



The United Nations World Water Development Report 2016

# WATER AND JOBS

## Executive Summary

---

## Unsustainable management of water and other natural resources can cause severe damages to economies and to society, thus reversing many poverty reduction, job creation and hard-won development gains

Water is an essential component of national and local economies, and is needed to create and maintain jobs across all sectors of the economy. Half of the global workforce is employed in eight water and natural resource-dependent industries: agriculture, forestry, fisheries, energy, resource-intensive manufacturing, recycling, building and transport.

Sustainable water management, water infrastructure and access to a safe, reliable and affordable supply of water and adequate sanitation services improve living standards, expand local economies and lead to the creation of more decent jobs and greater social inclusion. Sustainable water management is also an essential driver of green growth and sustainable development.

Conversely, neglecting water issues runs the risk of imposing serious negative impacts on economies, livelihoods and populations with potentially catastrophic and extremely costly results. Unsustainable management of water and other natural resources can cause severe damages to economies and to society, thus reversing many poverty reduction, job creation and hard-won development gains.

Addressing the water-jobs nexus, notably through coordinated policies and investments, is therefore a prerequisite to sustainable development in both developed and developing countries.

### WATER JOBS

Jobs in water sectors fall under one of three functional categories: i) water resources management, including integrated water resources management (IWRM) and ecosystem restoration and remediation; ii) building, operating and maintaining water infrastructure; and iii) the provision of water related services including water supply, sanitation and wastewater management.

These jobs serve as the building blocks for a wide array of water-dependent job opportunities in sectors such as agriculture (including fisheries and aquaculture), energy and industry. Specifically, investments in safe drinking water and sanitation have been shown to foster economic growth, with high rates of return. Access to a safe and reliable water supply and sanitation services at home and the workplace, coupled with appropriate hygiene, is critical to maintaining a healthy, educated and productive workforce.

A number of ancillary jobs also enable employment in water-dependent sectors. These include jobs in regulatory institutions within public administrations, infrastructure financing, real estate, wholesale and retail trade, and construction.

Together, water jobs and ancillary jobs provide the enabling environment and necessary support to the activities or operation of numerous organizations, institutions, industries and systems, and to the jobs they generate. By estimating the potential employment supported by investments in the conservation, treatment and delivery of water, governments can determine the investment and employment policies that will increase and improve jobs across the economy.

## WATER, ECONOMY AND JOBS

Failure to secure an adequate and reliable supply of water to support heavily water-dependent sectors results in the loss or disappearance of jobs (i.e. no water, no jobs). Floods, droughts and other water-related risks can also have economic and employment repercussions that can go far beyond the immediate affected areas.

In addition to jobs in agriculture and industry, sectors with heavily water-dependent jobs include forestry, inland fisheries and aquaculture, mining and resource extraction, water supply and sanitation and most types of power generation. This category also includes some jobs in the health care, tourism and ecosystem management sectors. The analyses made in this Report have allowed to estimate that more than 1.4 billion jobs, or 42% of the world's total active workforce, are heavily water-dependent.

It is further estimated that 1.2 billion jobs, or 36% of the world's total active workforce, are moderately water-dependent. These are sectors that do not require access to significant quantities of water resources to realize most of their activities, but for which water is nonetheless a necessary component in part(s) of their value chains. Examples of sectors with moderately water-dependent jobs include construction, recreation and transportation.

In essence, 78% of jobs constituting the global workforce are dependent on water.



Rice farmer in Ubud, Bali (Indonesia)  
Photo: © iStock.com/FiledIMAGE

## AGRI-FOOD SECTOR

Insufficient or erratic water supplies affect the quality and quantity of employment in the agri-food sector. They constrain agricultural productivity and compromise income stability with dramatic effects for the poorest households with limited assets and safety nets to cope with risks. Furthermore, agriculture plays a wide role supporting livelihoods, notably for the poorest, with an important self-consumption aspect. Agricultural production, which includes fisheries and forestry, is also a generator of jobs and self-employment in the supply of inputs, machinery and rural infrastructure, transformation of agricultural products and distribution to the end consumers. While agricultural investments often increase agricultural productivity and raise the quality of employment, it may do so at the expense of the numbers of available jobs. In such cases, appropriate policies are needed to limit the impacts on displaced workers.

