

# Global Outlook on Water and Sanitation Service Providers: Water for Sustainable Cities



**GWOPA**  
Global Water Operators' Partnerships Alliance



UN-HABITAT



## Foreword

Safe water and sanitation are the bedrock of health, dignity and sustainable urban life. Water and sanitation utilities provide indispensable public services, protect health, enable human dignity and drive our cities and communities to thrive. They are central to realizing the human rights to water and sanitation and to delivering on the promise of the Sustainable Development Goals.

Yet, as this report makes clear, much remains to be done. More than 2.1 billion people still lack safely managed drinking water, and 3.4 billion live without safely managed sanitation (JMP 2025). These are not abstract figures: they represent families whose health is at risk, communities whose opportunities for prosperity are constrained, and cities whose resilience is undermined.

The UN-Habitat Strategic Plan 2026–2029 places safe water and sanitation at the heart of equitable prosperity, climate action and preparedness for crises. The strength, reach and adaptability of utilities will determine how quickly we can advance towards our

strategic goals on adequate housing, land and basic services for all. For this reason, UN-Habitat facilitates the Global Water Operators' Partnerships Alliance (GWOPA) to strengthen these critical local actors and cultivate solidarity-based peer collaboration to share knowledge, co-create solutions and strengthen capacity to provide sustainable, equitable services.

This Global Outlook on Water and Sanitation Service Providers: Water for Sustainable Cities offers a fresh assessment of the utilities today, highlighting the challenges, the innovations and the systemic changes needed to achieve universal access.

No utility can succeed alone. Transformation requires enabling policies, sound governance, sustainable financing and strong partnerships. I call on policymakers, partners and utility leaders to act on these findings. By investing in the capabilities and resilience of utilities, we invest in healthier, fairer and more sustainable communities – and in the future we have pledged to build together.

### **Anacláudia Rossbach**

United Nations Under-Secretary-General  
Executive Director of the United Nations Human Settlements Programme (UN-Habitat)



## Foreword

Safe water and sanitation services are human rights, essential for people to live dignified, healthy, modern lives. Yet they are more than this; they are foundational public services that underpin every aspect of our lives and our economies. Managed well, they provide a basis for resilience notwithstanding the multiple challenges we face. Managed poorly, and they add to those challenges, actively undermining resilience and putting people – and particularly the poor and vulnerable at risk.

Providing these crucial public services requires entire systems (of people, infrastructure and natural resources) to work together efficiently and effectively. Crucial actors in these systems are water and sanitation utilities – organizations, public or private, who are mandated to provide these services. Utilities are at the heart of this report, which covers not just the challenges that they face but the many innovative and exciting ways in which they are overcoming these challenges to

provide ever higher levels of service. But utilities cannot do it all on their own; the broader enabling environment – of policy, regulation, finance and political leadership – within which they operate is essential if they are to perform to their full potential. This report also identifies high potential pathways to strengthening the enabling environment to better enable utilities to do their work.

There are no shortcuts to the hard work of building effective water and sanitation utilities – but there are experiences to share and promising paths to follow. I echo the UN-Habitat Executive Director's call to all those involved in providing or enabling the provision of these essential services – to join with us in engaging with the report and acting on its findings. I especially call on all in positions to do so to raise safe water and sanitation up their national development agendas, ensuring that these vital public goods receive the attention and finance that they require.

### **Patrick Moriarty**

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# Table of Contents

<b>Foreword</b>	<b>3</b>
<b>Acknowledgements</b>	<b>5</b>
<b>Acronyms</b>	<b>8</b>
<b>Executive Summary</b>	<b>10</b>
What is a utility?	10
Impact on the Sustainable Development Goals	10
Innovation and leadership in utilities	11
The way forward – Pathways for change	11
<b>Introduction: Water and sanitation utilities</b>	<b>13</b>
Progress made – but still a way to go	13
Putting utilities centre stage	14
An urban focus	15
Localization of the SDGs	16
The human rights to water and sanitation	17
Other forms of water and sanitation service provision	17
Community-led and market-based sanitation	17
A systems framework	18
Aims of this report	20
Structure and methodology	20
<b>References</b>	<b>22</b>
<b>Chapter 1: Global Overview of Water and Sanitation Utilities</b>	<b>24</b>
<b>Introduction</b>	<b>25</b>
The global landscape of water and sanitation utilities	25
Number and size of utilities	27
Structure and governance	29
Funding	31
Utility performance	34
Regulation and accountability	40
<b>Conclusion</b>	<b>42</b>
<b>References</b>	<b>43</b>
<b>Chapter 2: Water and Sanitation Utilities and the SDGs</b>	<b>46</b>
<b>Introduction</b>	<b>47</b>
Local action to realize the SDGs	47
Case study: Faecal sludge management in Waling municipality	48
SDGs, systems thinking and action by utilities	49
<b>Water and Sanitation Utilities and the SDGs</b>	<b>49</b>
Water and sanitation services delivery (SDG 6 targets 6.1 and 6.2)	51
Wider water and sanitation SDGs (SDG 6 targets 6.3-6.7)	53
Case Study: Jordan on track for SDG 6.1 despite huge pressure on resources	53
<b>The Impact of Water and Sanitation Utilities Beyond SDG 6</b>	<b>55</b>
Case study: Ghana: Ensuring the urban poor people can access water	55
Case study: Utilities recommend gender equality	58
Case study: Luapula Water Supply and Sanitation Company, Zambia: Harnessing biogas for a sustainable future	59
Case study: Utility-led water services for refugee and host communities	62
Case study: How a 2000-year-old aqueduct can help ease city heat islands	64
Case study: Improving resilience	66
Case study: Utilities in Costa Rica raise funds to protect ecosystems	67
Case study: Nepal progress on SDG 6 addresses major hurdles	69
<b>Conclusions</b>	<b>71</b>
<b>References</b>	<b>72</b>

<b>Chapter 3: Doing Things Differently: Innovation in Water and Sanitation Utilities</b>	<b>76</b>
<b>Introduction</b>	<b>77</b>
Systems thinking and change within utilities	78
<b>Innovations in Planning and Development</b>	<b>79</b>
<b>Innovations in Planning and Developing Sanitation Infrastructure</b>	<b>84</b>
<b>Innovations in Utility Management for Water and Sanitation Services</b>	<b>87</b>
Operations and (minor) maintenance	87
Non-revenue water management: Leakage control and pressure management	87
Customer services	89
Finance and accounting	91
Administration and human resources	94
Information technology	96
Monitoring and benchmarking	97
Board and corporate affairs	98
Board authority and responsibilities	99
<b>Conclusion</b>	<b>101</b>
<b>References</b>	<b>102</b>
<b>Chapter 4: Enabling Success</b>	<b>106</b>
<b>Introduction</b>	<b>107</b>
<b>Seven Pathways for Change</b>	<b>107</b>
Political and systems leadership	108
Climate action and environmental management	109
Regulation and performance monitoring	112
Digital transformation	112
Economies of scale and collaboration	113
Using funding effectively	115
Innovative partnerships	117
<b>Conclusion</b>	<b>119</b>
<b>References</b>	<b>120</b>
<b>Annex: Methods and Data</b>	<b>124</b>

## Acronyms

<b>ADECOR</b>	Asociación de Desarrollo Comunitario Rural (Rural Community Development Association, Guatemala)
<b>AI</b>	Artificial Intelligence
<b>ARESEP</b>	Autoridad Reguladora de los Servicios Públicos (Regulatory Authority of Public Services, Costa Rica)
<b>CEO</b>	Chief Executive Officer
<b>CLTS</b>	Community-led total sanitation
<b>COP</b>	Conference of the Parties
<b>CRA</b>	Comisión de Regulación de Agua Potable y Saneamiento Básico (Regulatory Commission for Potable Water and Basic Sanitation, Colombia)
<b>EPA</b>	Environmental Protection Agency, United States of America
<b>ESAWAS</b>	Eastern and Southern Africa Water and Sanitation Regulators Association
<b>EYDAP</b>	Athens Supply and Sewerage Company, Greece
<b>FAO</b>	Food and Agriculture Organization
<b>FESAN</b>	Federación Nacional de Cooperativas de Servicios Sanitarios de Chile (National Federation of Sanitary Services Cooperatives of Chile)
<b>GIZ</b>	Gesellschaft für Internationale Zusammenarbeit, Germany
<b>GLAAS</b>	Global Analysis and Assessment of Sanitation and Drinking-Water
<b>GWOPA</b>	Global Water Operators' Partnerships Alliance
<b>HMWSSB</b>	Hyderabad Metropolitan Water Supply and Sewerage Board, Pakistan
<b>IBNET</b>	International Benchmarking Network for Water and Sanitation Utilities
<b>IDB</b>	Inter-American Development Bank
<b>IT</b>	Information Technology
<b>ITWU</b>	Itang Town Water Utility, Gambella, Ethiopia
<b>IWA</b>	International Water Association
<b>JMP</b>	Joint Monitoring Programme for Water Supply, Sanitation and Hygiene
<b>KfW</b>	Kreditanstalt für Wiederaufbau (KfW Development Bank, Germany)
<b>LICSU</b>	Low Income Customer Support Unit
<b>LMICs</b>	Low- and middle-income countries



<b>LpWSC</b>	Luapula Water Supply and Sanitation Company, Zambia
<b>MuAN</b>	Municipal Association of Nepal
<b>NWSC</b>	National Water and Sewerage Corporation, Uganda
<b>NWASCO</b>	National Water Supply and Sanitation Council, Zambia
<b>PPWSA</b>	Phnom Penh Water Supply Authority, Cambodia
<b>SDG</b>	Sustainable Development Goal
<b>SIWI</b>	Stockholm International Water Institute
<b>SWOP</b>	Sanitation-focused Water Operators' Partnership
<b>UCLG</b>	United Cities and Local Governments
<b>UN</b>	United Nations
<b>UNDP</b>	United Nations Development Programme
<b>UN-Habitat</b>	United Nations Human Settlements Programme
<b>UNICEF</b>	United Nations Children's Fund
<b>UNIDO</b>	United Nations Industrial Development Organization
<b>WASH</b>	Water, sanitation and hygiene
<b>WASREB</b>	Water Services Regulatory Board, Kenya
<b>WATCO</b>	Water Corporation of Odisha, India
<b>WHO</b>	World Health Organization
<b>WOP</b>	Water Operators' Partnership
<b>WSUP</b>	Water and Sanitation for Urban Populations

## Executive Summary

Safe water and sanitation are fundamental public services – essential for meeting the global goals of Agenda 2030 for Sustainable Development and for humanity to live and thrive. However, water sources are increasingly under pressure from rising demand, climate change and pollution. Untreated human waste is a significant threat to the environment and freshwater reserves.

The institutions at the forefront of addressing these challenges and delivering these services are water and sanitation utilities. As this report demonstrates, these come in a myriad of shapes and sizes, from small town institutions serving a few hundred people to corporations with tens of millions of customers. They are an essential actor in a rapidly urbanizing world where well-organized, effective and sustainable water and sanitation services are essential.

The aim of this report is to:

- Highlight the centrality of the utilities to achieving all the global Sustainable Development Goals (SDGs)
- Inspire innovation and leadership to improve utilities' ability to provide safe and sustainable services
- Identify pathways where change within utilities and the wider policy and governance environment will have the greatest impact.

### What is a utility?

A water and sanitation utility is a legally recognized entity responsible for delivering safe and reliable services to a defined population or area. There are at least 285,000 water and sanitation utilities in the world with huge variations in size and structure, but all are subject to public oversight and regulation and accountable to local or national government. While billions of people still rely on informal, community-based services or forms of self-supply, utilities are clearly the future for improved water and sanitation services as the world's population becomes increasingly urbanized.

Currently most utilities are under-resourced and underpowered to meet demand, especially in low- and middle-income countries. None of the global targets or indicators for access to safe water and sanitation (SDG 6) is on track. Nevertheless, progress is being made. In the first 22 years of this century, access to piped water increased from 3.5 billion to 5.3 billion people with the biggest increase in cities (JMP 2023).

A survey of 153 utilities in 79 countries, carried out for this report, indicates that a clear majority are optimistic about increasing the range and quality of their services. Overall, 63 per cent thought that these had improved over the past five years. However, only a little over half are covering their costs – even when subsidies from local and national government are considered. Those working within and with utilities expressed frustration at lack of investment, organization, and lack of capacity in terms of staff, skills and equipment.

Moreover, utilities are also less optimistic about the impact on their services of the broader enabling environment (of policy, regulation and finance) within which they operate – with only 37 per cent believing this is improving and almost half (47 per cent) thinking it remains the same.

More than two-thirds of respondents are concerned or very concerned about the effects of climate change, including drought, water quality and availability, floods, disease, interruption of supply chains, declining groundwater and increased competition.

### Impact on the Sustainable Development Goals

Connections between SDG 6 – safe water and sanitation for all – and other SDGs are powerful and dynamic given the central role these services play in the peoples' lives, countries' economies and the environment. Beyond providing water and sanitation services, utilities must also invest in the conservation and maintenance of the catchments and aquifers which supply raw water and the safe management of the effluents that they release – since wastewater is a major source of pollution.

A number of case studies in the report illustrate how action is being taken by local actors (governments, utilities and communities) becoming catalysts of change, grounded in local priorities and realities, such as:

- A municipal council in Nepal implementing a faecal sludge management action plan
- Ghana Water Company reaching the poorest families with household water connections
- Luapula Water Supply and Sanitation Company (LpWSC) in Zambia developing a biogas power project at a newly constructed sewage treatment plant

- Itang Town Water Utility (ITWU) in Gambella, Ethiopia, providing cost-effective reliable water services for refugees and local host communities
- Athens Water Supply and Sewerage Company in Greece creating blue and green spaces in the city with the help of a 2,000-year-old aqueduct.

## Innovation and leadership in utilities

Poor performance is found in a mixture of weaknesses within utilities themselves and in sectoral and governance capability in the wider enabling environment. A systems approach is needed to address the whole picture – one that covers the utilities and the enabling environment in which they operate.

For utilities, innovation – doing things differently to bring about improvements – is essential. Rapid technological change brings the promise of doing things more effectively. But change must be managed so that technology is targeted to where it gives greatest benefit and builds on basic competencies, such as network management, tariff setting and revenue collection. The report identifies the following nine key areas where innovation can improve the performance of utilities:

- Infrastructure planning and development
- Operations and minor maintenance
- Customer services
- Finance and accounting
- Administration and human resources management
- Information technology
- Benchmarking, monitoring and evaluation
- Board and corporate affairs
- Leadership

Three main case studies highlight innovations that succeeded in turning large utilities around: the National Water and Sewerage Corporation in Uganda; the Phnom Penh Water Supply Authority in Cambodia; and the Water Company of Odisha, India. Current and former leaders of these utilities explain how they addressed organizational challenges to improve performance and morale and create a sense of teamwork.

The report looks at practical issues, such as how projects can be best prepared, the design of city roads to support faecal sludge collection, how to identify and reduce water leaks and what technology has to offer to end the dehumanizing practice of handling human excreta.

Technology offers potentially exciting opportunities for reducing high levels of water lost to leaks or theft. Artificial intelligence could become a game changer for anticipating demand, while new techniques for managing faecal sludge could turn today's risks into tomorrow's commercial opportunities. But this will only happen if managerial and technical skills are strengthened so that utilities are motivated to improve, innovate and learn.

## The way forward – Pathways for change

Utilities can only achieve their potential when they function within an enabling environment that supports them to do so. A shift is needed, not only within utilities, but also by the external bodies and forces that make up this wider environment.

The report suggests seven pathways that signpost system-level action to improve the enabling environment surrounding utilities. These range from actions by elected leaders to protect water resources and prioritize equitable access to services, to financial de-risking of water and sanitation sectors in order to unlock diversified funding sources. The pathways were generated and validated by an experienced group of stakeholders and represent leverage points with the potential to enable broad progress among a range of service delivery models and contexts. Intentional systems-level change can support utilities to innovate, enabling their stronger contributions toward the SDGs.

1. *Political and Systems Leadership:* Political support for water and sanitation, from municipal leaders to heads of state, is critical to mobilizing additional resources for utilities and driving change across the whole system.
2. *Climate Action and Environmental Management:* Utilities are on the frontline of both mitigation and adaptation. They need to shift from fossil energy to renewables and to boost energy efficiency, while taking action to reduce pollution and emissions from human waste.
3. *Regulation and Performance Monitoring:* Strong and independent regulation is essential for improved accountability and performance.
4. *Digital Transformation:* The introduction of digital technologies to water supply and distribution systems has been relatively slow and a cultural shift is required in policy and regulation to encourage uptake.

5. *Economies of Scale and Collaboration:* Consolidating utilities (and integrating urban and rural utilities) to achieve economies of scale and extending mandates is an essential transformation to improve coverage, efficiency and the ability to attract finance.
6. *Using Funding Effectively:* Insufficient finance is the most significant barrier to change and progress towards universal and lasting WASH services: low- and middle-income countries are being asked to transform services without the resources required. To attract investments, utilities need to become more creditworthy by increasing efficiency and mitigating risks. Climate funding also needs reform to improve accessibility.
7. *Innovative Partnerships:* Utilities cannot solve these multiple challenges alone. They need partnerships that support learning and knowledge sharing and strengthen skills and efficiencies. Water Operators' Partnerships (WOPs) help bridge the gap between those who need guidance and those who can provide it, using mentorship to strengthen the capacities and performance of water and sanitation operators.

Water quality testing in Accra, Ghana.  
Photo: Noel Elorm Kwamivi/Ghana Water Company



## Introduction: Water and Sanitation Utilities

### Progress made – but still a way to go

The drive to meet global ambitions for safe water and sanitation is a challenge increasingly addressed in an urban setting. Already a clear majority of people live in cities, and by 2050, it is probable that seven in ten people will live in an urban environment (World Bank 2023). As cities expand to accommodate this human flow, they struggle to meet demands for homes and basic services, among which water and sanitation are primary needs. If people cannot access safe water and sanitation, then adequate and safe housing remains out of reach. The poor and vulnerable and those without tenure are most at risk.

