (Figure 8). Hanjra and Qureshi (2010[20]) estimated that 5 600km^3 of water would be needed to feed the global population in 2050, even when accounting for management and productivity increases would leave a gap of 3 300 km^3. Additionally, adaptation to climate change will require investments to cover reservoir construction and irrigation to meet the increasing demand for food and water, estimated at USD 225 billion or USD 11 billion per year until 2030, according to the IPCC AIB scenario (HLPE, 2015[16]).

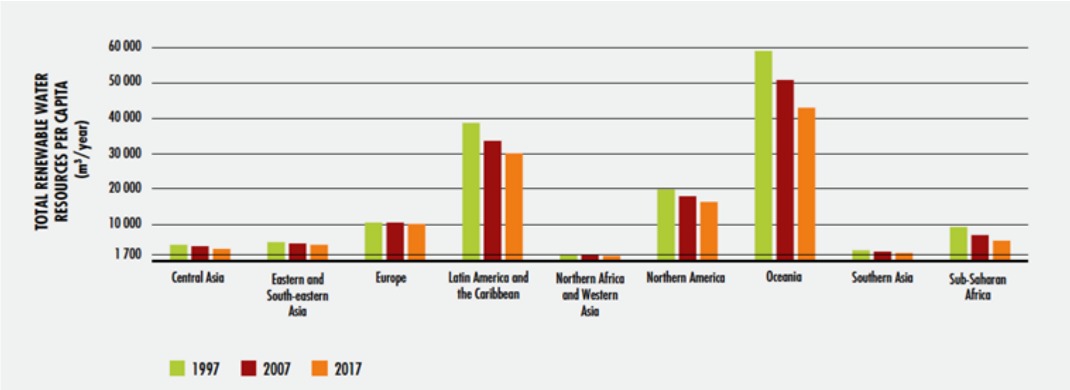
The OECD and FAO (2020[21]) project an 11% expansion in the global population between the period 2017-19 and 2029 (an increase of 842 million people) and gains in per capita income in all regions, with total consumption of food commodities[9] expected to rise by 15% by 2029. Due to regional differences in demographic developments, income distribution and cultural consumer preferences, the impact of these factors on food and water demand will differ by both country and region (OECD/FAO, 2020[21]). The Asia Pacific, the world's most populous region, will continue to play a lead role in global demand for food and is projected to account for 53% of the global population in 2029 (4.5 billion people) (*Ibid*.).

[7] The QWIDS database, which includes private financial flows did not report any figure for agriculture water resources.

[8] As comparison, this is less than a minimum estimate of the amount spent on agriculture and food as relief measures in response to COVID-19 during the first four months of 2020 (Gruère and Brooks, 2020[37]).

[9] The food commodities here refer to those studied in the OECD/FAO Agricultural Outlook 2020-2029. These include maize, other coarse grains, rice, wheat, oilseeds and products, pulses, roots and tubers, meat, dairy, fish and sugar.

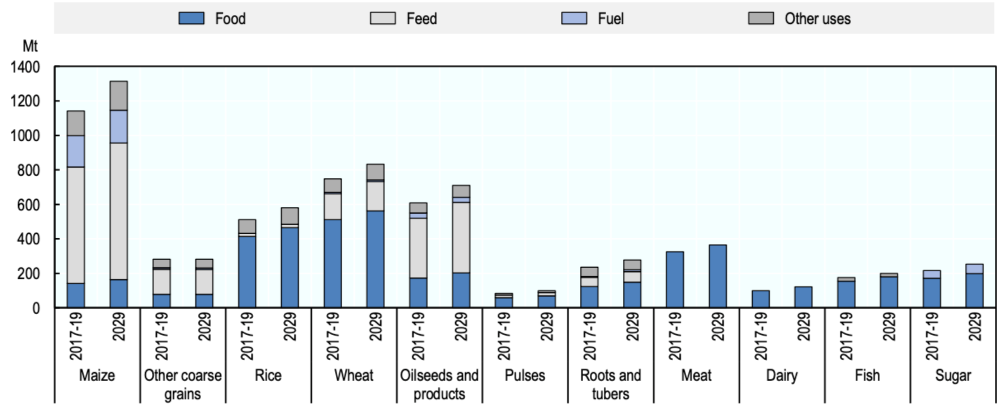
Figure 8. Per capital freshwater resources by region, 1997-2017



Note: Average renewable freshwater resources per person are measured in m3/person/year. Oceania includes Australia and New Zealand.
Source: FAO (2020[15]).