## ENERGY SECTOR

The demand for energy is increasing, particularly for electricity in developing and emerging economies. The energy sector, with growing water withdrawal that currently accounts for about 15% of the world's total, provides direct employment. Energy production, as a requirement for development, enables direct and indirect job creation across all economic sectors. Growth in the renewable energy sector leads to growth in the number of green and non-water-dependent jobs.



Chaipattana water turbine in public park (Thailand)  
Photo: © iStock.com/PhongsakM

## INDUSTRY SECTOR

Industry is an important source of decent employment worldwide and account for a fifth of the world's workforce. Industry and manufacturing account for approximately 4% of global water withdrawals and it has been predicted that by 2050, manufacturing alone could increase its water use by 400%. As industrial technology and understanding of the essential role of water in the economy and of the environmental stresses placed upon the resource improve, industry is taking measures to reduce its water use per unit produced, thereby improving industrial water productivity. Increased attention is being directed to water quality, particularly downstream. Industry is also putting efforts to reuse and recycle water, matching water quality to use and moving towards cleaner production, with possible benefits in terms of better paid jobs (for more highly trained employees) within industry as well as treatment equipment suppliers.



Hydroelectric power generators  
Photo: © iStock.com/leezsnow

## GLOBAL PERSPECTIVES ON WATER

Freshwater withdrawals have increased globally by about 1% per year since the 1980s, mainly due to growing demand in developing countries. In much of the world's highly developed countries, freshwater withdrawals have stabilized or slightly declined.

Accelerated urbanization and rising living standards, increased demand for water, food (especially meat) and energy from an ever-growing global population will inevitably lead to the creation of jobs in certain sectors (i.e. municipal wastewater treatment) and to the loss of jobs in others.

Water scarcity is likely to limit opportunities for economic growth and the creation of decent jobs in the upcoming years and decades. Unless there is sufficient infrastructure to manage and store the water, as is the case in many developed countries, water availability might vary significantly, leaving (parts of) countries 'water scarce' for extended periods. Water availability is also highly dependent on water quality. Poor quality water may not be fit for several uses and the cost of the required treatment may be a prohibiting factor, thus contributing to the burden of economic water scarcity.

Reduced water availability will further intensify competition for water among users, including agriculture, maintenance of ecosystems, human settlements, industry and energy production. This will affect regional water, energy and food security, and potentially geopolitical security, prompting migration at various scales. The potential impacts on economic activity and the job market are real and possibly severe. Many developing economies are located in hotspots of water-related stress, particularly in Africa, Asia, Latin America and the Middle East.

Climate change exacerbates the threats to water availability and is expected to increase the frequency, intensity and severity of extreme weather events. Climate change will inevitably lead to the loss of jobs in certain sectors. A proactive approach to adaptation via employment policies may offset some of these losses. At the same time, climate change is creating job opportunities of its own in terms of mitigation and adaptation activities.

Adopting an ecosystem-based approach to watershed management, including the economic valuation of ecosystem services, is one way of quantifying their benefits for livelihoods and employment. In that regard, the emerging market for payments for ecosystem services (PES) schemes can offer low-income populations the opportunity to create a new type of entrepreneurship (with its related jobs) that generates increased income while implementing restoration/conservation practices.

## INVESTING IN WATER IS INVESTING IN JOBS

Water investments are a necessary enabling condition for economic growth, jobs and reducing inequalities. Conversely, failure to invest in water management not only represents missed opportunities, but may also impede economic growth and job creation.

Assessing the relationship between water, economic growth and jobs is particularly challenging. It has however been shown that countries exhibit a strong positive correlation between water-related investments and national income, as well as between water storage capacity and economic growth.

Investments in infrastructure and operation of water-related services can provide high returns for economic growth and for direct and indirect job creation. Water investments can also lead to production systems that are more labour intensive. Notably, green development can increase employment opportunities through green jobs, more labour intensive practices and PES.

It is essential to plan water investments in conjunction with relevant sectors, such as agriculture, energy and industry in order to maximize positive economic and employment results. Within a suitable regulatory framework, public-private partnerships (PPPs) offer prospects for much needed investment in water sectors, including building and operating infrastructure for irrigation and water supply, distribution and treatment. With a view to promoting economic growth, poverty reduction and environmental sustainability, consideration must be given to methods that mitigate job loss or displacement and maximize job creation that may result from the implementation of an integrated approach to water management.