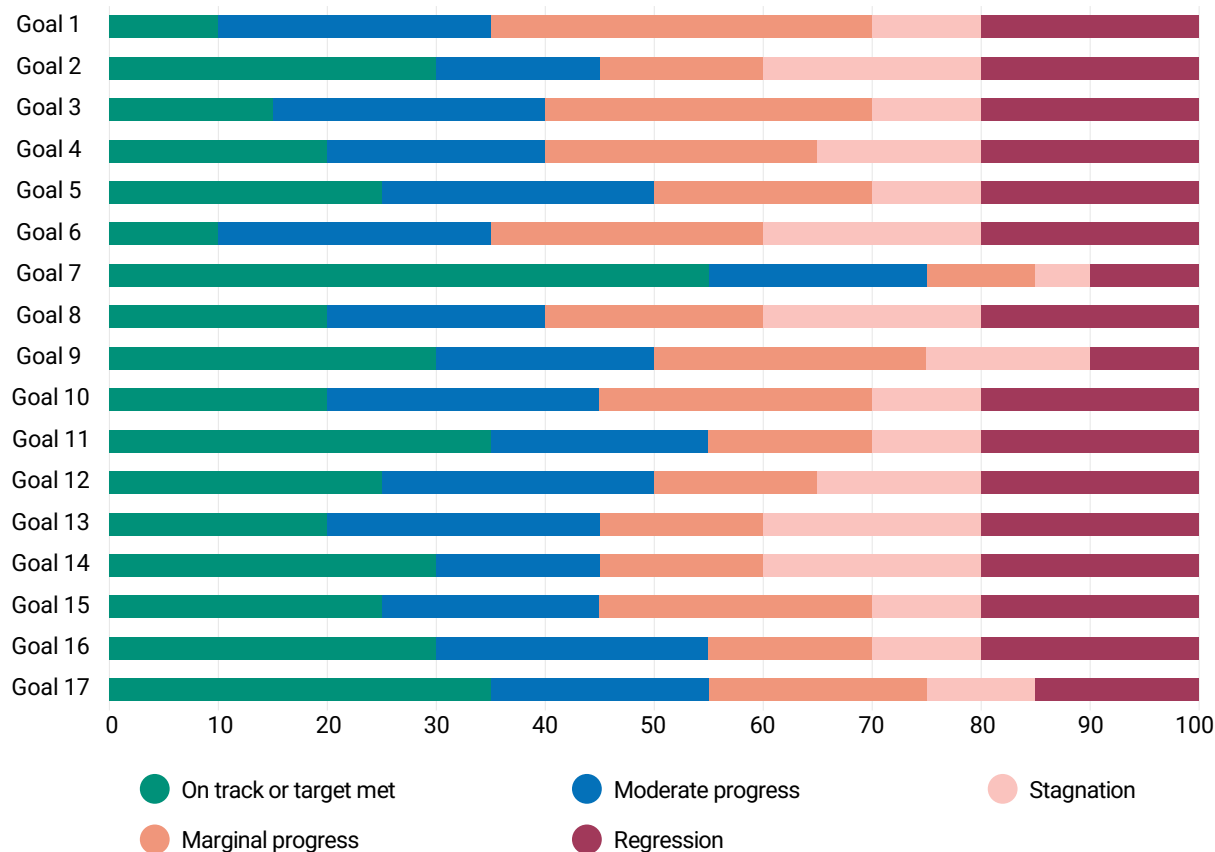
The utilities that provide water and sanitation services must meet this challenge at a time when climate change is disrupting global water cycles, impacting water quality and availability, and threatening urban water supply. As cities grow and populations increase, utilities have to find new water sources and transfer water longer distances, depleting reserves and

increasing costs. Piped sewage systems in developing cities usually serve only a minority of homes and where containment and collection of pit latrines fail, untreated sewage pollutes the local environment and threatens freshwater reserves.

Most utilities are chronically under-resourced to face these challenges. However, it is important to recognize that progress is being made. Between 2000–2022, the number of people using piped water supplies increased from 3.5 billion to 5.3 billion and three quarters of those with piped water live in urban areas (JMP 2023).

Survey responses from utilities featured in this report (see Chapter 1) indicate that service coverage is growing at a pace that outstrips population growth in many areas. The rate of expansion is moving in the right direction, although it falls well short of what is needed to meet global targets.

**Figure 0.1. Progress assessment for the 17 Goals based on assessed targets, by Goal (by percentage)**



Progress reported by the United Nations against the 17 Sustainable Development Goals. Source: UN (2024)

Ten years after the launch of the Sustainable Development Goals (SDGs) and their supporting targets, none of the targets set globally for SDG 6 (to ensure access to water and sanitation for all) is on track. The sobering figures from data collected in 2024 show that 2.1 billion people were living without safely managed drinking water, and 3.4 billion people live without safely managed sanitation (JMP 2025).

From 2015 to 2024, 961 million people gained access to safely managed drinking water services, increasing global coverage from 68 per cent to 74 per cent. The largest percentage gains were in rural areas, while urban coverage only kept pace with the growing urban population and remained at 83 per cent. In all, 2.1 billion people still lack safely managed drinking water, of whom 777 million live in urban areas. Most of these urban dwellers (79 per cent) do have access to basic services, implying that they have an improved supply, but the water may not be available on the premises, not always available when needed or not free from contamination. Only a very small part of the urban population has no access to an improved water supply service at all (JMP 2025).

Between 2015 and 2024, 1.2 billion people obtained access to safely managed sanitation services, rising from 48 per cent to 58 per cent globally and from 59 per cent to 66 per cent in urban areas. The number of people practising open defecation has fallen and in urban areas has been eliminated (<1 per cent). However, as of 2024, 3.4 billion people still lack safely managed sanitation services. Of these, 1.6 billion live in urban areas. Most of these (70 per cent) can access basic sanitation. Of the 3.1 billion urban people that enjoy safely managed sanitation, 78 per cent rely on a service provider to transport and treat sewage or faecal sludge (JMP 2025).

Figure 0.1 shows the state of each of the global development goals (with the Goal number on the y-axis). The UN records more red (warning) than green (progress) markers on the global scoreboard across the SDGs. Countries are on track to achieve only 17 per cent of progress towards SDGs targets, while making minimal or moderate progress on almost half and stalling or going backwards on more than a third. Notably, Figure 0.1 shows that SDG 6 for water and sanitation is one of only three SDGs where none of the targets are on track, the other two being the goals for poverty and for climate action.

Strengthening utilities should be a top priority for achieving the aims of Agenda 2030 for Sustainable

Development. This is not only for the sake of SDG 6.1 (safe and affordable drinking water for all) and SDG 6.2 (adequate and equitable sanitation and hygiene for all). Broader societal outcomes related to the economy, health, poverty and climate resilience cannot be achieved if populations lack access to safe water and safe sanitation. Water and sanitation services are fundamental to the achievement of almost all SDGs. They can be drivers of greater equity when they provide services for all, leaving no one behind.

Safe and affordable housing is explicitly dependent on basic services. Lack of access to water and sanitation is among the greatest problems of rural, peri-urban and urban slum households. Lack of sanitation in public spaces increases health risks and curtails freedom of movement, especially for women.

Utilities also need resources and improved capacity to reduce their carbon footprint, the generation of greenhouse gases, and to protect water sources from climate extremes and pollution. Currently utilities can be seen as part of the problem in terms of their impact on climate change. With investment, utilities can reverse this by turning what is currently thought of as waste into useful and marketable products, reducing their own reliance on fossil fuel energy and making a positive contribution to meeting the goals of the Conference of the Parties (COP) to the United Nations Framework Convention on Climate Change set out in the Paris Agreement in 2015.

## Putting utilities centre stage

A water and sanitation utility is a legal entity that exists to deliver water and/or sanitation services to consumers in a defined population or area. It is the executive body responsible for managing safe and reliable delivery of these services locally: a service provider that is responsible to local or national government and can be held accountable for its performance.

Public utilities that supply essential goods and services are often monopolies due to the high costs of inclusive services. Although utilities can take many forms, including public, private, social enterprises or community organizations, most are publicly owned and all are subject to forms of public control and regulation. The structure and role of water and sanitation utilities are typically defined locally in national legislation.

Utilities may be known as operators, service providers, suppliers or systems, but if they have a mandate from central or local government to provide services at



scale, they are legal entities, and have professional staffing, whether they supply services to a few hundred households or provide for many millions. Whatever the scale and model, the responsibilities and powers of utilities always derive from government, which holds the overall mandate for achieving safe and reliable water and safe sanitation for its population.

The functions, activities and responsibilities of a utility remain much the same, at different scales, whether they are a proto-utility emerging from a community water structure, part of a Municipal Council, a public provider or a privatized utility. Some possible forms include:

- A community leader who acts as general manager with their own laptop billing system, with a technician, meter reader/billing agent and labourer;
- A village water committee responsible for retailing piped water to their village from a government bulk water supplier;
- A legally recognized not-for-profit village cooperative with a handful of staff;
- A council water supply department with a dozen people;
- A private business serving a middle-income peri-urban community from a single borehole;
- A small-town water entity given standalone responsibilities out of an urban council;
- A larger town organization with a couple of hundred staff;
- A city or regional utility with a Board, more than a thousand staff, increasing professionalization and commercialization.

Larger utilities help define how cities grow and societies develop. They carry responsibilities for public health and wellbeing and when they interact with other essential services they help societies to flourish. Utilities have the potential to be at the cutting edge of innovation in a period where they are undergoing rapid technological changes. However, as explored in Chapter 3, many lack the resources and skills to finance and effectively use innovations.

Action is required because many utilities struggle to fulfill their mandates and provide adequate levels of service. In low- and middle-income countries, utilities are often under-appreciated and under-resourced.

They lack people, skills and training, infrastructure (pumps and pipes) and the funds to deliver services. They may lack information about unmet demand and the reliability and quality of their services. Where sewers serve only the core of homes in a community, it becomes a daunting but vital challenge to develop models for safe collection, treatment and disposal of waste. Poor levels of preventative maintenance or lack of managerial efficiency lead to high levels of what is known as non-revenue water, a euphemism for water leaking from poorly maintained pipes or spirited away through illegal connections.

In high-income countries too, utilities face problems of water shortages, pollution, difficulties in handling sanitation flows and financial shortfalls, especially in maintaining and replacing ageing infrastructure. They too must deal with the impact of climate change on water supplies and the effects of extreme heat.

These weaknesses increasingly concern governments and leaders at different levels. The President of South Africa in his 2025 State of the Nation Address, pledged to work with municipalities to establish “professionally managed, ring-fenced utilities for water and electricity services to ensure that there is adequate investment and maintenance.” (Eyewitness News 2025).

## An urban focus

This report places its primary emphasis on urban areas, recognizing that cities present both the major opportunities to improve water and sanitation services and the high levels of need and vulnerability. Globally, 25 per cent of urban populations – more than 1.12 billion people – live in slums or informal settlements (UN-Habitat 2024), and the proportion of people living in these settlements reaches 54 per cent in Sub-Saharan Africa, and 43 per cent in Central and Southern Asia. Utilities that serve these populations are often the least well resourced, but their services are vital to securing adequate housing. The demand for water in growing cities raises costs and depletes reserves as utilities go further in search of reliable water sources.

The United Nations Human Settlements Programme (UN-Habitat) is the global focal point for urbanization and human settlement matters. Mandated by the UN General Assembly, its purpose is to promote socially and environmentally sustainable towns and cities. The UN-Habitat Strategic Plan for 2026–2029 has a focus on adequate housing, land and basic services for all, including the urgent transformation of informal settlements and slums.

It details an increasing range of challenges. “Urban centres worldwide, especially in developing countries, often have characteristics that make them and their inhabitants especially vulnerable to the adverse impacts of climate change and other natural and human-made hazards, including earthquakes, extreme weather events, flooding, subsidence, storms, including dust and sand storms, heatwaves, water scarcity, droughts, water and air pollution, vector-borne diseases and sea-level rise.” (UN-Habitat 2025).

Many cities in low- and middle-income countries (LMICs) are struggling to manage wastewater and faecal sludge effectively throughout the sanitation service chain, and the impact on health and the environment causes huge economic losses, which are particularly substantial in LMICs (UN-Habitat 2023).

The development of utilities, and thus, the provision of piped water, sewerage systems and complementary services is essential for planned and sustainable urbanization. With approximately 55 per cent of urban land globally dedicated to housing and residential use, the development of neighbourhoods, cities and towns is inextricably linked to access to water and sanitation (UN-Habitat 2016). These infrastructure services enable sustainable human settlement, positively impacting residents’ quality of life and well-being. Their availability also influences urban housing and real estate markets.

The global lack of affordable housing underscores the multifaceted challenges faced by rapidly urbanizing populations, including inadequate investment in basic infrastructure – particularly water and sanitation – limited access to serviced land, and the proliferation of substandard living conditions in slums, informal settlements and unplanned neighbourhoods. In many of these areas, the absence of water and sanitation is a defining characteristic. The role of utility companies is critical for development of resilient cities and for addressing the housing crisis.

Access to safe water and adequate sanitation is also fundamental to the realization of the human right to adequate housing, recognized in human rights instruments. The UN Committee on Economic, Social and Cultural Rights affirms in General Comment No. 4 that adequate housing must include sustainable access to safe drinking water, sanitation and hygiene facilities (CESR 1991).

In the context of planned urban areas, this right is realized through the development of a piped water grid and a range of sanitation solutions, from in-situ treatment systems to comprehensive sewerage networks. The planning, design, implementation,

management and maintenance of these systems – including water collection, distribution, cost recovery through tariffs, and enforcement of safety and quality standards – underscore the essential role of utility companies.

Special attention should be given to marginalized communities in slums and informal settlements, where service provision is most lacking. The UN-Habitat Global Report on Sanitation and Wastewater Management in Cities and Human Settlements called on national and local governments to prioritize sanitation and wastewater as a public service, as they do for education, health and energy (UN-Habitat 2023). Sanitation needs to be recognized as fundamental to sustainable urban development. “Urban development will not advance in the way that it needs to if sanitation is not part of that, and sanitation will not advance if it’s not connected to other aspects of urban development.” (WSUP 2023).

## Localization of the SDGs

The 2030 Agenda for Sustainable Development set global goals that require leadership and action at a national and local level. Action to achieve the goal must be localized.

A UN general statement in 2022 said, “SDG localization is the process of transforming the SDGs into reality at the local level, in coherence with the national frameworks and in line with communities’ priorities. To be successful, localization needs to be anchored on the principles of inclusion, partnership and multilevel governance and build on adequate data and financing availability at the local level.” (UN-DESA 2022)

UN-Habitat is at the forefront of this process, promoting this agenda in more than 20 countries, with a vision to transform the lives of at least one billion people by promoting SDG localization processes in at least 1,000 cities and 50 countries.

The New Urban Agenda, endorsed by the UN General Assembly in 2016, works as an accelerator of the Sustainable Development Goals (SDGs), particularly SDG 11 (Make cities and human settlements inclusive, safe, resilient and sustainable). The Agenda commits to building the capacity of public water and sanitation utilities to implement sustainable water management systems with the goal of eliminating inequalities. It notes that significant investment is needed to ensure full coverage of drinking water, sanitation and sewage management, but that money is not enough. “Water and sanitation are not simply infrastructural investments, but rather involved systems where multiple stakeholders must be engaged.” (UN-Habitat 2020)



## The human rights to water and sanitation

Safe water and adequate sanitation are not simply desirable goals. Access to safe drinking water and access to safe sanitation are recognized as human rights and form part of binding international law.

The Committee on Economic, Social and Cultural Rights acknowledged the right to water and sanitation in its General Comment 15 (CESCR 2002), noting that the legal basis is a component of the right to an adequate standard of living and as an essential prerequisite to the right to health and to other rights. The UN General Assembly confirmed its recognition of the right to water and sanitation in 2010.

In 2021, it further clarified this recognition, reaffirming that “the human right to safe drinking water entitles everyone, without discrimination, to have access to sufficient, safe, acceptable, physically accessible and affordable water for personal and domestic use, and that the human right to sanitation entitles everyone, without discrimination, to have physical and affordable access to sanitation, in all spheres of life, that is safe, hygienic, secure, socially and culturally acceptable and that provides privacy and ensures dignity, while reaffirming that both rights are components of the right to an adequate standard of living.” (UN 2021).

General Comment 15 recognizes four factors in achieving the right to water: availability, quality, accessibility and information. It includes the right to “be free from arbitrary disconnections” and states that “water should be treated as a social and cultural good, and not primarily as an economic good.”

## Other forms of water and sanitation service provision

Although utilities are essential for service provision in densely populated areas, millions of people in both urban and rural settings continue to receive water and sanitation services through alternative delivery models. According to a 2017 World Bank review of rural water service delivery, community-based management remained the dominant approach in rural areas, although there is also a trend for urban utilities to expand their reach to include peri-urban zones and densely populated rural communities (World Bank 2017).

Community-based management emerged as a cornerstone of rural service delivery during the 1980s, particularly in the context of the International Drinking Water Supply and Sanitation Decade. Decades later, it still plays a central role in many low- and middle-

income countries. However, most community-based organizations lack formal legal recognition and adequate support from service authorities. As a result, many water committees face persistent challenges in maintaining service levels and recovering operational costs (World Bank 2017; Schouten and Moriarty 2003). The model performs better where there is structural support for community management.

Self-supply is rarely included as a mainstream form of water supply, but it is a widespread phenomenon where households take the initiative to provide their own on-premises supply particularly by digging or drilling wells to tap groundwater. Self-supply is found in most countries in both urban and rural areas. For example, in sub-Saharan Africa, 78 million rural people drink on-premises water they provide themselves. Of these, around 46 million use improved groundwater and rainwater supplies, accounting for 16 per cent of basic coverage (Sutton with Butterworth 2021). A WHO survey of the European region found 20 million people in 27 responding countries served by individual self-supply (Rickert et al. 2016). For some remote households and communities self-supply is the only viable option given the high costs of extending piped water supplies.

These forms of supply can become training grounds for the development of skills and institutional support, when support is provided. In practice, countries that have achieved 100 per cent access to services have typically done so through a combination of service delivery models. A common pattern is that, over time, utility-provided services reach a wider part of the population while voluntary forms of community management tend to decline, and self-supply is restricted to more remote areas.

## Community-led and market-based sanitation

While self-supply is often considered an outlier in drinking water provision, it remains the norm for sanitation in many parts of the world. Community-Led Total Sanitation (CLTS) evolved into a global movement encouraging households to improve their sanitation through local knowledge, innovation, and collective action. The approach leveraged feelings of disgust toward open defecation and emphasized the health benefits of using toilets, often promoted through large-scale campaigns focused on individual latrine construction.

However, CLTS has faced criticism for stigmatizing those without toilets and for relying heavily on health-based messaging as the primary motivator for household

investment. Concerns have also been raised about the quality, durability and long-term sustainability of low-cost toilets built under such programmes. Despite these challenges, India's Swachh Bharat Mission (Clean India Mission) demonstrated what is possible at scale, achieving Open Defecation Free status by constructing and providing access to over 100 million household toilets in less than a decade.

Market-based approaches support sanitation demand and supply chains in areas that utilities do not reach, on the hypothesis that even low-income families are willing to invest in sanitation if they believe that it improves their homes and lives. The approach emphasizes convenience and safety, rather than health, and seeks to build sustainable supply chains, working with national and local government to support the sanitation market to develop quality choices for consumers. "A sanitation marketing programme seeks to understand both the consumer (demand) and the supply of products and services in the marketplace, as well as the policy environment that affects both of these." (USAID 2010).

Self-supply and community-managed services often evolve toward more centralized and professionalized forms of service delivery as they confront the inherent limitations of volunteer-driven systems. Many community-based initiatives become integrated into utility networks or progressively graduate to become small-scale utilities themselves.

## A systems framework

This report takes a systems approach. It looks at factors both within the utilities themselves and within the broader environment in which they operate; all of which have to perform well enough for services to function effectively. Systems thinking is about engaging with complexity in the real world to lead to more meaningful and sustainable solutions.

Systems comprise the networks of people, organizations, institutions and resources (actors and factors) necessary to deliver services. In the urban context, the system is not only the wider enabling environment within which city authorities and utilities work. It is everything together, including the utilities and users who need to have a voice in their development. It includes other city services, such as energy generation, transport and planning and those engaged with issues of housing, climate resilience and equity. The city is the arena where all these actors engage.