Dietary transition plays a primary role in shaping water demand in agriculture and the products requiring more water will be in higher demand over the next ten years (Figure 9) (FAO, 2020[15]). In particular, livestock products and oils require more water than do cereals, starchy roots, fruits and vegetables. Livestock products play a key role in increasing water demand in Brazil and China, and cereals are doing the same in India. Across these three countries, this change in diet led to an increase in daily water consumption of more than 1000 litres per capita, for a combined population of 3 billion people in 2019 (*Ibid.*).

Figure 9. Projected demand for different agriculture commodities and their use 2019-2029



Source: OECD/FAO (2020).

2.2.2. Investment gaps and needs

Globally, 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 (FAO, 2020[15]). In order to act on these areas of water stress, it is important to understand water availability and the hydrological and ecosystem needs for water quantity and quality over time—while balancing water use for food production, basic needs of poor and vulnerable populations and environmental flows. Secure water rights and access to ecosystem services will also create security for water users, promote efficient water use and encourage opportunities for water markets. Investments in agricultural water exist, but must be tailored to be responsible and account for environmental water uses. However, reinvestment in existing obsolete infrastructure accounts for a substantial part of investment needs. There has been poor operations and management due to unclear designation of responsibilities among stakeholders and systems designs have lacked environmental considerations in the past.

Modernisation of this infrastructure should draw upon lessons from the Green Revolution to account for other water uses and how to more efficiently design these systems.

- Investments required to achieve projected irrigation expansion in East Asia, the Pacific and South Asia are estimated to cost on average a total of USD 3.1 billion per year between 2015 and 2030 (Asian Development Bank, 2020[22]). This includes water infrastructure, such as irrigation technologies, dams, canals and other conveyance systems. The projected investments to improve water-use efficiency across developing nations in East Asia, the Pacific and South Asia make up USD 1.7 billion of the USD 3.1 billion estimate due to the large share of irrigated land. Soil and water management technologies have baseline investment estimates of USD 500 million per year across these three regions. Combining the acceleration of irrigation expansion 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. (*Ibid.*).[10]
- In the Near East and North Africa, population growth, which exceeded 20% in the last decade, is the key source of additional agricultural demand and it is projected to grow further by 1.5% annually over the next decade. Three-quarters of the additional population will be urban; this may lead to consumption of higher value products, such as those that include vegetable oil and sugar, but also meat and dairy products, which require more water (OECD/FAO, 2020[21]).
- Sub-Saharan Africa would largely benefit from increased irrigation, especially in relatively water-abundant areas, as it can help increase agricultural production, increasing economic development and reduce poverty (Hanjra, Ferede and Gutta, 2009[23]). FAO (2020[15]) estimates that expanding small-scale irrigation may benefit between 113 million and 369 million rural people, as only about 3% of cropland is irrigated. However, such efforts would need to be accompanied by other complementary investments and policy interventions, ensuring tenure, access to finance and credit, high-yielding crop varieties, agricultural inputs and functional markets to become effective. Furthermore, only 12% of the region's rural population has access to safely managed water, and it remains a challenge for more than 300 million of the rural population (FAO, 2020[15]).
- Difficulty in identifying needs for agricultural water financing is partly due to lack of widespread data, as discussed in Box 1 below.

[10] While India and China governments could use existing agriculture-water support, this may require significant policy and governance changes (OECD/ICRIER, 2018[38]; OECD, 2018[35]). Other countries may need to expand their funding efforts significantly.

Box 1. Data challenges related to estimating water-related investment needs

There currently exists no unified, consistent, longitudinal or cross-sectional database that contains cost or investment data on water supply and sanitation, or on irrigation. Obtaining data from countries on an individual basis by utilising country statistics websites, or liaising directly with country officials to gather data is fraught with challenges relating to definitional consistency between countries and lengthy procedures. The resulting output would likely not yield a viable data series.