Command room of hydroelectric energy plant  
Photo: © Matyas Rehak/Shutterstock.com

**In essence, 78% of jobs constituting the global workforce are dependent on water**



A woman in a light pink button-down shirt and black skirt is leaning over a conference table, looking towards a group of people seated around it. The table is cluttered with papers, a laptop, a blue mug, a glass of water, and a small potted plant with pink flowers. The background shows a large window with white blinds and a brick wall. The scene is brightly lit, suggesting a modern office environment.

The allocation of water resources and the provision of water services to different economic sectors will largely dictate the growth potential for high quality jobs



Photo: pixabay.com

## REGIONAL PERSPECTIVES

In Africa, the demand for jobs will be a major policy issue across a continent which is already experiencing high unemployment and underemployment, driving migration both within the region and externally. For Africa to be able to maintain its impressive growth rates of the last 10 years the basic infrastructure of water and electricity are prerequisites. Without these, African economies could lose momentum, resulting in the loss of direct water jobs and jobs in the water-dependent sectors.

In the Arab region, unemployment trends have worsened in recent years as rural income fell due to low agricultural productivity, drought, land degradation and the depletion of groundwater resources. These trends have fuelled rural to urban migration, the expansion of informal settlements and social unrest. As water scarcity is prevalent in the Arab region, employment in many sectors is water sensitive. Investments in water use efficiency and conservation present politically palatable avenues for governments that must weigh trade-offs between water sustainability and employment targets.

In Asia and the Pacific, most of the industries driving economic growth depend upon a reliable supply of freshwater for large parts of their production processes. Expanding economies will need increasing supplies of energy, which will in turn require access to more water. There is tremendous potential to create employment opportunities in the region by increasing access to water in the agricultural sector. There is also potential in the industry and service sectors

to create and support water-dependent jobs, especially through the improvement of water efficiency, pollution control and wastewater usage.

In Europe and North America, among the developments that have markedly influenced employment in water management and water services as well as qualifications required are the following: in the European Union and North America, increased automation, use of remote sensing and standardization; in Eastern pan-Europe, investment in infrastructure, resource constraints and reforms of national administrations. Emerging employment opportunities reside in the undeveloped potential for hydropower (in parts of the region) and other renewables. The need to repair, modernize and construct different types of water infrastructure may also create different job opportunities.

Economies in Latin America and the Caribbean rely heavily on the exploitation of natural resources, including water, particularly for mining, agriculture, including biofuels, forestry, fishery and tourism. This demands constant attention from policy makers in order to maximize the contribution of water to development and job creation, starting with strong, transparent and effective institutional arrangements for integrated water management and the provision of water and sanitation services. These actions protect public interest, promote economic efficiency, and provide the stability and flexibility necessary to attract investment to the development of water resources and related public utility services.

---

**Qualitative analyses show that women's involvement in the management of water resources and water infrastructure can improve efficiency and increase outputs**



Firefighter during a fire drill in Garantung village, Palangkaraya (Indonesia)  
Photo: © Achmad Ibrahim/Center for International Forestry Research (CIFOR)

## HUMAN RIGHTS, SUSTAINABLE DEVELOPMENT AND GENDER

Human rights, green economy, sustainable development and gender are among the most salient legal and policy frameworks to be considered by policymakers when addressing the water and jobs nexus.

The right to safe drinking water and sanitation is a prerequisite and integral to the realization of other human rights, most notably the rights to life and dignity, to adequate food and housing, as well as the right to health and well-being, including the right to healthy occupational and environmental conditions. The right to decent work is also an internationally recognized human right. A subset of economic, social and cultural rights, the right to work is enunciated in the 1948 Universal Declaration of Human Rights (UN, 1948), which states: 'Everyone has the right to work, to free choice of employment, to just and favourable conditions of work and to protection against unemployment.'

Despite these universally-recognized rights, there are 2.3 million work-related deaths annually. Work-related communicable diseases contribute to 17 % of these deaths and, in that category, the main contributing and preventable factors comprised poor-quality drinking water, poor sanitation, poor hygiene and related lack of knowledge. These figures underscore the need for countries to accelerate efforts towards securing safe drinking water and sanitation for all, including in the workplace.