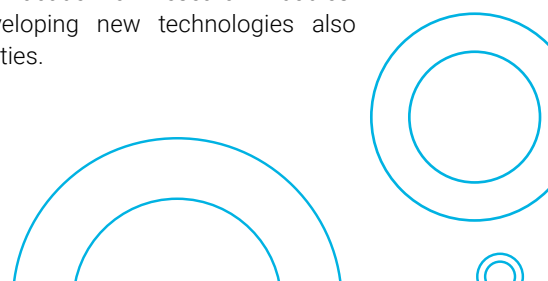
The enabling environment is everything outside the direct control of the utility that affects its mission and its ability to make progress toward that mission. That broader system includes the laws, regulations

and government structures within which the utility works. It relates to the availability of finance to make new investments and to maintain existing structures. It is affected by levels of economic growth and what that means for people's ability to pay for water and sanitation services, and by levels of economic equity that determine how many people are living on the margins and need subsidies. It is dependent on environmental protection of water sources and cross-border agreements on water sharing and protection. It relates to technological developments in delivering services and innovations in methods of dealing with faecal waste. The local environment is shaped by the way that cities and rural districts function, the support that local authorities provide, the planning systems that determine where housing and businesses develop and how easy it is to extend services.

The extent to which utilities can respond to challenges in the broader environmental and social environments is strongly related to the way that essential building blocks perform. These building blocks include institutional structures; service delivery models; monitoring; water resources management; financial support; planning and budgeting; regulation; procurement and project delivery; learning and knowledge sharing; asset management. (IRC 2017). For services to be delivered effectively, all these building blocks must be working at least to a certain level.

Key actors and functions involved in WASH services typically include national government, local government, service authority, regulator and users/customers.

- National government defines legal, policy and funding frameworks and regulations for service delivery.
- Regulatory processes (water quality, economic, environmental) monitor and enforce rules on the provision of services, quality standards and tariff setting.
- The service provider is responsible for day-to-day management of water and sanitation services, including operation and maintenance.
- The user/customer typically pays for services and should be able to participate in decision-making and hold service providers and service authorities to account. Civil society groups may be involved in monitoring service performance.
- Other actors include finance institutions, statistics agencies and academic research bodies. Companies developing new technologies also interact with utilities.



The identity and roles of these stakeholders differ in each country context and the institutional framework can be highly complex. However, in a well-functioning system, actors are clear about roles and interactions, and there are no major gaps or overlaps in areas of responsibility. Actors need adequate financial and human resources to carry out their responsibilities. Shortages of funds and skilled staff were major areas of concern reflected in the GWOPA survey carried out for this report. Clarity of accountability is also important.

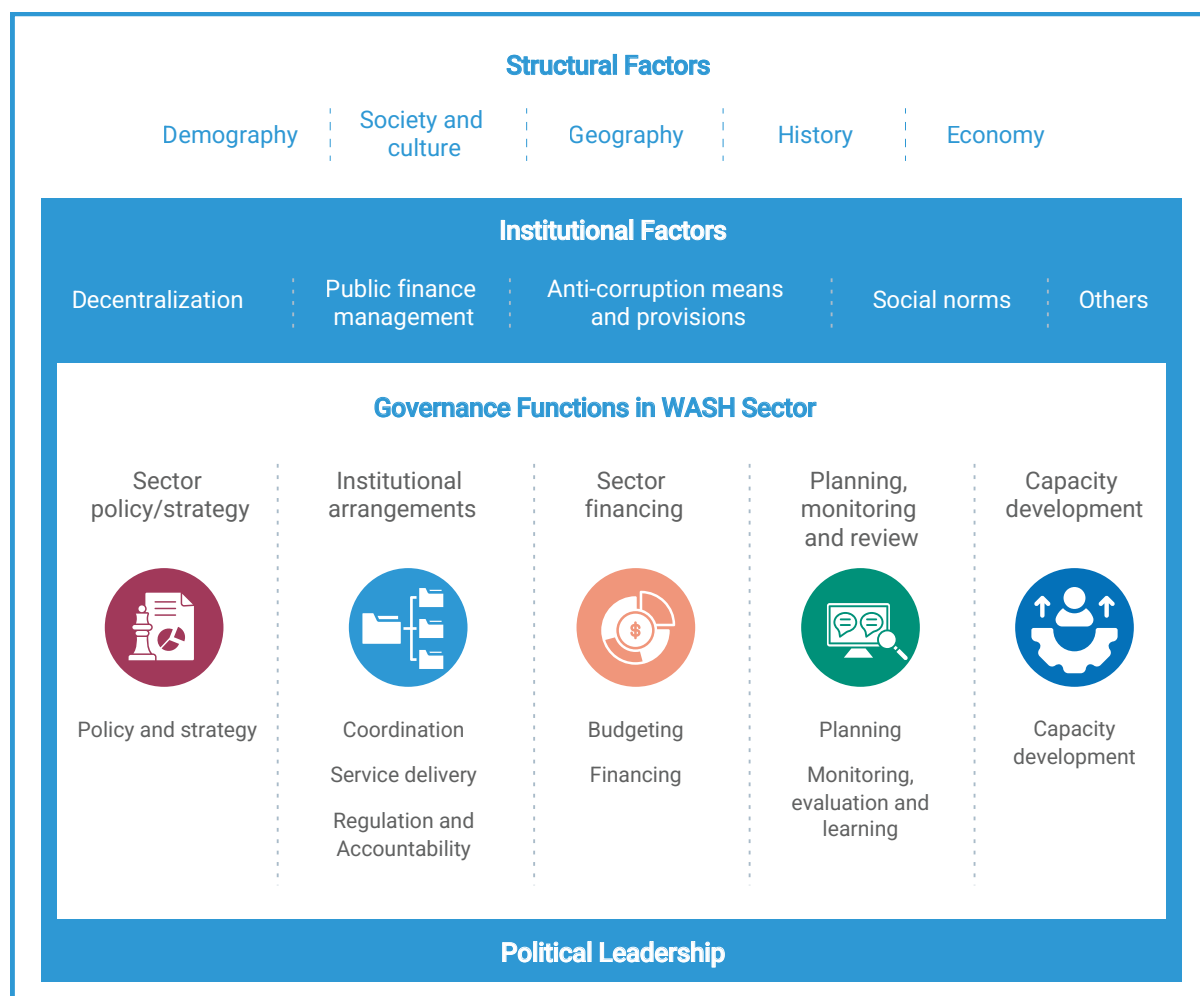
The enabling environment is also a function of how different agencies interact – levels of partnership and ability to deal with mainstream cross-cutting issues such as climate change in policymaking and programming across sectors with conflicting interests and to reach common goals. On the broadest front it is dependent on the cultural and social norms and expectations within society – the value that people put on water and sanitation services and the extent to which they are willing to utilize their different positions and perspectives to protect it.

A broad lens for framing the enabling environment used in this report was developed by UNDP-SIWI Water Governance Facility and UNICEF under the Accountability for Sustainability Partnership.

In this analysis (Figure 0.2) the top-level structural factors are outside the control of individual actors and set the context for development interventions. Institutional factors apply broadly in the public governance sphere beyond the WASH sector. Governance functions set rules and arrangements for the WASH sector.

Government leadership (national and local) is essential to ensure a coherent, logical and defined set of roles and relations between actors. In decentralized systems, local governments are responsible for service delivery in their area of jurisdiction with scope to develop policies and subsidiary legislation such as by-laws. They provide a good entry point for systems strengthening.

**Figure 0.2. The enabling environment for sustainable WASH services**



The enabling environment for sustainable WASH services as set out in the Accountability for Sustainability Partnership.  
Source: Accountability for Sustainability Partnership (Scharp, C., et al. 2018)

## Aims of this report

This report presents an overview of the state of water and sanitation utilities around the world, examining issues of governance, financing, capacity and performance, as well as the key challenges that utilities are facing and the opportunities for improvement. The report summarizes recent research findings and provides examples of utilities working to accelerate progress towards the SDGs. In showcasing areas of financial, technical, ecological and social innovation, it seeks to inspire action within utilities and to strengthen the enabling environment at regional, national and global levels.

The aims are to:

- Raise awareness of the significance of water and sanitation utilities in making progress towards the Sustainable Development Goals, and to outline their current strengths and weaknesses.
- Inspire action by those in leadership positions within utilities and by decision makers who shape the environment in which they work to improve the strength and resilience of utilities and their ability to provide safe and sustainable services.
- Identify specific areas where improvements in the management and performance of utilities will have most effect on service delivery, and where improvements in the wider policy and governance environment will have the greatest impact on enabling utilities' success.

Three significant cross-cutting themes that impact on progress are highlighted.

1. The need for utilities to connect strongly with the climate agenda to mitigate harmful impacts from wastewater and its treatment and to develop resilience to adapt to climate change and reduce vulnerabilities.
2. The link between water and sanitation to housing and basic urban services, and the need to develop integrated planning for development so that everyone can access a decent place to live, with safe water and adequate sanitation.
3. Ensuring that services are extended to all, and that attention is paid to gender and equity issues and the needs of marginalized groups and the urban poor people.

Key target audiences for this report include those who play a leadership role in water and sanitation utilities, and the decision makers whose choices affect their financial, organizational and technical strength. There is also a wider audience of all those committed to implementing the human rights to water and sanitation, achieving the Sustainable Development Goals, creating livable cities and meeting global climate goals. The report aims to be accessible to all those who want to know more about how water and sanitation utilities can play a stronger role in meeting urban challenges and how they can be better supported.

## Structure and methodology

The report is presented in four chapters:

Chapter 1 provides an overview of water and sanitation utilities worldwide, using relevant statistics and case studies to describe scale, key characteristics and performance. It discusses the results of a survey regarding utilities and their operating environments, highlighting areas of concern and opportunities for change.

Chapter 2 illustrates the connections between the work of water and sanitation utilities and the local realization of the SDGs, using examples and case studies to illustrate the multiple impacts of utilities and services.

Chapter 3 describes innovation within water and sanitation utilities, taking a systems approach to challenges and addressing key building blocks that determine performance in service coverage, reliability and quality.

Chapter 4 identifies gaps and opportunities for water and sanitation utilities to advance SDG achievements, describing pathways and practical actions that can be taken at various levels, recognizing that the extent to which utilities perform is strongly related to the wider enabling policy, institutions and regulations. The report offers a blend of data and analysis, highlights exemplary practices, reflects on contemporary policy discourse, provides guidance on emerging issues, and recommends management and policy strategies.

Sources include a review of existing literature, analysis of secondary data sources, a global survey of utilities and their partners, and case study interviews. The report draws on the resources of the UN-Habitat-facilitated GWOPA Secretariat and its Alliance, capitalizing on the data, case studies and expertise of its members and partners to draw out the critical information and

lessons. Authors have drawn on the experiences of those who have worked in strengthened utilities and conducted interviews to highlight experiences that illustrate how utilities are facing up to the challenges of achieving high quality services in an era of urban growth and climate change.

This story telling approach seeks to find a narrative to describe how change comes about. It underlines how utilities are not just about technology and engineering but about the people who work in and lead them and the millions of people who they serve.

Kapkembu village, Mauche Ward, Njoro Subcounty, Kenya.  
Photo: Annette Wanjiru Njoroge



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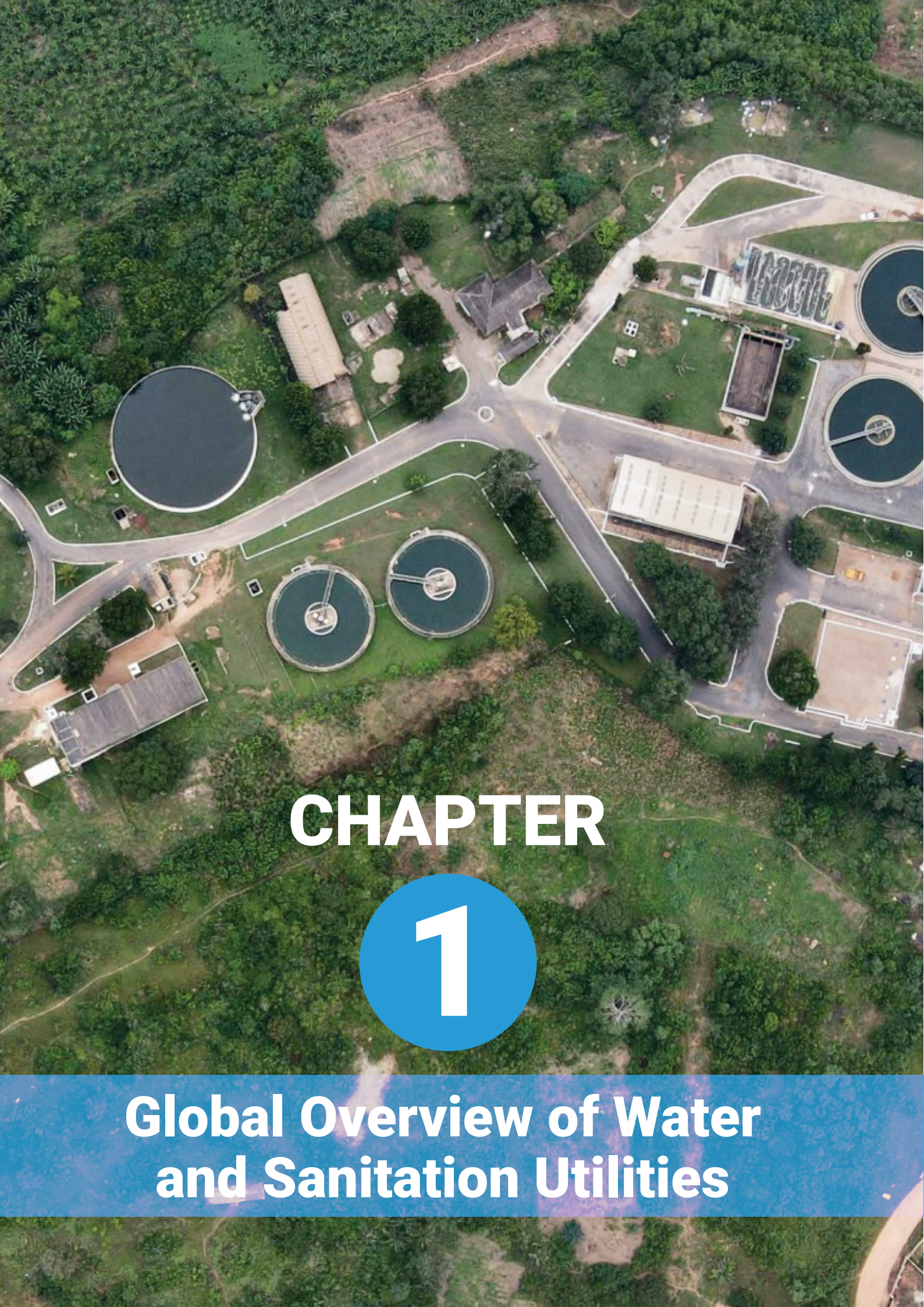
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# CHAPTER

# 1

# Global Overview of Water and Sanitation Utilities

## Introduction

This chapter sets out to give a global picture of the size, extent and variety of water and sanitation utilities – facilities on which billions of people rely for essential services. Utilities differ in scale, technical sophistication and the range of services that they provide. Together, this range of services and facilities provide the backbone for water provision and for sanitation that has progressed beyond individual provision. Their role is critically important in a period of increasing urbanization and is of growing significance in rural areas. The strength and abilities of water and sanitation utilities are among the core determinants that enable sustainable urbanization. This chapter provides an assessment of their present situation, together with their key concerns and aspirations for the future.

A water and sanitation utility is a legally recognized entity that exists to deliver water and/or sanitation services to consumers in a defined population or area. It is responsible for managing safe and reliable services and is accountable to local or national government. While utilities can take many forms, most are publicly owned, and all are subject to public oversight and regulation. Because of the high embedded costs of providing inclusive services through extensive and expensive infrastructure (pipe and sewer networks), utilities normally operate as monopolies. They may be referred to as operators, service providers, suppliers or systems, but to qualify as utilities they must: 1) hold a government mandate to provide services at scale, 2) operate as legal entities, and 3) employ professional staff. Their authority ultimately derives from government, which bears responsibility for ensuring safe and reliable water and safe sanitation for all.

This chapter aims to deepen the understanding of the diversity, status and performance of utilities worldwide. We start by asking the following five key questions:



How many water and sanitation utilities exist globally? Where are new ones being established, and how do differences in size, level of integration and consolidation affect those estimates?



How are utilities structured and governed and what new forms are emerging?



How are utilities funded, what funding gaps persist, and what solutions are emerging?



How are utilities performing?



How are utilities regulated and held accountable?

The chapter draws on global datasets, supplemented by self-reported information from utilities and expert perspectives. It highlights how utility leaders and practitioners view the challenges to expanding sustainable water and sanitation services, and the solutions they see as viable. These findings can inform efforts to strengthen utilities so they can meet the human rights to water and sanitation, protect the environment from waste pollution, and reduce inequities in service provision across different contexts.

## The global landscape of water and sanitation utilities

Since 2000, the number of people using piped water supplies increased from 3.5 billion to 5.3 billion in 2022; three quarters of whom live in urban areas (JMP 2023). Despite these strong gains, significant gaps remain. According to the Joint Monitoring Programme (JMP), 2.1 billion people lack access to safely managed water services and 3.4 billion are not served by safely managed sanitation services (WHO and UNICEF 2023). Global spending levels to close this gap need to triple to USD 140.8 billion annually, according to the World Bank Group (Joseph et al., 2024).

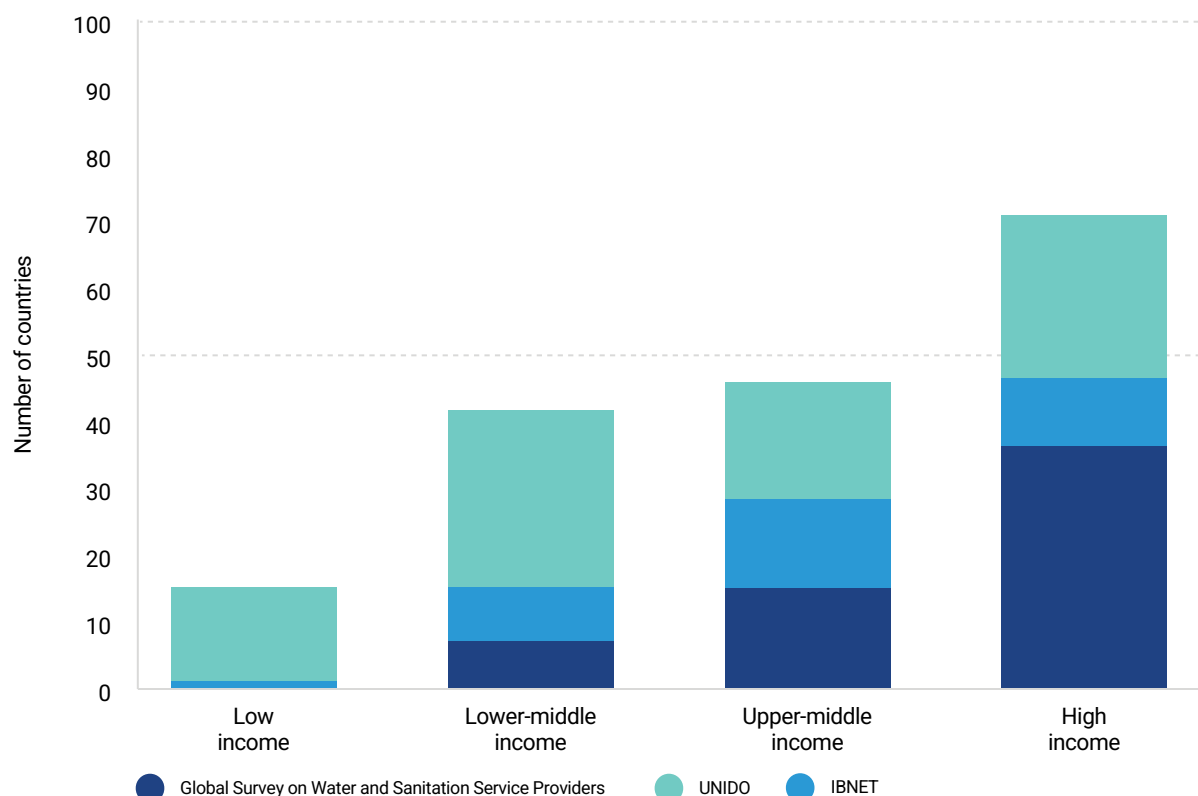
Estimates of reliability of water services show stark differences between low-, middle- and high-income countries, ranging from 13 per cent coverage in countries least well served to 100 per cent in some high-income countries. Globally, only about 30-40 per cent of the population has access to a reliable, 24/7 water supply. This is only one measure of a safely managed water service, but an important one given that water supplies located outside of a home or shared with others cannot be considered to be available as needed. While 71 per cent of the global population has access to safely managed drinking water, this does not always translate into continuous supply, particularly in developing regions (WHO & UNICEF 2023).