The data availability of irrigation costs is exceedingly sparse compared to other sectors, and makes constructing projections on investment needs a challenge. This lack of available data on a country level makes individual country estimates an unwieldy exercise, and projecting individual countries using those estimates a less than fruitful exercise. An alternative is to project costs at the regional level, where credible estimates exist and geospatial and agricultural variables are more homogeneous. An example are the results published in the World Bank (2019) paper, "Beyond the Gap: How Countries Can Afford the Infrastructure they need while Protecting the Planet". The authors produce their results using the GLOBIOM-irrigation module; the GLOBIOM is a recursive dynamic land-use and agriculture partial equilibrium model that uses geospatial and agricultural variables, such as crop production, irrigation land use, irrigation expansion, and irrigation efficiency, as its drivers (Rozenberg & Fay, 2019). Projections of irrigation costs are made over the timeframe 2015 to 2030 and uses the Shared Socioeconomic Pathway 2 scenario (SSP2). This model produces regional estimates for capital and maintenance irrigation costs.

Source: Authors.

As of 2015, about 0.25 to 1.5 million hectares of irrigated land were estimated to be lost annually from salinisation due to bad irrigation practises, while globally, 34 million hectares impacted by salinity represent 11% of total irrigation-equipped areas (HLPE, 2015[16]). Large investments often come with high maintenance costs and suspending maintenance can lead to negative consequences (such as on drainage, salinization, etc.). There is a need to address these secondary salinisation and drainage issues in order to maintain the potential of these areas and to promote investment in irrigation-equipped land, as well as to ensure continuity of funding for maintenance costs associated with water investments (*Ibid*.).

There are critical needs to invest in governance, policy, institutions, practices and technologies that support the improvement of agricultural water management, particularly in developing countries (FAO, 2020[15]). This includes general infrastructure investment is needed, investment and innovation to support small-scale farmers in rain fed areas and non-consumptive uses of water. Community-based watershed management approaches and attention to land tenure, water ownership and market access can work to address water scarcity and land degradation and can contribute to forest conservation and the restoration of watersheds (Mwangi, Markelova and Meinzen-Dick, 2011[24]).

3. Financing agricultural water should be accompanied by improved policies

Financing agriculture water needs to be effectively framed by robust water and agriculture policies to provide an enabling environment for investment and ensure that investments are sustainable in the long term. First, this encompasses ensuring that the policy environment is consistent with sustainable progress and that water policies to reduce water risks are not generating future water challenges. For example, in developing countries there is a need for water infrastructure for water storage, flood control and energy supply; however, this need is compounded by inadequate investment in maintaining costly assets. Therefore, it is necessary to integrate planning and management of water infrastructure and investment projects to identify synergies to reduce trade-offs between water users. Second, investments in this area should ensure availability of water for all users and uses, including the environment.

3.1. An improved policy environment

Ensuring policy coherence across sectors and policy domains—including macro-economic policies, agricultural and food security policies, water supply and sanitation policies, trade policies, rural development and environmental policies—is necessary to improve water resources management and water governance in relation to agriculture. In particular, agriculture policies that support water use or electricity for pumping, encourage excessive use of water and make farmers more vulnerable to climate change (OECD, 2015[11]; Gruère and Le Boëdec, 2019[18]). Production support that distorts prices or encourages production without constraints can also lead to pollution (Henderson and Lankoski, 2019[25]). Instead, policies that level the playing field across sectors and commodities can enable small-scale farmers to make better informed and less risky water decisions involving water harvesting or irrigation investment (FAO, 2020[15]).

Water policies should ensure that investments in, and management of, irrigation systems achieve water efficiency at catchment level and minimise negative impacts on land and water quality as well as on downstream water quantity. Irrigation investment to improve water productivity can help address water scarcity issues by producing more crops with less water; however, effective savings of water consumption will generally require policy oversight. This is largely because of two phenomena (OECD, 2016[26]). First, increased irrigation efficiency can encourage farmers to switch to more intensive crops or expand cultivated area (World Bank - OECD, 2018[27]). Second, reducing water withdrawals or applications by increasing irrigation efficiency may still lead to maintaining or increasing water consumption by plants, thanks to the reduction of water flows returning to the environment (to aquifer or surface water) (Pérez-Blanco, Hrast-Essenfelder and Perry, 2020[28]; Grafton et al., 2018[29]). Where water is scarce, effective quantitative water policy instruments should precede investment in modernising irrigation and should acknowledge water consumption as the key variable to reduce use, not only water withdrawals. More broadly, this encompasses an understanding of the hydrology of the entire catchment or basin before the broad suggestion of investments in water-use efficiency (HLPE, 2015[16]).