In September 2015, the international community adopted the Sustainable Development Goals (SDGs). Goal 6 aims to ensure the availability and sustainable management of water and sanitation for all, and Goal 8 addresses the promotion of sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all. Water- and labour-related concerns are also of importance to several other SDG targets, notably Goal 1 on poverty and Goal 3 on health, and as such will be central to the realization of the SDGs.

Evidence from various economic sectors demonstrates the significant contribution women can make in formal positions at the highest levels, and qualitative analyses show that women's involvement in the management of water resources and water infrastructure can improve efficiency and increase outputs. Nevertheless, women continue to experience widespread discrimination and inequality in the workplace. In many parts of the world, women often occupy undervalued and low-paid jobs and still shoulder responsibility for most unpaid care work. A number of measures can be undertaken to improve women's participation in, and contribution to the water-related workforce, including: adopting equal opportunity policies and measures; improving sex-disaggregated workforce data sets; addressing cultural barriers, social norms and gender stereotypes; and expanding access to public services and investment in time- and labour-saving infrastructure.

## INNOVATION

Innovation contributes to the continuous improvement of water management, with the related benefits to economic development and decent jobs. In addition to their potential efficiency, effectiveness, and performance improvements, innovations can have important implications for water-dependent and water sector employment opportunities in quantitative and qualitative terms. Innovation resulting from the shift towards a greener economy is changing the range of tasks associated with various jobs, as well as working conditions, due to new technologies, processes and practices. Innovation will change the number and nature of jobs and the required skill sets and competencies. Policy mechanisms need to be in place to draw on relevant research for capturing the job-creating opportunities in the field of water innovation and to ensure the required capacity for the generation and diffusion of water-related innovations.

**Failure to invest in water management not only represents missed opportunities, but may also impede economic growth and job creation**

## OPPORTUNITIES FOR WATER SOURCE DIVERSIFICATION

The increased demand for water in sites where the resource is scarce or where there is high competition for water creates the need for using so-called 'non-conventional sources' for water, rainwater, urban runoff, storm water and wastewater recycling. This will create jobs not only through technology development, because it enables new forms of small-scale intensive uses of water, such as cultivation of highly profitable crops in small plots, but also in the operation and maintenance of treatment plants to reclaim water.

Provided that the health risks are adequately managed, wastewater (treated to 'fit-for-purpose' levels) offers opportunities for source diversification, especially in water scarce areas. It is estimated that between four million and 20 million hectares of land are irrigated with untreated wastewater. Not only does this practice provide livelihoods for farming families and those involved in marketing the products, but with its expected scaling up and formalization, substantial job creation in this sector can also be expected.

Water source diversification will initially generate jobs at the research level, leading to new jobs being created for the operationalization, supervision, and maintenance and fine-tuning of smart systems. Beyond the jobs that water reuse will create within the water, agriculture and public health sectors, it is also likely to generate jobs in research, agricultural extension, produce marketing and the cultivation of non-food crops. These evolutions will require a different type of skillsets from workers and, consequently, stress the importance of capacity development and continuous professional development.

## IMPROVING WATER EFFICIENCY AND PRODUCTIVITY

Both water-use efficiency and water productivity can contribute to improving socio-economic development and create opportunities for employment and decent jobs in water-dependent sectors, especially under conditions of water scarcity (where inadequate water supplies may impede development). New resource-efficient technologies as well as enhanced competitiveness and innovation are also generating shifts in employment and changes in the workforce worldwide.

Governments can create policy frameworks to enable, support and reward improvements in resource efficiency or productivity bringing increased competitiveness, resilience and security, and new sources of jobs and growth. By doing so, they can facilitate significant cost savings for different agents from improved efficiency and productivity, commercialization of innovations, and enhanced water management over the entire product life cycle. However, understanding and considering the trade-offs and synergies between water, energy, food, ecosystems and other issues at the proper scale is essential for wise management and to meet overall sustainability goals.



Community workers' forum

Photo: © International Labour Organization (ILO)



Assessing environmental pollution

Photo: © cubephoto/Shutterstock.com

## ADDRESSING CAPACITY DEVELOPMENT NEEDS AND IMPROVING DIALOGUE

The skills, qualities and capacities of employed human resources are vital for the successful performance of the water sectors and for the sustained use, adaptation and development of scientific and technological innovations. This is particularly salient in view of the broadening fields of expertise that are needed for these sectors, which include water resources management, building and managing water infrastructure, and the provision of water-related services.