The description of utility characteristics in this report comes from secondary data from the International Benchmarking Network (IBNET)<sup>1</sup> and the United Nations Joint Monitoring Programme (JMP)<sup>2</sup>.

1 IBNET is the International Benchmarking Network for Water and Sanitation Utilities. It is a global initiative established by the World Bank in 1994 to encourage water and sanitation service providers to improve their performance through benchmarking and data sharing. <https://newibnet.org/>

2 The WHO/UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene (JMP) global database. It is the leading international source for comparable data and estimates on access to drinking water, sanitation, and hygiene (WASH) at the household, school, and health care facility levels. <https://washdata.org/>

Figure 1.1 Data coverage by country income level in global water and sanitation utility datasets



Data on utilities is skewed towards high and upper-middle income countries in global datasets. UNIDO data also includes industrial water and sanitation facilities. Survey respondents show a better balance between countries of different income levels by comparison. Source: IBNET 2023, UNIDO 2023, Global Survey on Water and Sanitation Service Providers 2025.

Secondary data also remains incomplete, with a bias towards larger urban utilities. JMP data for the SDG 6 indicators on water and sanitation represented 51 per cent and 86 per cent of the global population in 2022, respectively (JMP 2023). The low coverage is partially due to lack of data from India and China, the world's two largest countries by population. Generally, global datasets on water and sanitation services often focus on the larger, urban utilities due to the ease of data collection, scale of operations, and resources available in such settings. The JMP has begun closing this gap by disaggregating service levels for rural and urban areas. Fewer than 10 per cent of the 452 utilities that submitted data to IBNET between 2021-2023 represent service areas with fewer than 10,000 people, although around 43 per cent of the world's population lives in rural areas (IBNET 2023; World Bank Open Data 2023).

As a complement to these global datasets, the primary source of data on trends and opinions on utility performance for this report is a survey with 243 responses from 79 countries. Of these, 153 responses corresponded to a unique utility. The respondents were utility managers, executives, consultants and operators, many from smaller utilities and low and lower-middle

income countries (LMICs). Figure 1.1 compares the numbers of countries included in utility datasets to this survey by country income level.

When it comes to small, informal, community-based or local government-managed services, particularly in rural areas and low-income regions, these systems are often invisible in high-level policy discussions and investment decisions. As highlighted by the saying, "What is not measured is not managed," the underreporting or absence of robust data on these systems contributes to their ongoing invisibility in planning and financing frameworks (JMP 2023).

Gaps in monitoring and reporting for SDG 6 are closely linked to populations that are systematically left behind. Aggregate statistics often mask pronounced disparities, and disaggregated analyses by gender, ethnicity, disability or poverty show large deviations from national averages in many places (Shears 2022).

Lack of data is not unique to low- and middle-income countries. The United States stopped tracking household water service levels in 1995, leaving gaps in understanding about who is left behind – most often

informal communities, the homeless, private well users and native American tribal communities (US Census Bureau 2021). A study that estimated that two million people in the United States lack access to indoor running water also found a high correlation between lack of clean water access and race (Dig Deep 2019).

This report aims to illuminate some of these blind spots through improved methodology, targeted outreach to smaller providers, and the inclusion of previously underrepresented perspectives. However, limitations remain, such as sample bias, self-reported data reliability, and lack of longitudinal data for trend analysis. These challenges underscore the need for ongoing improvement in monitoring systems and transparent communication of data limitations.

## Number and size of utilities

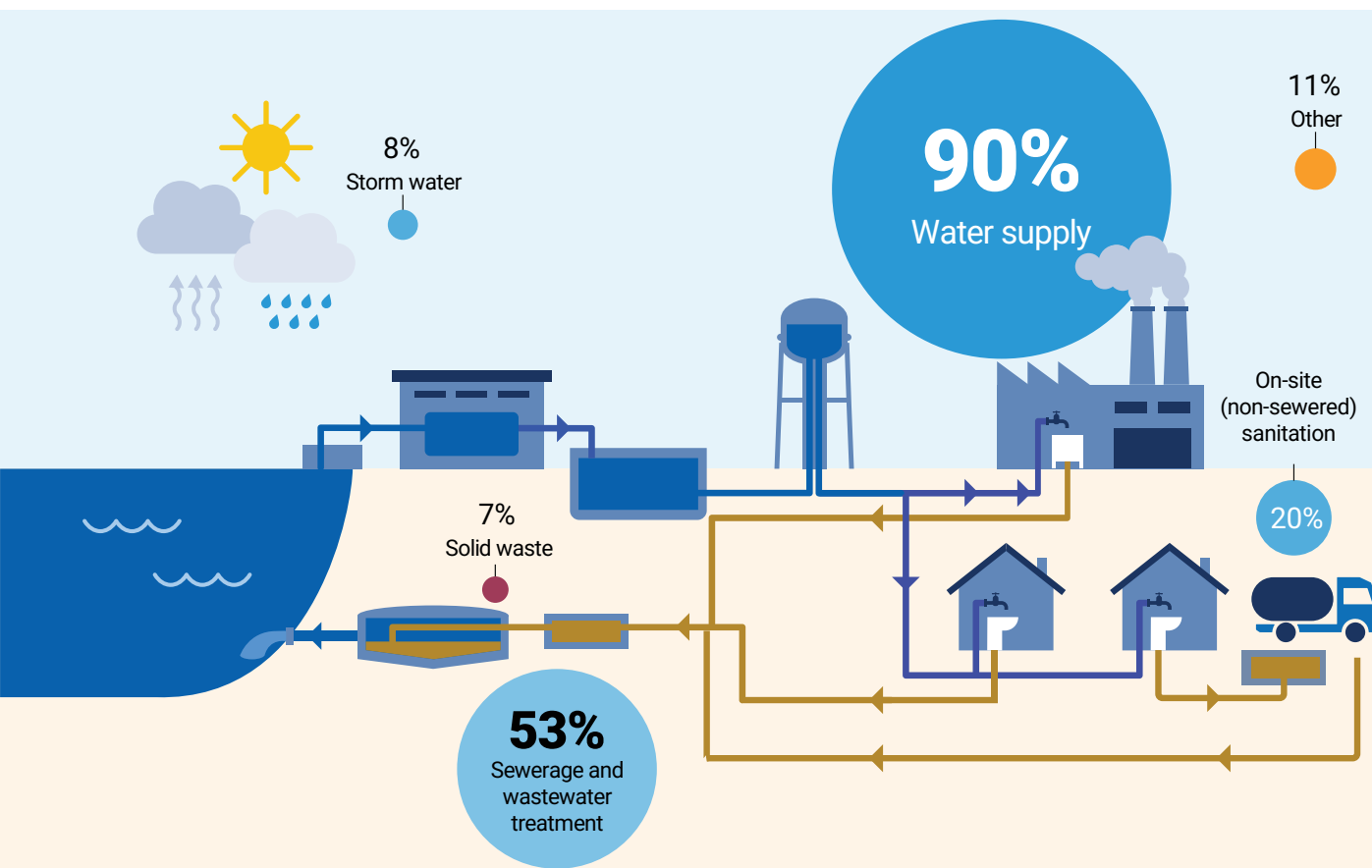
Understanding the number and distribution of water and sanitation utilities worldwide, the emergence of new service providers, and how variations in size, integration and consolidation shape these estimates

is central to interpreting the evolving global landscape of water service provision.

Of the 153 survey responses from utility representatives seen in Figure 1.2, 90 per cent provided water supply services, and half offered sanitation services, usually in addition to water. More offered sewerage and wastewater treatment than on-site (non-sewered or faecal sludge) services, including collection, transportation and treatment. A minority of utilities also provided collection and processing of solid waste and stormwater management, and several others offered industrial wastewater treatment, well construction, training and consulting services, water bottling or electricity generation.

Differences in the organisational forms of water and sanitation utilities across countries make a precise global count difficult. A reasonable estimate is nevertheless possible and remains valuable, as each utility delivers essential services that contribute to the SDGs and requires recognition and support from governments and partners.

Figure 1.2. Service offer of water utilities



Water utilities often deliver additional services, including wastewater, non-sewered sanitation, solid waste and stormwater management. Multiple responses were possible. Source: Global Survey on Water and Sanitation Service Providers 2025.

The data from some of the world's largest countries by population are illustrative examples. In the United States, there are approximately 60,500 public, private and cooperative water and sanitation systems, making it the country with the most fragmented and numerous water and sanitation service providers in the world (US EPA 2024). In India, approximately 2,023 municipal corporations, councils and state-level water and sanitation boards operate water and sanitation services<sup>3</sup>. Indonesia has more data available on rural water service providers, with 35,095 of them accounted for in 2021, versus the mere 394 urban utilities who are members of the country's professional association (Kurniatin & Maksum 2022; PERPAMSI - Indonesia Water Association n.d.). In addition, there are countries with one centralized formal utility, like the Ghana Water Company, which serves urban areas for the entire country (rural areas and small towns falling under the remit of local government and the community water and sanitation agency – CWSA).

An indicative estimate was developed for the number of service providers in the 40 most populous countries. The calculation was based primarily on official and publicly accessible sources, including government and regulatory censuses of service providers, which were available for 22 of the 40 countries. However, definitions of service providers vary substantially across these sources. In some cases, only corporatized urban utilities are counted, while in others the figures also include large numbers of formalized community-based providers.

For the remaining countries, the estimate relied on unofficial information, including figures published on platforms such as Wikipedia and other non-validated sources. These values could not be confirmed and are therefore rated as low to moderate reliability.

Based on the available figures and their extrapolation to the global level, the total number of water and sanitation service providers worldwide is estimated to be no fewer than 285,000. This figure should be regarded as an indicative order-of-magnitude estimate in light of (1) the

limited reliability of a substantial share of the underlying data and (2) divergence in definitions of service providers across the official datasets consulted.

The size of utilities and their level of consolidation across settlements have an obvious effect on these numbers. Ethiopia and Uganda are good contrasting examples that demonstrate the heterogeneity of organizational structures in lower-income countries with large rural populations. In Ethiopia, most towns have their own town water utility and in total there are close to 1,000 water utilities. Uganda has one large national utility in the form of the National Water and Sewerage Corporation (NWSC), covering 276 cities and larger towns, and six regional umbrella authorities managing systems in small towns and rural areas (NWSC 2021). Both countries have large numbers of community-managed water schemes.

The World Bank found an emerging trend of urban utilities integrating peri-urban and denser rural populations into their service areas, including for example in China, Morocco and the Philippines (World Bank 2017). Aggregated management models, under which service providers manage multiple rural centers, were also identified as in multi-village schemes in India. Management had been delegated to private operators in some rural small towns (Bangladesh, Haiti, Vietnam), sometimes even managing standalone systems in their service areas (for example, Benin). In Ghana some larger villages that were community-managed are now managed by the Community Water and Sanitation Agency (NDPC 2020).

An observable trend in many LMICs, driven by population growth, economic development and an increasing demand for higher levels of service is the utilization of rural water services (Franceys 2019). Utilization means professionalizing community water providers by supporting them to become more customer and commercially oriented. Urban utilities also begin absorbing rural areas into their service areas. This can be seen as a means of institutionalizing the long-term support that piped on premises rural water supply

3 Water and sanitation services in urban areas in India are primarily managed by municipal corporations, municipal councils, and urban local bodies. India has 4,602 urban local bodies registered with the Swachh Bharat Mission, which include: Municipal Corporations (large cities), Municipal Councils (medium-sized towns), Nagar Panchayats (semi-urban settlements). For this count we are excluding Nagar Panchayats, although some do operate as utilities in more capacitated states. These models reflect varying degrees of decentralization, autonomy, and technical capacity important when assessing the landscape of utility-like service providers in India. Here are a few illustrative cases that reflect the diversity in urban water service delivery across Indian states:

Pune and Hyderabad (Municipal Corporations): both cities operate relatively professionalized, in-house utilities. Pune Municipal Corporation manages water supply through a dedicated Water Supply Department and has adopted SCADA systems, district metering, and non-revenue water reduction strategies. Similarly, the Hyderabad Metropolitan Water Supply and Sewerage Board (HMWSSB), although technically a state utility, functions as an autonomous parastatal with end-to-end responsibility planning, billing, operation and management under strong municipal oversight.

Madhya Pradesh and Odisha (smaller municipalities): in most towns, the Public Health Engineering Department continues to manage water supply infrastructure. Urban local bodies often lack technical staff and depend on the Department for planning, execution and even billing. This limits professionalization and restricts local accountability, although some convergence efforts are underway.

Rajasthan and Karnataka (public-private partnership/hybrid models): smaller urban local bodies have experimented with public-private partnerships to overcome technical and financial constraints. In Rajasthan, select towns under the Rajasthan Urban Infrastructure Development Project outsourced operation and management to private operators. The Karnataka Urban Water Supply and Drainage Board supports a model where billing and customer service are handled by private contractors, while asset ownership remains with the state/urban local bodies.



requires. National governments play an important role in driving this trend. Although utilization has been found to increase coverage and improve service levels, many utilities still struggle to provide rural areas with a continuous on-premises water supply free from contamination (Adank et al. 2021).

## Structure and governance

Water governance is complicated to define given its nature as “a combination of functions, performed with certain attributes, to achieve one or more desired outcomes, all shaped by the values and aspirations of individuals and organizations” (Jiménez et al. 2020).

In practice, utilities are governed by three pillars – policy, institutions and regulation, which together support the delivery of high-quality services at low cost while answering to the public good (Mumssen et al. 2018; Romano & Akhmouch 2019).

Utility management and organizational structures vary based on roles, legal mandates, ownership structures, and integration with regulatory frameworks. Utilities are typically defined in national legislation that sets goals and strategies, defines targets, standards, sector structure and roles and responsibilities. Responsibilities for serving the poorest often begin at the constitutional level, with 31 countries that explicitly guarantee the

right to water in their constitutions (Human Right 2 Water 2024). Some countries allow more flexibility than others in legislating what forms of utility models are permitted, such as the 2025 high-level declaration from South Africa instructing all water service authorities to form municipally owned utilities, which can be a ring-fenced internal department, a municipal entity, a water board, a concession or another option (South African Government 2025).

Publicly owned utilities are the most widespread form of utility and can sit at different levels of government, from local community-managed, to municipal to national ownership, often depending on the degree of state centralization.

Private sector enterprises are nearly always engaged somewhere in utility supply chains. Formal private sector participation may include asset ownership, public-private partnership, delegation or outsourcing. In certain countries like China, public private partnerships are common during construction, but not in the management of wastewater treatment plants (UN-Habitat 2023).

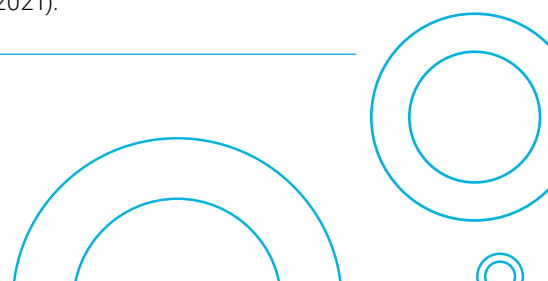
Following the IBNET convention, utilities are classified into seven main organizational forms, as defined in Table 1.1, each with distinct legal structures and varying degrees of public and private sector participation.