Investments in tools and technological innovations to improve data and information on water resources, agriculture, interactions and trade-offs can lead to the exploration of ways forward and policy responses that balance economic, environmental and social objectives. Governance innovations should complement these efforts to transform the present food system and water paradigms to lead progress towards sustainable and inclusive development (FAO, 2020[15]). Integrated data and information systems that monitor water resources and rights work to inform efficient water allocation systems to ensure sustainable water consumption in the long run. There are opportunities for synergies towards improved productivity and nutritional benefits from irrigated agriculture, while ensuring water connectivity, environmental flows and ecosystem conservation and protection. Enhancing supply from non-conventional resources – namely, desalination and wastewater reuse – is also important, but requires sizeable investments.

3.2. Ensuring responsible investments

Not all investments in agriculture are of equal benefit and some may even induce or exacerbate water-related risks. For example, the use of water-efficient irrigation technology may not necessarily decrease water use, and often has the potential to maintain or increase levels of water use, as farmers often adapt to these technologies by planting more crops or planting water-intensive crops. Investments, particularly in irrigation technology, should focus on avoiding the creation of any future liabilities. Likewise, desalination and water reuse have become important tools to augment water supplies, but with current technologies, these options are not economically feasible for lower-value added uses. Trade-offs must be considered, such as the fact that desalination requires up to 23 times as much energy as water withdrawn from surfaces sources, leading to higher financial and environmental costs. Desalinised water costs about 4 to 5 times more on average than treated surface water (World Bank, 2016[30]). Investments in agricultural water should account for all stakeholders—throughout communities, and across farmers, investors, the environment more broadly and related policies—to ensure that investments show benefits across stakeholders to attract financing at scale. This is a component of an enabling environment for agricultural water investments, which should drive responsible investments and business conduct through strengthening coherence, consistency and predictability of policies, laws and regulations related to business and investment in agriculture and food systems. The enabling environment is also formed through addressing trade-offs between water users, as well as between costs, mobilising a diverse set of financial resources at scale and avoiding the creation of future liabilities.

The Principles for Responsible Investment in Agriculture and Food Systems by the Committee on World Food Security (CFS RAI), together with the Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the Context of National Food Security (VGGT) serve as a guide for stakeholders on responsible investment, as recognised by G20 Agriculture and Water Ministers in 2020 (G20, 2020[31]).

The OECD-FAO Guidance for Responsible Agricultural Supply Chains (OECD/FAO, 2016[32]) serves as a practical tool that enables businesses to enact responsible business conduct and to understand their impact and contribution to sustainable development along agricultural value chains. Responsible business conduct verifies compliance with international laws and standards along a company's supply chain, while integrating crucial aspects such as environmental protection, financial accountability, labour relations and the respect for human rights.

Responsible investments in irrigation need to account for climatic conditions, labour availability, sources and prices of energy, infrastructure costs and depth of groundwater sources to invest in appropriate irrigation systems. Future irrigation investments would benefit from including policy interventions addressing youth, gender, health and nutrition particularly in developing countries. Including these policy priorities could help irrigation programmes evolve into essential aspects of poverty reduction and food and water security strategies, to shift focus from increased food production (FAO, 2020[15]).

Last but not least, increased responsible investments in agriculture innovation, particularly crop and animal breeding, are necessary in all irrigated areas to make the best use of scarce irrigation water. Indeed, in the long term, agriculture productivity investment may lead to more gains than investments in irrigation (Ringler, 2011[33]). This can include research on agronomic practices, the development of drought tolerant or other stress resistant varieties. Conservation agriculture also provides an important option for enhancing efficient water and nutrient use (OECD, 2016[34]).

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