The lack of capacity and the challenges facing the water sectors require the design of adequate training tools and innovative learning approaches to enhance the competencies of staff as well as to strengthen institutional capacity. This applies to government and its agencies, river basin organizations as well as other groups including private sector organizations. Solutions to filling these gaps include: creating an enabling policy environment for collaborative frameworks between the education sector, sector employers (public, private, NGOs), trade unions and employees; developing incentives to attract and retain staff; strengthening technical and vocational training; and giving attention to human resources capacity development in rural areas. New and transversal skills also need to be instilled to respond to new needs.

## MONITORING, ASSESSMENT AND REPORTING

Reliable and objective information concerning the state of water resources in terms of their quantity, quality and vulnerability at the local or basin level is often poor or lacking, as are specific metrics for water demand and use by different economic sectors. Globally, water observation and monitoring networks are in decline and improperly funded. Development of technology and increased use of remote sensing can help to fill gaps, but only to a point.

In terms of jobs and employment, few statistics reflect the current reality of work. They tend to simplify the core situation (often due to their objectives, measurement methods and conceptual frameworks), resulting in partial coverage, insufficient detail and an incomplete analysis of complex topics. One of the greatest challenges is gathering data and information concerning informal, part-time and/or unpaid work. Another challenge lies in identifying the level of 'water-dependence' of any given job.

Data from the World Input-Output database could be analysed to derive evidence on how dependent the whole economy is on water supply and how many jobs are created when a government increases or improves water supply, estimating backwards and forwards linkages of water supply and related sectors to calculate total multiplier effects of potential investments in a given sector.

## POLICY RESPONSES

Critical relationships and essential linkages exist between the management of water and employment opportunities in countries at all levels of development. Sustainable water management, combined with access to safe and reliable supply of water and appropriate sanitation services, create an enabling environment for employment opportunities to develop and grow across economic sectors.

The political will to set and implement water-related policy objectives that mutually support sustainable development and job creation is essential. However, there is frequently a low level of appreciation of the high risks and serious impacts to which neglect of water issues can lead, often with catastrophic and extremely costly results. Improving knowledge and understanding, especially among politicians and policy-makers, of the pervasive role of water resources, infrastructure and services in the economy, and in employment creation would enhance benefits in terms of generation of decent jobs, as well as serve the broader objectives of sustainable development.

Meeting these societal goals requires coherence and a shared vision, notably between water, energy, food, environmental, social and economic policies, ensuring that incentives are aligned for all stakeholders and that negative impacts are mitigated, for example in ensuring future employability of those displaced in sectors where employment may fall. In the coming years,

governments and their partners will be required to develop and implement sustainable, integrated and mutually supportive water, employment and economic strategies in order to respond to the challenges arising from the risks and opportunities at the water and jobs nexus highlighted in this report.

It will be important for each country, according to its own resource base, potential and priorities to identify and promote specific and coherent strategies, plans and policies to achieve the right sectoral balance and generate the highest possible output of decent and productive jobs without compromising the sustainability of water resources and the environment. The international community is already showing the way, having set long-term goals for water, sanitation, decent work and sustainable development that offer an action framework for countries' development objectives.

The allocation of water resources and the provision of water services to different economic sectors will largely dictate the growth potential for high quality jobs at country and local levels. Focusing on the economic sectors that are most relevant for environmental sustainability and job creation will prove to be the ultimate key to success. Reaching these targets involves coherence and shared vision, notably between water, energy, food and environment policies, in order to ensure that incentives are aligned for the benefit of all stakeholders.

Prepared by WWAP | Richard Connor and Marc Paquin

Cover photo: Aquaculture in Europe – Oyster farmers, Grandcamp-Maisy, France  
© iStock.com/Dmitry Chulov

United Nations World Water Assessment Programme  
Programme Office for Global Water Assessment  
Division of Water Sciences, UNESCO  
06134 Colombella, Perugia, Italy

Email: [wwap@unesco.org](mailto:wwap@unesco.org)  
<http://www.unesco.org/water/wwap>

We acknowledge with gratitude the financial support provided by the **Government of Italy** and **Regione Umbria**



**Regione Umbria**