Training of Pakistani water professionals in Istanbul, Turkey.  
Photo: İSKİ (Istanbul Water and Sewerage Administration)



**Table 1.1. Common forms of utility structures and governances**

Organizational forms of utilities	Definition	Key features
Jointly (Government and Private) owned provider operating under commercial law	A utility with mixed ownership between government (local or national) and private entities. It operates as a commercial company, with both public and private shareholders participating in governance and decision-making.	<ul style="list-style-type: none"> <li>Public-private partnership or mixed ownership structure</li> <li>Risk, capital and expertise sharing</li> </ul>
Privately owned provider operating under commercial law	A water or sanitation utility that is fully owned by private individuals or corporations, operating under commercial law to generate profits for shareholders.	<ul style="list-style-type: none"> <li>Full private ownership and management</li> <li>Driven by a profit incentive</li> <li>Still subject to legal and regulatory standards for public services</li> </ul>
Local or National Government Department – Not ring-fenced	A utility organized as a traditional department within a government where finances for water or wastewater functions are not separated from other government activities. Resources, revenues and expenditures are pooled with the overall department budget.	<ul style="list-style-type: none"> <li>Less transparency for utility performance</li> <li>Possible diversion of water funds to other purposes</li> <li>Possible cross-subsidization of water from other services</li> </ul>
Not-for-profit provider operating under commercial law	A utility organized as a non-profit, meaning it must reinvest all surplus revenues into its operations or community objectives. It is incorporated under non-profit commercial law and operates with commercial management practices.	<ul style="list-style-type: none"> <li>Cannot distribute profits to shareholders</li> <li>Governed by an elected board</li> <li>Most common in rural areas or small utilities</li> </ul>
Statutory Body	An organization established by specific legislation (a statute), giving it a distinct legal identity to manage water and sanitation services. Typically governed by a board and has specific powers and responsibilities set by law.	<ul style="list-style-type: none"> <li>Public ownership and accountability but operational autonomy</li> <li>Sometimes called a statutory authority, statutory corporation or public corporation</li> <li>Water boards, conservancy districts and special vehicles are statutory bodies</li> </ul>
Local or National Government Department – Ring-fenced	A division within a government department specifically for water or wastewater services, where all financial activities (revenues, expenses, assets, liabilities) for this function are separately identified and reported.	<ul style="list-style-type: none"> <li>Financial transparency for utility performance</li> <li>Ring-fencing can be a step in the creation of a new entity (corporatization) (Orda et al., 2021).</li> </ul>

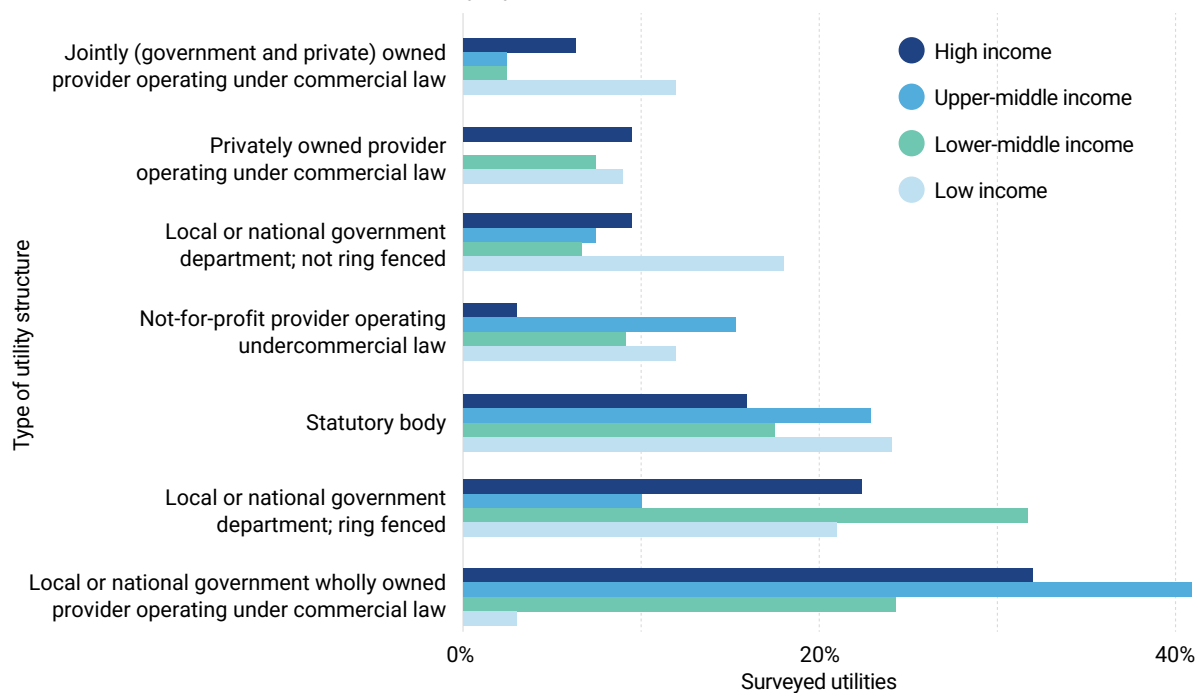


Organizational forms of utilities	Definition	Key features
Local or National Government wholly owned provider operating under commercial law	A water or sanitation utility fully owned by a government (local, regional or national) but structured and run as a commercial entity, meaning it is expected to be financially self-sufficient. Also called a state-owned enterprise.	<ul style="list-style-type: none"> <li>May have a board of directors, separate financial accounts and commercial management practices.</li> <li>Required to cover operational costs with revenue</li> </ul>

Figure 1.3 shows that the majority of utilities in the survey were government-owned providers either operating under commercial law, with dedicated budgets (ring-fenced), as statutory bodies or as government departments without ring-fencing. Only 17 per cent were fully privately owned, 7

per cent for profit and 10 per cent not for profit. Despite the popularity of joint public and private ownership models, only 4 per cent of utilities surveyed fit this category. The organizational structures in Table 1.1 and Figure 1.4 are ordered from least to most common in the sample.

**Figure 1.3. Organizational form of the utility, by form of law followed**



Categories of utility organization and operational structure by country income level. Source: Global Survey on Water and Sanitation Service Providers 2025

## Funding

Water and sanitation utilities around the world rely on a fragile balance of tariffs, taxes and transfers (from donors or governments) to finance service delivery, maintenance and infrastructure expansion. Yet revenue is rarely sufficient. There is financial pressure on utilities across the world and in LMICs utilities are often drastically under-resourced. Only a little over

half (58 per cent) of sampled utilities said they are generally recovering all costs with revenue (including subsidies). Data from IBNET found that 86 per cent are unable to cover the total costs of service provision and 65 per cent are unable to fund operation and minor maintenance costs (IBNET 2023). Although there are challenges in relying on self-reported data from urban utilities for a global overview, funding for the sector is clearly insufficient.

## How utilities are embedded and roles are defined



### National Utilities

The National Water and Sewerage Corporation (NWSC) is a public utility company wholly owned by the Government of Uganda. It is mandated to operate and provide water and sewerage services in areas entrusted to it on “a sound commercial and viable basis” and to provide water and sewerage services “efficiently and economically” to the people of Uganda. It provides water services for 20 million people in 276 Ugandan towns and cities and centralized sewerage systems to collect, treat and discharge effluent in 17 towns and cities (NWSC 2021).



### Integrated Utilities

Empresas Públicas de Medellín (EPM) is an integrated public utility providing water, sewerage, electricity and gas to the Aburrá Valley Metropolitan Area including Medellín, the second largest city in Colombia. It was created in 1995 by fusing different municipal entities and is owned by the municipality of Medellín with the city mayor acting as President of the Board of Directors. The Aburrá Valley Metropolitan Area of almost 4 million people has the highest percentage of treated wastewater in Colombia (UN-Habitat 2023).



### State Utilities

In India, city water and sewerage services are generally provided by State owned utilities. For example, the Chennai Metropolitan Water Supply and Sewerage Board is a statutory board of the Government of Tamil Nadu, established in 1978 to provide an adequate supply of safe and good quality water and to collect, treat and dispose safely of sewage with reference to protecting public health (IWA 2020). The state of Odisha established the Water Corporation of Odisha (WATCO) as a not-for-profit company with a mandate to provide water and wastewater services in the city of Puri.



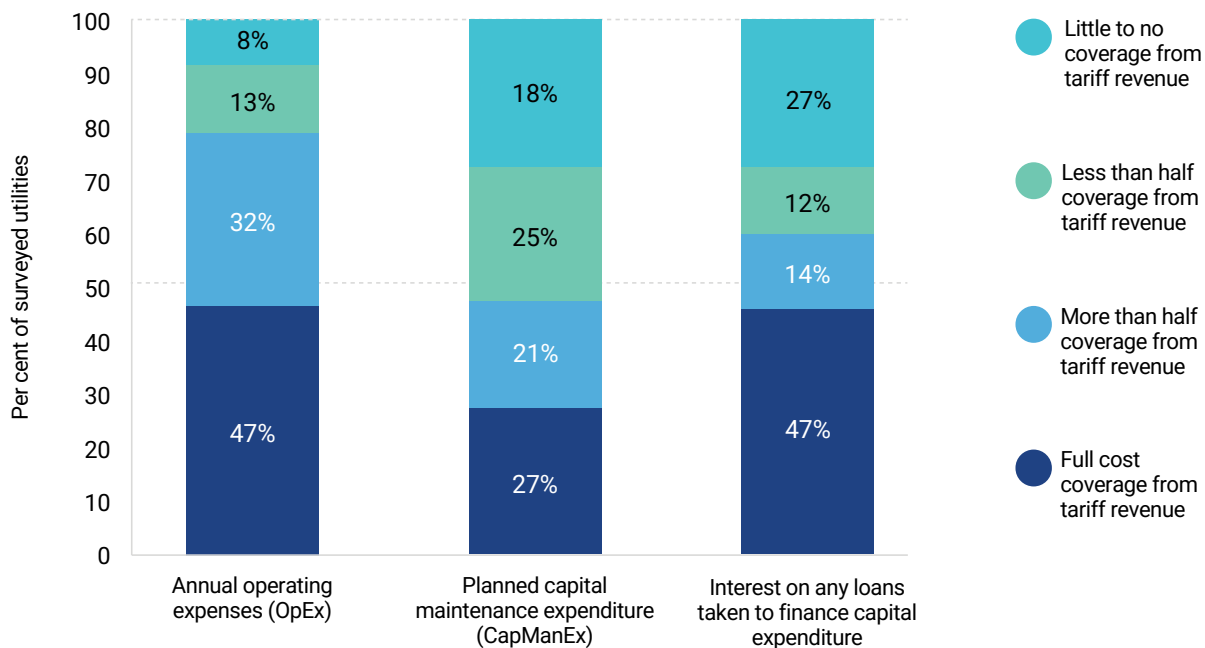
### Full Water Cycle Utilities

Aguas do Porto takes a direct role in water resources management in Porto, Portugal. As well as managing more than 2,000 km of water infrastructure water mains, sewers, and storm water pipes, Aguas do Porto actively manages 66 km of streams and 3.4 km of seafront, including bathing areas (Bentley Systems n.d.).

The World Bank identified that spending from all sources on water and sanitation amounts only to roughly 0.5 per cent of gross domestic product in developing countries and that current expenditure needs almost to triple to meet targets. In Sub-Saharan Africa, where there has been a historic reliance on subsidies and aid, the funding gap for water supply and sanitation is estimated at USD 73.5 billion annually (Joseph et al. 2024). Recession or low growth, debt, pandemic, conflicts and climate change impacts make bridging the water sector’s financing and funding gap even more challenging.

Utilities today are increasingly expected to rely on tariffs to recover all costs. Yet there are social and other practical barriers to putting this in place, including non-payment of bills. Collection rates from private (household) customers are generally higher – often 90 per cent or better – than from public institutions, which are sometimes below 50 per cent in many LMICs (Zupan 2020). Instead of disconnecting accounts in arrears, high-income countries such as Australia, France and the United Kingdom often implement assistance programmes and explicitly prohibit water disconnections to balance financial sustainability

Figure 1.4. Extent of cost coverage from tariff revenues



Cost coverage from tariff revenue of utility expenditures. Source: Global Survey on Water and Sanitation Service Providers 2025

with human rights obligations (Marques et al. 2023). LMICs face greater challenges in achieving cost recovery through tariffs alone, often lacking robust subsidy frameworks and facing higher default rates, which can lead to shortfalls for maintenance and service disruptions. Utilities in countries like Ethiopia and Kenya often experience significant gaps between their budgets and the full costs of service delivery, leading to operational inefficiencies and reduced service quality (Libey et al. 2020).

Figure 1.5 represents the self-reported cost coverage from tariffs for the main expenditure categories in utilities. In the survey conducted for this report, utilities reported less than full cost coverage from tariff revenue for expenses in most cases, with operating expenses the most likely to be covered from tariff revenue and planned capital maintenance expenditures the least likely. Interestingly, utilities choose to use revenue to cover interest on any loans taken out to finance capital expenditure before financing capital maintenance expenditures; in effect choosing to pay the bank in preference to making upgrades or budgeting for major repairs and replacements. It is a short-term strategy to stay financially stable but can clearly backfire when equipment fails.

Financial pressures are also acutely felt in advanced economies. The US Environmental Protection Agency (EPA) estimates that the country will need to spend more than USD 744 billion over the next two decades on water infrastructure, including pipes, treatment

plants, and wastewater management facilities (Council for Foreign Relations 2024). In the United Kingdom, Thames Water, the largest of the privatized water and sanitation companies, said that bills need to rise by 59 per cent between 2025 and 2030 or else the business will not be able to recover from a financial crisis. The company has borrowed heavily since privatization in 1989 and currently has more than GBP 15 billion of debt. Plans to raise an emergency loan have been challenged by environmental campaigners who say that the utility should be renationalized even if temporarily.

These financial shortfalls translate into lower performance outcomes: utilities with poor cost recovery tend to have higher non-revenue water rates, lower reliability of supply, and limited investment in infrastructure (IBNET 2023). By contrast, utilities with stronger tariff structures and higher collection efficiencies are better positioned to improve service levels and resilience, highlighting the critical role of sustainable financing strategies in achieving SDG 6 targets. Emerging solutions to fill finance gaps are discussed in Chapters 3 and 4.

## Utility performance

Knowledge of water and sanitation utility performance is largely based on self-assessment, evaluations and benchmarking. Performance monitoring is the systematic process by which utilities continuously track, analyse and report on key metrics related to

their operations and service delivery. This includes monitoring aspects such as reliability, efficiency, customer satisfaction, safety, costs and environmental impact. When done well, it helps utilities identify inefficiencies, optimize operations, and improve service delivery.

Traditional performance monitoring uses comparison benchmarking for evaluation and focuses on collecting standardized indicators and developing management information systems and performance improvement plans (EPA 2024). The information flows up to higher levels of management, and decisions flow down on how to improve performance. The long-running CEPT University Performance Assessment System for India is a good example, covering 800 cities and measuring access, equity, service quality, efficiency and financial sustainability, but not broader governance (Center for Water and Sanitation 2025).

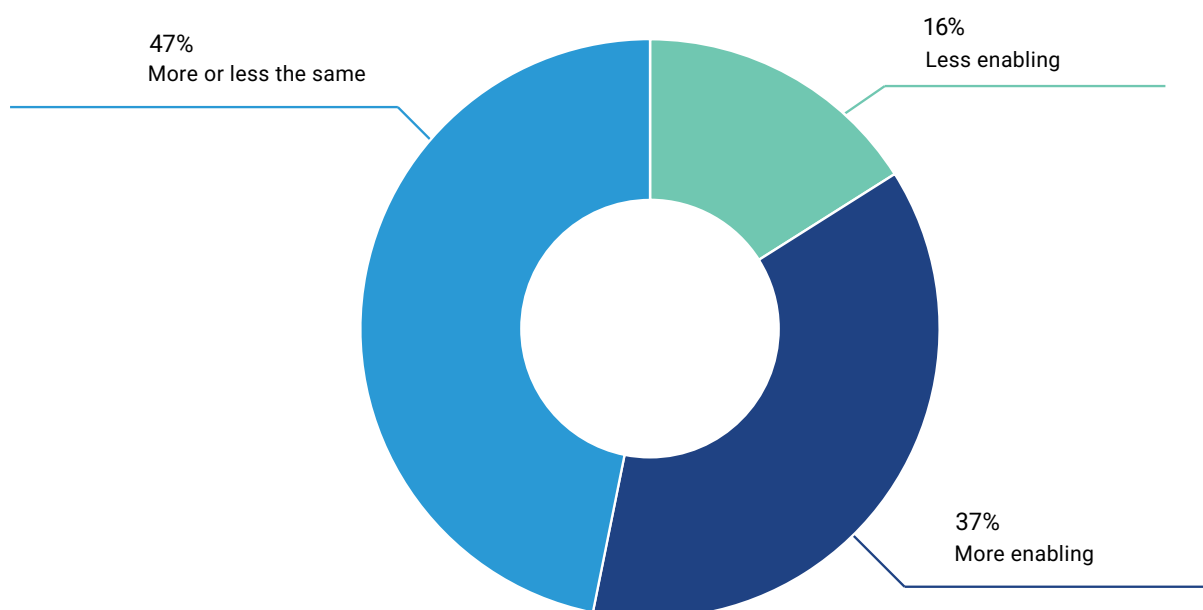
Utility performance monitoring can be considered a social-construct as it entails choosing indicators to prioritize or ignore, and these are often more aligned with top-down needs from donors and government rather than the needs of consumers. Donor-driven reform efforts based on only technical capacity or structure often fail due to neglect of power structures, political incentives and diverse cultural, legal and ecological contexts (Whaley 2022).

Integrating the enabling environment into discussions of performance indicators, we present findings on access, service quality, efficiency and financial sustainability because strategies to improve utility performance in these domains are essential for sector finance to close coverage gaps. Overall, most survey respondents were optimistic about the enabling environment for utility performance, with only 16 per cent saying that things were getting worse as seen in Figure 1.5.

### Access to utility services

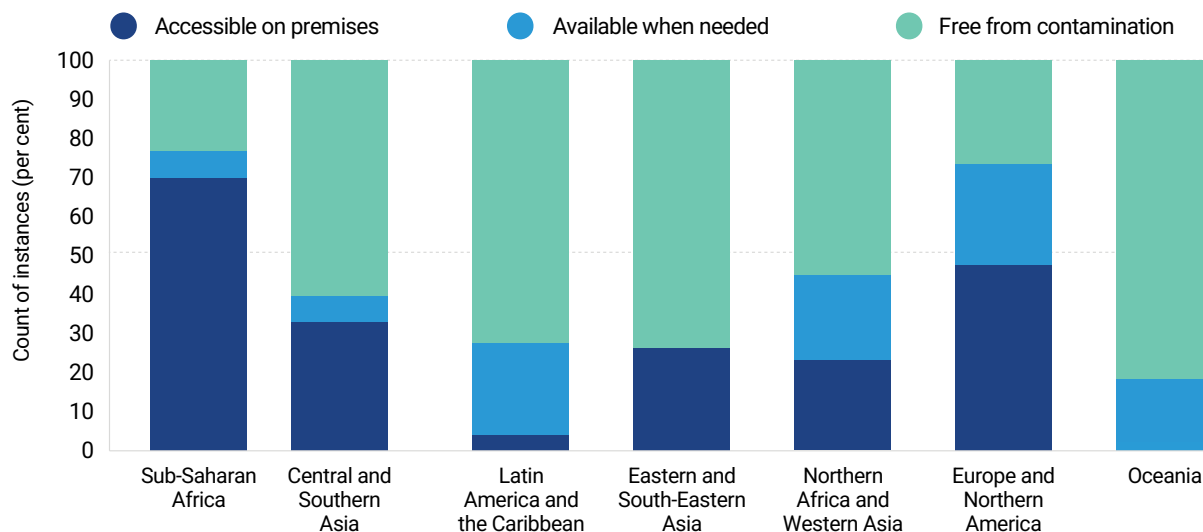
Overall, utilities are expanding services to more people, with the number of people using piped water supplies increasing from 3.5 billion to 5.3 billion from 2000-2022, an increase of 8.9 per cent globally. However, there are stark regional and urban/rural differences. Nearly three quarters of those new piped supplies reached urban populations (1.3 billion people). While all regions experienced growth, Asia had the largest increase in terms of numbers of people reached and Sub-Saharan Africa had the least (JMP 2023). The growth of piped supplies (which are generally managed by utilities) outpaces the growth of people gaining access to non-piped improved supplies over the same period.

Figure 1.5. Trends in the enabling environment for utility operations



Perception of the enabling environment's trends and impacts on utility operations. Source: Global Survey on Water and Sanitation Service Providers 2025

Figure 1.6. Reasons for non-achievement of safely managed water services, by region



Factors limiting water services from reaching safely managed water, all countries. Source: JMP 2023

Countries with the largest percentage increase in piped water supply coverage according to JMP included Kyrgyzstan, Paraguay and Thailand, while in absolute numbers, Brazil, China, Ethiopia, India and the Philippines have seen the biggest increase. Some countries experienced reduced access to piped water, including Algeria, Democratic People’s Republic of Korea, Haiti, Pakistan, Nigeria, State of Palestine and Ukraine due to high population growth, instability and conflict.

Some notable outliers in JMP estimates include instances of Some for All in water – meaning there were overall increases in coverage but growth was unevenly distributed. In some countries there was a decrease in basic coverage, but growth in piped water (Congo, Sao Tome and Principe) or there was a large increase in basic coverage, but less growth in piped water (Afghanistan).

Many countries making progress on water access struggle to reach universal coverage with piped systems, by reaching what the JMP classifies as safely managed services. To be considered safely managed, a piped water service must be on the premises of the household (such as a yard tap), available when needed and free from contamination. Of countries that are close to achieving safely managed services, half experienced water quality as the limiting factor, while 30 per cent did not meet the standard for accessible on premises. Figure 1.6 shows the breakdown of limiting factors for safely managed services by region, for example accessibility on premises is the main issue in Sub-Saharan Africa but Latin America struggles with contaminated water (JMP 2023).

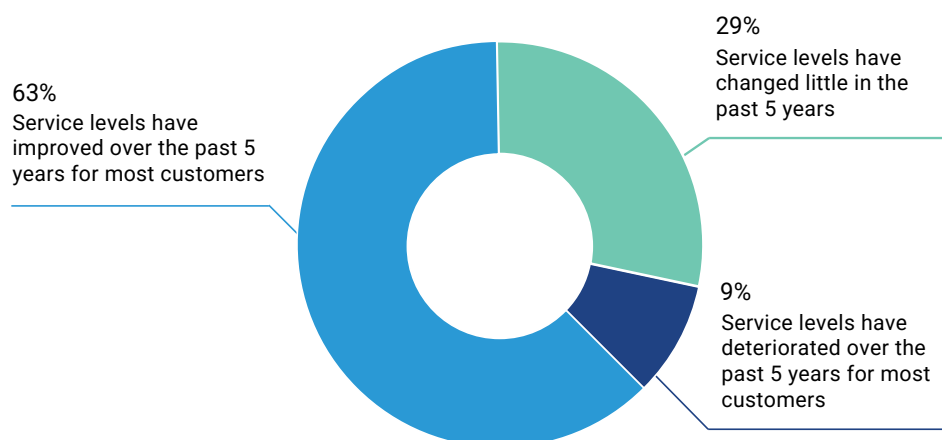
Sanitation has made slower progress globally. For measuring the global coverage for sewerage services as a proxy for the presence of a wastewater utility, JMP estimates that at least 3.2 billion people have access to sewers, 1.2 billion of whom gained access since 2000 (JMP 2023).

Egypt and the Northern Africa/Western Africa region had the largest growth in sewers and Sub-Saharan Africa had the least progress, with only 11 per cent currently served with sewers. Even in Europe and Northern America, 18 per cent do not have sewers and use on-site sanitation solutions.

There are many countries that saw progress on piped water but next to none on sewers. All for Some or elite capture explains some of the trends too, in countries where total sanitation coverage decreased due to backsliding in basic sanitation, but sewerage had modest increases. Some countries (Kazakhstan, Kenya, Spain, Zambia and Zimbabwe) had an absolute increase in sewer connections, but population growth outpaced the extension of services. There was also backsliding, notably among island nations and territories who lost sewer connections due to increasing climate damages.

Sixty-nine per cent of utilities surveyed reported that over the past five years they reached more consumers faster than population growth, though only 60 per cent reported the same for very low-income or slum dweller populations, a significant difference. So, progress is being made, albeit inequitably.

Figure 1.7. Perception of overall level of services provided by the utility



Utility perception of service levels (combining issues of accessibility, availability and quality). Source: Global Survey on Water and Sanitation Service Providers 2025

### Service quality

High-quality water and sanitation services are essential – not only for utilities to boost revenue and expand their reach, but also because they are fundamental to human dignity and public health. Only a high-quality water service that is free from contamination, available all the time and covers an entire community, protects against water-borne disease. A high-quality sanitation service must insulate users and the environment from human waste at each step, from a private and sanitary toilet until final treatment and disposal.

While utilities often self-report on their performance, customer perceptions can offer a more objective view of service quality. Even so, the qualitative explanations provided by utilities and experts are still enlightening. Of the 63 per cent who reported that service levels have improved for most consumers, reasons given included fair transparent tariffs, reliable water supply, infrastructure upgrades, community engagement with underserved populations, alternative service models including kiosks and bulk supply, better customer service and staff training.

By contrast, Figure 1.7 shows that only 9 per cent of surveyed utilities thought that the level of service they provide has deteriorated over the past five years. These respondents pointed to factors such as a shift

toward more commercialization of service provision, internal management challenges, the difficulty (and expenses) of serving dispersed rural households, prioritizing higher-paying commercial customers, aging infrastructure, insufficient political will and sector funding and rapid population growth outpacing utility capacity.

### Efficiency and financial sustainability

Improving operational efficiency and financial sustainability were considered the most important factors by surveyed utilities because of the difficulty in making other reforms before operational costs are fully covered. Global averages of performance in the IBNET database rely on standardized Key Performance Indicators (KPIs) and management practice benchmarks.

These indicators cover technical, financial and service quality aspects, such as water coverage, non-revenue water, staff productivity, cost recovery and simplified metrics for water quality compliance. Averages for 15 indicators by country income category are given in Table 1.2. Sanitation performance indicators had the widest ranges, with large differences between income levels in sanitation coverage, sewerage blockages, wastewater collected and treated, and service complaints.

**Table 1.2. Utility performance indicators by country income level**

Performance category	Indicators	Low-income	Lower-middle-income	Upper-middle-income	High-income	Average
Service coverage	Water coverage (per cent)	68	69	82	89	76
	Sanitation coverage (per cent)	15	37	53	83	52
Quality of service	Continuity of supply (hrs.)	16.55	17.39	23.28	23.89	20.34
	Percentage with continuous supply	29	33	44	83	43
	Wastewater collected and treated (per cent)	72	58	18	39	35
	Service complaints Resolved (per cent)	89	81	29	34	57
	Drinking water quality (per cent)	86	88	95	99	91
Billing and collections	Revenue collection ratio (per cent)	99	89	96	97	94
Non-revenue water	Non-revenue water (per cent)	36	44	40	28	39
	Non-revenue water (l/conn/hour)	9.77	25.50	16.12	19.25	18.57
Financial performance	Operation cost coverage (per cent)	123	107	117	170	121
Metering practices	Metered connections (per cent)	93	76	88	59	81
Pipe network performance	Sewerage blockages (number/100 km network)	201.52	999.55	7135.24	62.20	3959.63
Staffing	Employees per 1000 connections	9.18	10.39	5.89	7.14	8.00
	Female employees (per cent)	21	23	24	27	23

Averages for utility performance indicators by country income level in the IBNET utilities database (N=607 utilities). Income levels are a strong predictor of the service coverage, quality of services, finances and non-revenue water. Source: IBNET.

Kavoor Sewerage Treatment Plant, Mangalore, India.  
Photo: ADB



Utilities reported between 4-99 per cent non-revenue water in the IBNET, making it hard to trust the global average of 39 per cent. High non-revenue water percentages are driven by aging infrastructure, leakages, theft, metering inaccuracy and energy inefficiency (Fonseca 2024).

The global average for female participation in water and sanitation service provision stood at 23 per cent in 2019, with significant regional variation. Europe had the highest percentage at 26 per cent and South Asia the lowest at 9 per cent female employees. The Equal Aqua initiative by the World Bank on gender ratios in staffing, barriers to inclusion, and how to recruit more women to water and sanitation careers found that low rates of female employees can be seen in high-income countries too (World Bank 2019).

Gender equity goes beyond participation of women in water and sanitation careers. SDG 6 specifically targets gender equity, calling for the participation of women in decision-making processes related to water governance. Additionally, the UN-Water framework emphasizes the role of women as critical stakeholders in water resource management and UN Women calls for a feminist approach to address the world water crisis (UN Women 2023).

Despite progress, gender inclusion in technical and management roles within utilities is still limited and gender-specific sanitation facilities (e.g., for menstrual hygiene) remain insufficient in many regions (WHO & UNICEF 2023).

## Improving utility performance

Emerging and tried and tested opportunity areas for utility improvement are discussed in more detail in chapters 3 and 4. Utilities in the Global Survey also provided input on these topics, sharing thoughts and rankings of where to strengthen utility management to improve services in the short-term (Figure 1.8), actions to improve financial performance specifically (Figure 1.9), and opportunities for improvement in the enabling environment (Figure 1.10).

To improve utility management in the short-term, leadership has to make evidence-informed decisions on what to prioritize. Figure 1.8 shows those priorities ranked from most to least important. In the short-term, what matters most is investing in infrastructure, operation and maintenance, and collecting revenue from customers. The lowest ranked priorities were leadership, IT, and benchmarking, monitoring and evaluation. Leadership was the most contentious, with several marking it as the most critical area to improve and others marking it last, not surprising given many respondents were in leadership and may not be evaluating their own performance objectively. The last place score for benchmarking suggests utilities know and understand the challenges they face, and what to do about them. For breakthroughs in service coverage and quality, financing hardware has to come first.

A similar preference for improving efficiency and cost recovery comes across in the ranking of actions to

Figure 1.8. Top priorities for improving water and sanitation utility services, according to utilities



Utility reported priorities for improving services. Source: Global Survey on Water and Sanitation Service Providers 2025

improve financial performance, shown in Figure 1.9. Utilities agreed that reducing costs and increasing or introducing tariffs were most important, followed by new capital investments to extend or improve services, improved willingness to pay for services, and sustaining levels of subsidy. Lowest ranked were action to improve integrity (reducing corruption at all levels) and introducing new services or business lines (e.g. faecal sludge management).

The enabling environment or the broader political economy and environment in which utilities operate, similarly needs addressing for utilities to be resilient and successful. In Figure 1.10, external factors

that affect utility performance are ranked in order of importance. Political leadership, followed by regulation, then availability of finance were the top factors chosen. Together with policies these are essential for good utility governance and finance. Climate action, specifically adaptation of services to local climate risks is also essential. Few ranked digitalization and data, integrity and transparency, local collaboration or partnerships highly – suggesting that utilities are already well-positioned in those areas. Innovative training programmes, integrity interventions and new networks for collaboration may be less requested than improved governance and finance availability.

**Figure 1.9. Measures to improve utility financial performance**



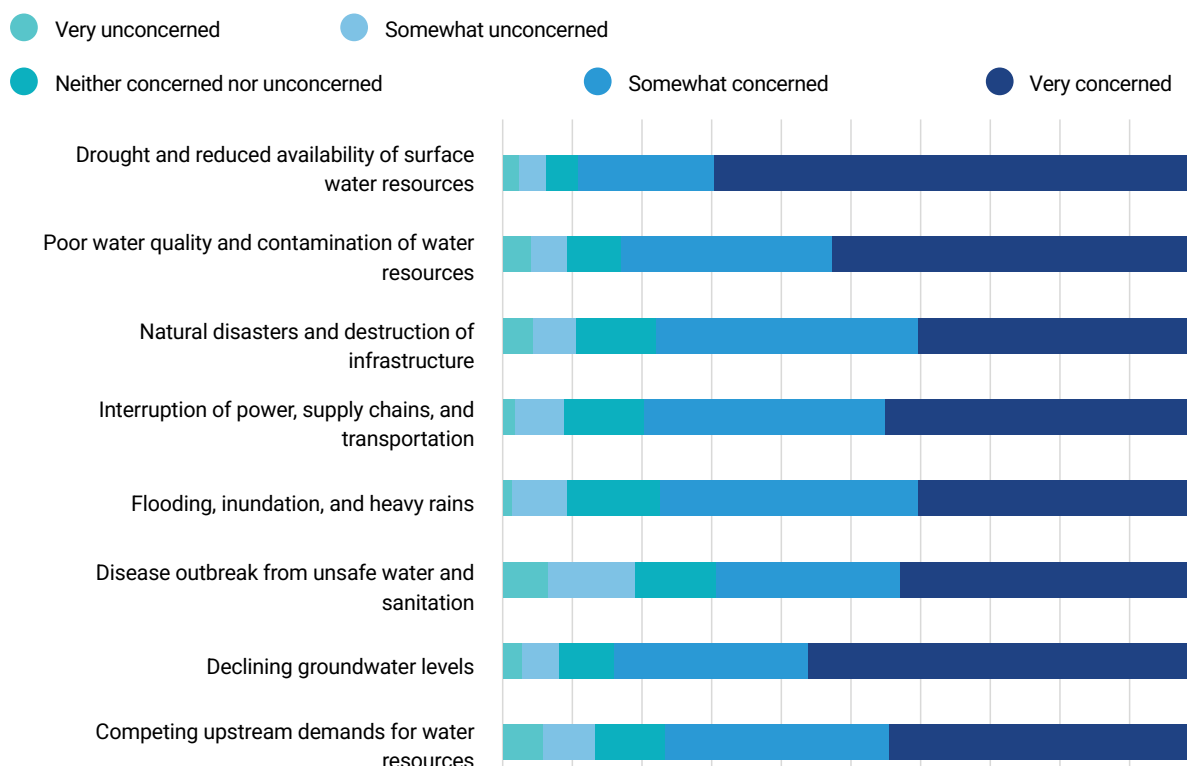
Utility reported assessment of the most important actions for improving financial performance. Source: Global Survey on Water and Sanitation Service Providers 2025

**Figure 1.10. Areas for strengthening the enabling environment for utilities**



Utility prioritization of opportunities for improving the enabling environment for operations. Source: Global Survey on Water and Sanitation Service Providers 2025

**Figure 1.11. Concerns about risks to the utility's operations due to a changing climate and water**



Utilities are highly concerned about risks from climate change and water resources. Source: Global Survey on Water and Sanitation Service Providers 2025

## Climate change

More than two-thirds of survey respondents (Figure 1.11) were concerned or very concerned about the effects of climate change, including drought, water quality and availability, floods, disease, interruption of supply chains, declining groundwater and increased competition. This high level of concern held true across regions and country income levels.

## Regulation and accountability

Understanding how water and sanitation utilities are regulated and held accountable involves exploring the diverse legal, institutional and policy frameworks that govern service provision globally, the roles of regulators and oversight bodies and the mechanisms through which utilities are monitored, incentivized and penalized to ensure quality, equitable access, financial sustainability and responsiveness to environmental and social challenges.

In most high-income settings, utilities control capital budgets while regulators perform audits, but oversight is often at arm's length. In contrast, many LMICs exhibit closer and more fragmented oversight, with models including line ministries, local governments or being contract-based, with utilities generally controlling less of their budgets. Enforcement generally progresses

from soft measures (warnings, corrective action plans and public advisories) to hard sanctions (tariff disallowance, fines, license suspensions, prosecution and recall of leadership) (Bilalova et al. 2025).

A widely used framework for assessing the strength of governance of water and sanitation regulators and government agencies ranks their autonomy, accountability, transparency and use of tools and capacity to achieve regulatory objectives (Andres et al. 2024). These dimensions capture how well the regulator, and therefore the utility, is held answerable for its decisions and performance.

Countries such as Brazil have independent or semi-autonomous regulators with enforcement mechanisms but sanctions and penalties often rely on political approval so rankings are often used to call out poor performers instead of fines (Andres et al. 2024). Community and civil society can also play a key role in regulation and democratic accountability, particularly in privatized models. For example, the poor performance and high debt of water companies in the United Kingdom has been blamed on the regulator, Ofwat, being captured by the water companies by critics, meaning that business interests have superseded utility best interests (Plimmer

2023). This led to a decision in 2025 to abolish Ofwat in favour of a new more powerful regulator – considered the biggest change in the water sector in England and Wales since privatization (Horton 2025).

Traditional regulatory models designed for urban utilities do not easily apply to rural settings, where infrastructure is dispersed, populations are smaller and institutions often have limited capacity. In many contexts, rural water and sanitation services are delivered by community-based organizations, small-scale providers and local authorities operating with constrained resources. These characteristics call for regulatory approaches that are sensitive to context and able to support service improvements over time, rather than imposing standards that are not feasible to implement.

The WASH Regulation (WASHREG) approach for rural areas addresses these challenges by promoting adaptive, inclusive and context-appropriate regulation (SIWI 2023). It encourages the use of flexible, risk-based tools that prioritize essential regulatory functions and allow for progressive enhancement of service delivery. Community engagement is considered central to building legitimacy and accountability, as well as to supporting the gradual professionalization of rural providers.

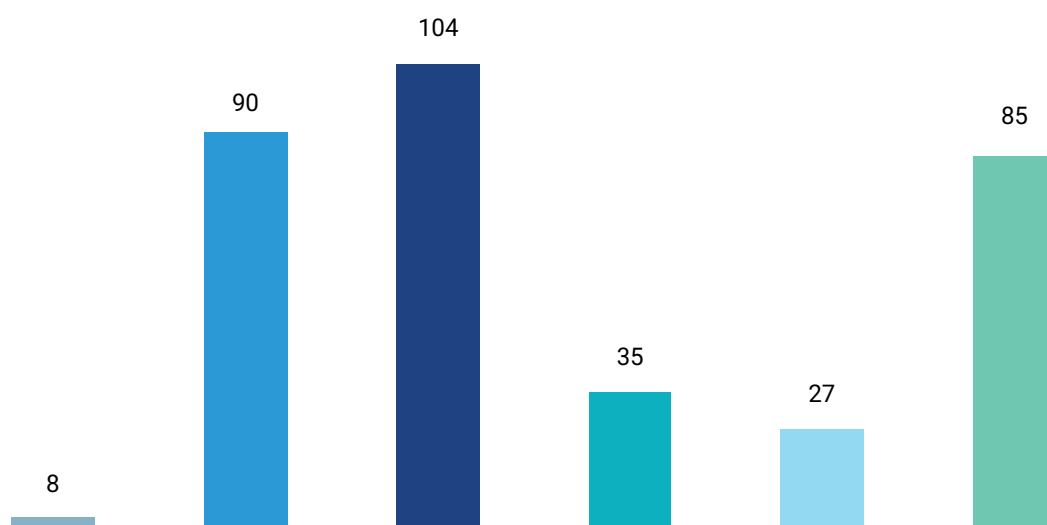
The WASHREG guidance recommends tariff-setting approaches that reflect affordability and the financial realities of small-scale operators. It also proposes

simplified monitoring and accountability mechanisms, such as community scorecards, which align with local capacities. The approach further supports aggregation and regionalization where these can improve efficiency and reliability, provided such processes are demand-driven and adequately resourced (SIWI 2023).

In practice, utilities often report to multiple governing bodies, which can lead to overlapping mandates for regulation between levels of government and independent regulators. The chart in Figure 1.12 shows survey responses to the question of who governs and makes high-level decisions to hold the utility accountable. Responses showed 91 per cent of utilities in the survey are directly governed by local, regional or national governments. Government ministries or municipalities have decision-making authority in these cases, meaning elected officials or civil servants may be subject to political influence and lack technical expertise, but public service and equity is also prioritized.

Of the utility staff who responded to the survey, 85 said they are governed by a regulator, while only eight mentioned a Board of Directors. Independent boards may be more insulated from political influence and possess higher sector expertise and accountability to customers. The independence of boards and directors is further discussed in Chapter 3 as a key innovation for improved management.

**Figure 1.12. Governing authority of the utility**



Counts of different institutions responsible for governance and regulation of utilities. Utilities could select more than one option and 'Other' responses included community-managed, donor-managed and those not currently governed by an external entity. n=243 Source: Global Survey on Water and Sanitation Service Providers 2025

## Conclusion

Water and sanitation utilities are foundational for achieving SDG 6 and underpin many other development goals. Yet they face mounting challenges: urbanization, climate risks, aging infrastructure and financial instability. Globally, an estimated 285,000 utilities of varying size supply piped water to more than five billion people and sewerage sanitation to at least three billion, but progress in closing coverage gaps and improving performance is uneven across regions and populations.

Performance benchmarks reveal persistent inefficiencies, including high levels of non-revenue water, inadequate sanitation coverage and weak financial sustainability. Governance constraints hinder progress: many utilities, especially in LMICs, operate with limited autonomy and fragmented oversight. Promising approaches for rural regulation and the ongoing utilization of rural services, remain underused. Utilities also struggle with fiscal constraints: fewer than half recover full operating costs, even with subsidies, jeopardizing long-term maintenance and reliability.

Fragmentation, particularly in LMICs, complicates coordination, regulation and data reporting. At the same time, it reflects the adaptability of service provision models to local contexts – from small, community-managed systems to large national utilities. Most utilities operate under tight fiscal constraints and struggle to expand or maintain services. Fewer than half report recovering their full operating costs with revenue, even with subsidies, jeopardizing capital maintenance and service reliability. Data-driven policies ensure that

funding is allocated efficiently, targeting areas with the most critical needs while fostering local diversity and innovation on the path towards professionalization. Governments can use global data to understand regional variations and support customized solutions that reflect local realities.

Utilities have contributed to major gains in access to water and sanitation since 2000, especially in Asia. But access remains inequitable, with coverage gaps in rural areas and for slum populations, and significant barriers for people with disabilities, women and marginalized groups. Many services still fall short of standards for safely managed, primarily due to contamination and lack of on-premises access. Overcoming these limiting factors is the responsibility of water and sanitation utilities but also requires government to provide adequate funding.

Utilities are increasingly tasked with addressing these gaps by extending their networks and improving service delivery, but they must overcome funding limitations, threats to water quality, aging infrastructure and the need to keep pace with rapidly growing urban populations. The challenges of safe collection and treatment of sewage in cities that include slums and informal developments are huge. Rural developments are also reshaping the utility landscape as rural service providers professionalize, consolidate or are absorbed by urban utilities. The ability of utilities to close coverage gaps is critical for achieving universal access to safe water and sanitation, a core objective of SDG 6.

Training of water professionals from Godawari in Nepal at the Vatten och Avfallskompetens I Norr AB (VAKIN) plant in Umeå, Sweden. Photo: VAKIN



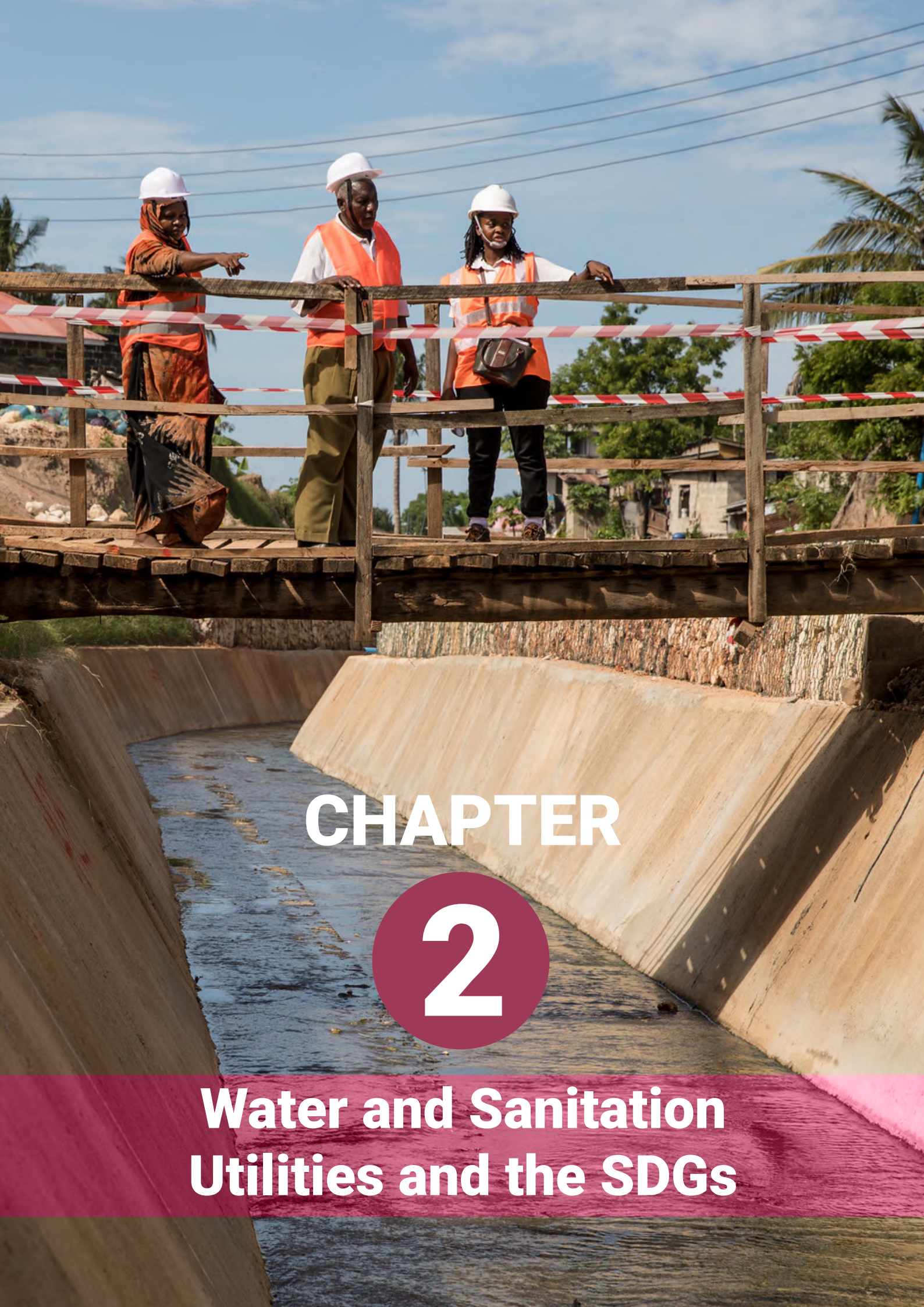
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Planning of the Manguharjo Drinking Water Supply System in Semarang, Indonesia.  
Photo: Izzan Arif Hutomo/VEI





# CHAPTER

# 2

## Water and Sanitation Utilities and the SDGs

## Introduction

This chapter explores how the service delivery activities of water and sanitation utilities link, directly or indirectly, to other Sustainable Development Goals (SDGs), and shows how progress in meeting targets for water and sanitation (SDG 6) contributes towards strengthening many others. Utilities and the water and sanitation services they provide, impact significantly upon poverty, health, climate, biodiversity, cities, food, decent work, peace and related goals and targets.

Interconnections work both ways - positively and negatively - and the trade-offs between SDG impacts require collaboration, negotiation and partnership. Utility leaders can work with other policy and decision makers to maximize synergies and manage trade-offs, such as competition for water resources for household consumption, agriculture and industry, and minimizing the polluting effects of sludge and wastewater from the sanitation cycle. The negative climate impacts of water and sanitation services related to greenhouse gas emissions need to be managed, and there is a tension between the need for utilities to recover their costs and the human rights to water and sanitation services.

Nilsson et al. (2016) proposed that the influence of one Sustainable Development Goal on another could be scored from +3 to -3 depending on whether that influence is positive or negative. The scoring proposal has not been generally adopted but the authors argue that such interactions are often not addressed because policymakers and planners operate in silos, with separate ministries for energy, agriculture and health. Policymakers lack tools to identify the most important interventions and lack evidence to show how interventions and policies help or hinder progress towards the goals.

This chapter examines the way that the sustainable development goals for water and sanitation interact with other SDGs.

### Local action to realize the SDGs

Case studies in this chapter show water and sanitation utilities working for practical realization of the SDGs, providing examples of utilities of innovating and adapting to address challenges. These underline the fact that goals expressed in global terms can only be achieved by enabling local actors (governments, utilities and communities) as catalysts of change, grounded in local priorities and realities. UN-Habitat promotes this process of transforming the SDGs into actionable local strategies as a two-way process where the local meets the national and the global, and

vice-versa. UN-Habitat provides support to empower local, regional and national governments to localize the SDGs, so that:



Cities and local governments strengthen data systems, planning processes and implementation capacities



National governments develop National SDG Localization Frameworks to guide policy



Local and national governments engage with the SDG Cities Global Community and key UN and intergovernmental forums (UN-Habitat 2025).

Water and sanitation utilities are significant stakeholders in SDG localization as they serve specific communities and cities and operate at local and regional levels of government within national, transnational and international agreements on sustainable water production and use. They have direct contact with consumers at the household level and their role is fundamental to public health and environmental sustainability.

Utilities are accountable in many directions. Upstream, they depend on catchments which supply raw water and so utilities are increasingly invested in their conservation and maintenance. Downstream, they are responsible to local agencies and the communities into which their treated effluent flows. This remit as a key public service provider – an urban basic service provider – makes utilities a primary focus for localization.

The United Nations (UN Policy Brief 2024) highlights the role of urban basic services as providing essential amenities and facilities to meet fundamental needs, and in providing a vital, foundational element of effective emergency response and emergency preparedness. The UN lists access to clean water and sanitation first among these services along with housing, education and energy.

“Local and regional governments play a pivotal role in providing and managing [urban basic services], which are essential to ensuring quality of life, economic growth and social equality. Recognizing these services as global common goods emphasizes inclusive governance and community collaboration. Ensuring universal access without exclusion or privatization is crucial, especially in marginalized areas. By collectively

managing and preserving these services, communities promote resilience, social justice and the well-being of all residents, safeguarding fundamental human rights and dignity.” The brief emphasizes the importance of financing basic services especially “in low- and lower-middle-income countries where the gaps between required investment and current resources are widest.”

Basic services in this sense naturally signify the fundamental necessity of these services, and is not a judgement about quality. Basic in the sense used by the JMP is a step on the water and sanitation ladder that utilities must exceed to reach what are judged to be safely managed services.

If local authorities and utilities are to localize action, they need localized data, disaggregated by different population groups and geographical areas, a responsibility of national actors, such as National Statistic Offices as well as local authorities. Engaging local communities in the process can ensure that the indicators reflect conditions on the ground. Engagement and participatory approaches foster accountability and empower communities to advocate for their water and sanitation needs.

One way to do this is through a voluntary local review that allows local authorities to analyse SDGs for their local context, to identify their own priorities and to work with citizens as a basis for accelerating planning and policy to move towards the goals. By August 2025, in excess of 400 voluntary local reviews had been prepared by 305 urban localities in 65 countries, to monitor progress and highlight action taken to promote the SDGs (UN-Habitat 2025).

Water and sanitation delivery usually plays an essential part in these reviews – for example the Jakarta Voluntary Local Review for 2024 highlights the construction of a new Jakarta sewage system to pipe domestic wastewater to treatment centres and mitigate the risk of groundwater and surface water contamination (Ajie 2024).

The World Organization of United Cities and Local Governments (UCLG) supports subnational bodies to conduct voluntary reviews covering broader areas.

## **Case study: Faecal sludge management in Waling Municipality**

*This case study touches on SDG 3 (Good Health), SDG 11 (Sustainable Cities and Communities), and SDG 15*

*(Life on Land). It involved collaborative partnerships at global, regional and local levels (SDG 17 Partnerships for the Goals). Nepal's 2024 Voluntary Sub-National Review was itself the outcome of a partnership between the Municipal Association of Nepal and the World Organization of United Cities and Local Governments.*

Waling Municipality, known as the Pink City after the painted walls of its houses, has a population of more than 50,000, in the hilly western province of Gandaki, Nepal.

In 2019, a shit flow diagram survey revealed serious risks of waterborne diseases and groundwater pollution due to poor faecal sludge management. The municipality lacked a formal sewerage system, and 2 per cent of the population discharged toilet waste directly into stormwater drains. Many pits had no sealed bottoms and were connected to soak pits and open drains. Although the municipality had been declared open defecation free, 1 per cent of the population still practised open defecation in forests, rivers or open land.

The main drinking water source was surface water, increasing contamination risks from faecal sludge, as households rarely emptied their containment tanks and the terrain allowed infiltration. Unregulated private desludging services often dumped untreated faecal sludge onto farmland. The municipality had no faecal sludge management policy or regulation.

The findings sparked an immediate response. Led by the Mayor, Waling Municipal Council endorsed a faecal sludge management policy and action plan, making septic tanks mandatory for all new buildings and promoting anaerobic biogas digesters to farmers.

Waling Municipality repurposed its existing solid waste management site as a combined municipal sanitation centre, and funded and constructed a faecal sludge treatment plant, with technical assistance from the Environment and Public Health Organization (ENPHO). The municipality also introduced mechanical desludging services to work alongside private operators, to meet growing demand.

The sanitation centre treats 2 m<sup>3</sup> of faecal sludge per day, producing sludge cake and treated water. Sludge is distributed to local farmers as fertilizer, while the water is used for landscaping a public recreational area at the sanitation centre, where families and school children come for picnics, with a learning hub where visitors can see how the system works.



The Waling experience has underlined several lessons:



The shit flow diagram served as a powerful catalyst, highlighting the urgent need for improvements.



Strong leadership from the Municipal Council and clear, actionable data transformed Waling into a model for faecal sludge management practices in Nepal.



Faecal sludge treatment plants can foster social acceptance and community engagement when integrated in public spaces, rather than isolated as technical sites.

This experience shows the benefits of partnership – Waling Municipality was supported by the Municipalities Network Advocacy on Sanitation in South Asia project, a regional UCLG ASPAC programme that aims to strengthen the capacity of local municipal associations and municipalities. Waling Municipality is seen as an example for municipalities to follow. The Government of Nepal has recognized the potential of Waling for development under the Smart City initiative<sup>1</sup>.

## SDGs, systems thinking and action by utilities

The SDG framework can inspire utilities, national sectors and others to understand better the links between water and sanitation and other facets of development and progress.

The introductory chapter to this report introduced a systems approach to understanding how utilities are enterprises with their own mission and goals and, at the same time, part of a wider environment that includes other basic services, governmental and regulatory bodies and citizens. They function within an economic and cultural background that can encourage or hinder growth and change. Utilities engage with the complexity of this wider environment and are at the same time part of it.

Some of the vital elements of this environment have to be working to a sufficient level if utilities are to fulfill their mandate and work effectively alongside other actors. Chapter 3 examines building blocks as they apply directly to water and sanitation facilities and as described in the World Bank Utility of the Future programme. Ensuring that the broader environment works to support utilities is explored in the pathways for change in Chapter 4.

When countries and regions look at how the system interacts, they can visualize links that need to be made between different parts of the system to make overall progress.

In South Africa, interlinkages between SDG 6 indicators and other goals were mapped using social network analysis through analysis of literature, interviews and a stakeholder workshop (Libala et al. 2021). The results revealed, for example, that achieving SDG 3 (good health and well-being) will rely on building stronger links between communities, local governments and other agencies in water areas to enable a more holistic approach to health and water governance. The authors identified an urgent need for “scientists or researchers in the agriculture and water resources disciplines to share knowledge and collaborate more.” Figure 2.1 illustrates visually the sheer complexity of the network analysis interactions.

In Ghana, a high-level meeting and consultations led by the National Development Planning Commission identified SDG 6.2 (sanitation) as one of five top priority SDG targets for action, (NDPC 2023) based on synergies with targets for better health, education and economic growth. Potential benefits identified included higher productivity, lower health-related costs and a reduction in ocean pollution. Opportunities in the sanitation value chain could have a catalytic effect on Ghana’s recycling rate and industrialization with residual benefits through job creation and poverty reduction. The consultation identified 35 potentially negative outcomes such as increased pollution if interventions were not well designed and managed. Synergies are shown visually in Figure 2.2

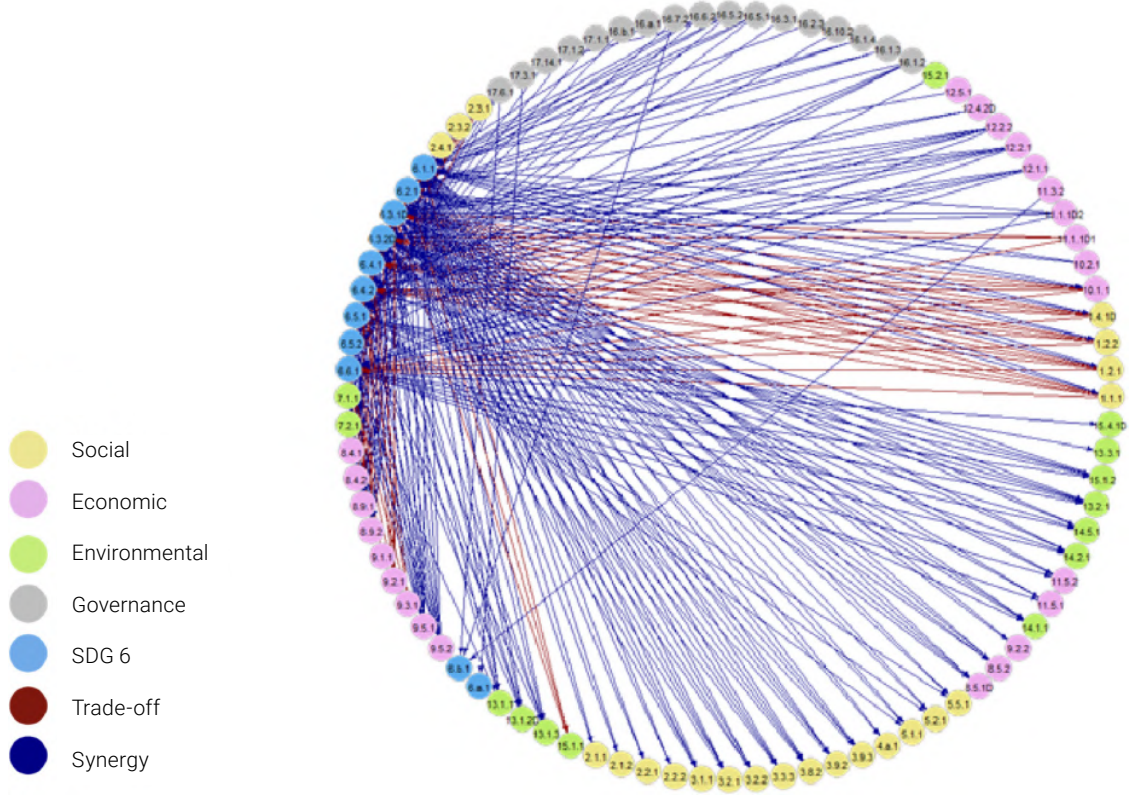
## Water and Sanitation Utilities and the SDGs

Water and sanitation utilities have the most direct impact on their core activity (SDG targets 6.1 and 6.2), the provision of water and sanitation services. Utilities also have a direct and indirect impact on the wider targets of SDG 6 – notably on protection of the

environment and ecosystems, increasing the efficiency of water use and strengthening the participation of local communities in improving water and sanitation management.

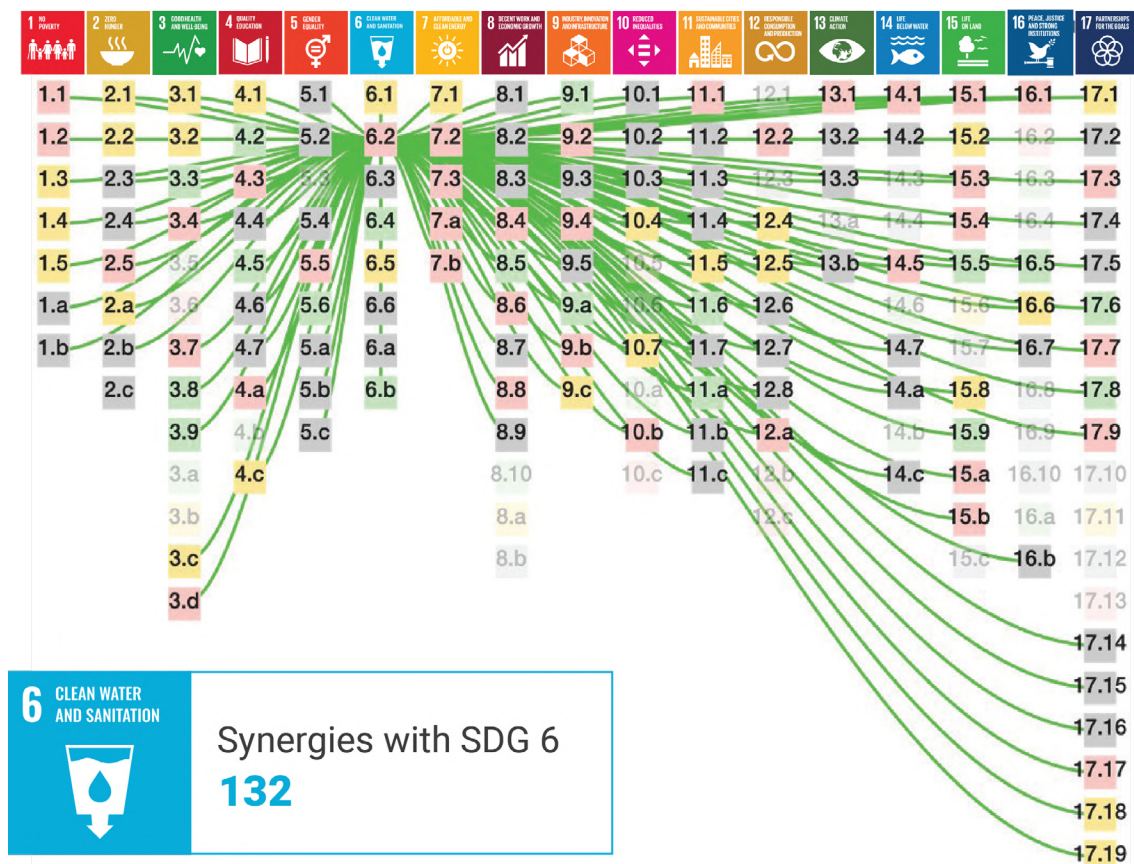
<sup>1</sup> The case study is based on Nepal Voluntary Sub-National Review 2024 and Jagam & Buddha 2019.

**Figure 2.1. Linkages between SDG 6 and other SDG indicators**



Linkages are between SDG 6 and other SDG indicators based on a social network analysis in South Africa (Libala et al. 2021)

**Figure 2.2. Identified linkages between SDG target 6.2 and other targets in Ghana**



Source: NDPC 2023

What utilities do and the way that they do it also have an effect on the other SDGs, since being able to access safe water and sanitation services impacts deeply on people's lives and influences everything from levels of poverty and hunger to gender equality, education, climate change, to peace and security. There are feedback loops in these wider systems, as the quality of the environment, the health of ecosystems and levels of community participation in turn affect the ability of the utilities to provide services.

The relationships between the water and sanitation targets and other SDGs were detailed by the UN-Water Task Force for the 2030 Agenda (UN-Water 2016): "Improvements in access to safe drinking water supply, sanitation and hygiene (WASH) services [6.1, 6.2, 1.4, 11.1] in homes, healthcare facilities, schools and workplaces, and improving ambient water quality [6.3] are essential for reducing multidimensional poverty [1.1, 1.2], improving nutrition [2.2], improving health [3.2, 3.3] and education [4.1–4.3], achieving gender equality [4.5, 5.1, 5.2, 5.5, 10.2, 10.3], improving work opportunities [8.5] and overcoming inequalities [10.1].

"These improvements are also required to meet international commitments to the human rights to water and sanitation... Harnessing synergies is critical to meeting the 2030 Agenda, particularly given the ambitious nature of the Sustainable Development Goal targets and the aim to leave no one behind."

UN-Water publishes three Country Acceleration Case Studies a year based on progress in reporting on SDG 6 global indicators. To date (2025) reports have been published on Brazil, Cambodia, Costa Rica, Czechia, Ghana, Jordan, Pakistan, Senegal and Singapore<sup>2</sup>.

## Water and sanitation services delivery (SDG 6 targets 6.1 and 6.2)

The primary SDG targets under goal 6 (SDG 6.1 and 6.2) relate to the provision of water and sanitation respectively.

SDG 6.1: By 2030, achieve universal and equitable access to safe and affordable drinking water for all.

SDG 6.2: By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations.

Progress on domestic water supply is tracked using indicator 6.1.1, the proportion of population using safely managed drinking water services, defined as being accessible on premises, free from contamination and available when needed (see Figure 2.3).

Progress on sanitation and hygiene is tracked using indicator 6.2.1, the proportion of population using (a) safely managed sanitation services and (b) a hand-washing facility with soap and water. Safely managed sanitation means improved sanitation facilities that are not shared with other households and where excreta are safely disposed of in situ or transported and treated offsite. Anything less than safely managed services increases the risk of cross-contamination (Figure 2.3).

Figure 2.3 shows the service levels for drinking water provision and for sanitation management. The outer circles are the least satisfactory levels (amounting to no service) while safely managed services (the smallest circles) reach only a minority in many countries but most people in advanced economies. Where larger circles overlap there is a risk of contamination of drinking water inlets. Only safely managed services prevent these risks.

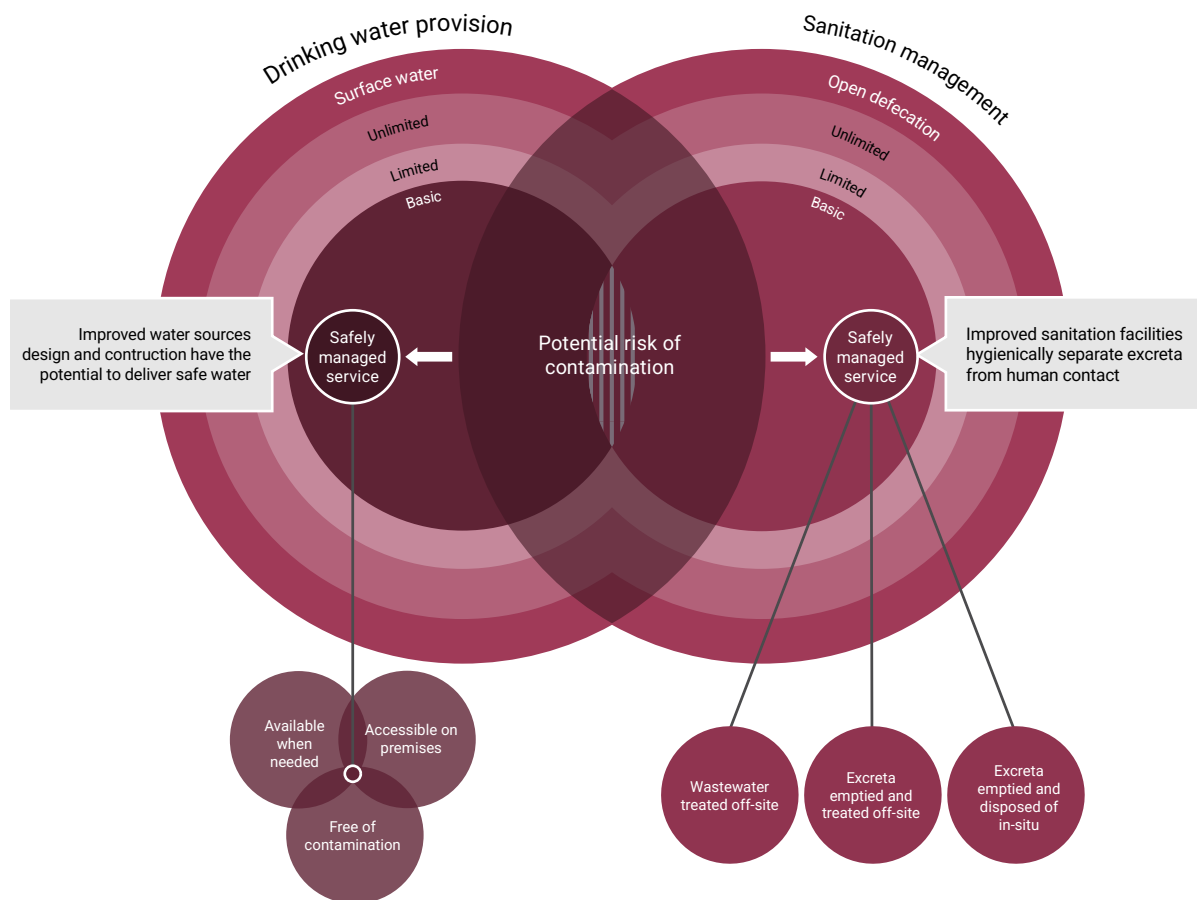
Indicators 6.1.1 and 6.2.1 are used to track progress and identify gaps in service delivery. Tracking these indicators reveals how access to safely managed water and sanitation services is marked by significant inequalities, particularly in rural areas and among vulnerable populations. The UNICEF/WHO Joint Monitoring Programme provides authoritative global reports based on data for households, schools and healthcare facilities.

Utilities have a critical role in addressing gaps and inequalities at the localized level. In the case of water, this can mean extending and improving the management of piped supplies in towns, cities and rural areas, where piped supplies are increasingly seen as the most effective route to extending access.

For sanitation, it may mean integrating sanitation and wastewater management into wider urban development, extending services to serve informal settlements, and making greater use of effective decentralized systems for wastewater management (UN-Habitat 2023).

2 [www.unwater.org/publications/country-acceleration-case-studies](http://www.unwater.org/publications/country-acceleration-case-studies)

**Figure 2.3. Sustainable Development Goal 6: Ensure availability and sustainable management of water and sanitation for all**



Unpacking the SDG water and sanitation targets 6.1 and 6.2. Anything less than safely managed services carries a risk of cross-contamination between water and sanitation. (Source: AfDB, UNEP and GRID-Arendal 2020)

### Global Urban Monitoring Framework

The Global Urban Monitoring Framework was endorsed by the UN Statistical Commission in March 2022 for implementation as part of the Harmonized Global UN Systemwide Strategy for monitoring the Sustainable Development Goals and New Urban Agenda and other regional, national and subnational urban programmes. The guide acknowledges a lack of knowledge about volumes of wastewater generated and treated, due to the complexity of measuring discharges and wastewater statistics being in an early stage of development in many countries. "Monitoring is relatively complex, costly, and data are not systematically aggregated to the national level and/or accessible; especially industrial wastewater data which are in general poorly monitored and seldom aggregated at national level."

The UN-Habitat objective is to create "an efficient, effective and harmonized framework to monitor the transformation towards a more sustainable, inclusive, safe and resilient urban area." The framework should be *efficient*, so it does not create a burden on cities, *effective*, so that measuring an indicator produces actionable information, and *harmonized*, so that information is comparable. Voluntary local reviews contribute by aligning the SDGs with the Urban Monitoring Framework and localizing indicators (UN-Habitat 2022).

## Wider water and sanitation SDGs (SDG 6 targets 6.3-6.7)

SDG 6 targets the management of water quality in the environment, where wastewater is a major source of pollution. The aim is to manage water use across sectors to reduce scarcity and to protect and restore water-related ecosystems. Targets include improving operational arrangements, integrated water resources management, international cooperation, capacity-building and the participation of local communities.

Table 2.1 links these wider SDG 6 targets and their indicators to water and sanitation utilities, identifying specific opportunity areas for action. It demonstrates that although development goals and targets are set for governments, there are specific roles in achieving targets that only the utilities can fulfill, working with other local and national government bodies and with communities.

### Case Study: Jordan on track for SDG 6.1 despite huge pressure on resources




*Jordan is vulnerable to climate change, which could lead to desertification. SDG 6 has been a driver to reuse treated wastewater and to improve agriculture, and spectacular progress has been made in part due to strong partnerships, within the country and through transboundary cooperation on water sharing.*

Jordan is among the most water scarce countries in the World, at risk of desertification and drought. Increasing pressure on resources comes from population growth, including refugees from neighbouring countries, and the impact of climate change. The Ministry of Water and Irrigation predicts that there will be only 35 m<sup>3</sup> of renewable freshwater resources available per person annually by 2040.

Despite this, Jordan has seen the fastest improvement in coverage of safely managed drinking water services in Western Asia and is on track to achieve the SDG 6.1 target. The proportion of the population with access to safe drinking water rose from 53 per cent in 2000 to 86 per cent in 2022. Jordan has also made significant progress in sanitation, water quality and integrated water resources management. According to the WHO,

the proportion of domestic wastewater from sewers that is safely treated reached 93 per cent in 2022, while it is 48 per cent for septic tanks

The Water Authority of Jordan operates mainly through three publicly owned water utilities: Miyahuna, the Aqaba Water Company and the Yarmouk Water Company, established between 2004 and 2013 as part of a decentralization process. Jordan's experience is relevant for other medium-small water stressed countries, with urgency to take action and high levels of ambition. Key factors and drivers identified include:<sup>3</sup>

-  Commitment from the highest levels of government
-  Water-efficient agriculture, including less water-intensive crops, drip irrigation and drainage water reuse
-  Heavy investment in the reuse of treated wastewater, mostly for irrigation
-  Technical cooperation from development partners, national authorities and local communities
-  Massive investment in water infrastructure with donor support
-  High levels of targeted subsidies, covering more than half of the cost of water provision
-  Coping mechanisms, including water storage tanks, water reuse and rainwater harvesting
-  A well-regulated system of tankers to support households and farmers
-  Institutional reform
-  Transboundary cooperation with agreements on water sharing
-  Investment in water-related education and research

Source: Jordan Country Acceleration Case Study (UN-Water 2024).

<sup>3</sup> The case was based on country monitoring focal points, background interviews and inputs from two participatory workshops in collaboration with UNICEF, FAO and the Ministry of Water and Irrigation of Jordan.

**Table 2.1. SDG targets 6.3 to 6.b and their respective indicators**

SDG 6 target	Indicators	Actions for water and sanitation utilities and in supporting environment
<p>Target 6.3: By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally</p>	<p>6.3.1 Proportion of domestic and industrial wastewater flows safely treated</p> <p>6.3.2 Proportion of bodies of water with good ambient water quality</p>	<p>Extend and improve sewers and centralized wastewater treatment. Support treatment at decentralized levels, e.g. industry</p> <p>Develop safe on-site sanitation services</p> <p>Promote recycling and safe reuse of water</p>
<p>Target 6.4: By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity</p>	<p>6.4.1 Change in water-use efficiency over time</p> <p>6.4.2 Level of water stress: freshwater withdrawal as a proportion of available freshwater resources</p>	<p>Reduce losses in water supply (non-revenue water). Improve efficiency of water supply</p> <p>Introduce strategies and policies to manage demand, and promote efficient use by customers</p> <p>Understand the impacts of water withdrawals from rivers, lakes and aquifers and educate government and public about the risks of exceeding safe limits</p>
<p>Target 6.5: By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate</p>	<p>6.5.1 Degree of integrated water resources management</p> <p>6.5.2 Proportion of transboundary basin area with an operational arrangement for water cooperation</p>	<p>Develop and strengthen effective partnerships and cooperation with other stakeholders</p> <p>Develop with transboundary and downstream users codified and enforceable practices and standards</p>
<p>Target 6.6: By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes</p>	<p>6.6.1 Change in the extent of water-related ecosystems over time</p>	<p>Understand future impacts and the need to preserve and maintain viable ecosystems while responding to consumer demand – especially develop resilience to climate change pressures</p>
<p>Target 6.a: By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies</p>	<p>6.a.1 Amount of water- and sanitation-related official development assistance that is part of a government-coordinated spending plan</p>	<p>Develop and explain subsidy and investment practices, and improve utility budgeting, accounting and financial reporting processes</p>
<p>Target 6.b: Support and strengthen the participation of local communities in improving water and sanitation management</p>	<p>6.b.1 Proportion of local administrative units with established and operational policies and procedures for participation of local communities in water and sanitation management</p>	<p>Governments should set rules for utility governance and management, regulation practices. Utilities to improve community outreach and participation, and responsiveness to consumers</p>



## Impact of Water and Sanitation Utilities Beyond SDG 6

Water and sanitation utilities have a wider societal role to play since the availability and sustainable management of water and sanitation for all affects the attainment of all other SDGs.

### SDG 1: No poverty: ending poverty in all its forms

A specific target under SDG 1 is that the poor and vulnerable should have equal rights to basic services. This applies to housing, water and sanitation, which are also human rights.

The poorest people in communities are the least likely to have access to piped water. They spend more time accessing services and are more vulnerable to waterborne diseases, and consequently less able to work.

As economies grow, local and national governments have more resources to build and sustain water and sanitation services. Utilities find it more possible to cover their costs when more people are able to pay tariffs. Special measures sometimes are necessary to ensure that the poorest in society have access to basic services. Subsidies for the poorest are required and utilities need to be responsive – but financing subsidies is a responsibility for government at national, regional or local level.

### SDG 2: Zero hunger

This goal makes reference to the essential need for water for irrigation and food production, which are

threatened by floods and droughts. Clean drinking water itself is vital to nutrition. Malnourished people are more vulnerable to waterborne diseases, which can prevent the body from absorbing essential nutrients. The Food and Agriculture 2024 report on the State of Food Security and Nutrition in the World calls for a new approach to financing efforts to combat hunger. “Healthy diets and health status are main determinants of nutritional status, but multiple factors related to food security (e.g. availability and affordability of nutritious foods), practices (e.g. related to food and feeding, care and health seeking) and services (e.g. clean water, health, education and social protection) all influence the ability and mechanisms through which individuals can achieve healthy diets and adequate health.” (FAO, IFAD, UNICEF, WFP and WHO 2024).

### Case study: Ghana: Ensuring the urban poor people can access water

*Ghana Water Company Ltd. has shown that safe water for the urban poor people pays off. It contributes towards SDG 6.1 and provides a new, expanding customer base. It contributes to SDG 3 (Good Health), SDG 5 (Gender Equality), SDG 10 (Reduced Inequalities), SDG 11 (Sustainable Cities and Communities) and SDG 17 (Partnerships for the Goals).*

Fifteen years ago, it was almost impossible for the poorest communities in Ghana’s cities to access safe water. Household connections from Ghana Water Company Ltd. (GWCL) were reserved for the better-off. Water from tankers cost 30 times more than water from the tap.

#### SDGs 1 and 2 action points



Governments and utilities to agree on water tariffs at affordable levels. Tariffs should also be realistic for those who can afford to pay – no hidden subsidies for the better-off



Governments to set policies for subsidies and reimburse utilities if they are required to provide services below cost



Regulators to set policies and guidelines for disconnections to ensure that the poor are not deprived of services



Extend services to peri-urban areas regardless of whether housing is formally recognized



Modernize water and sanitation services to enhance efficiency, reduce costs, and promote sustainable resource management



Improve sanitation service and safety for those who do not have sewered systems



Ghana Water installed standpipes in some low-income areas of Accra. However, vendors added their own margins to the tariffs, so the poorest were still paying the highest rates. In 2009, a district manager was seconded to support pro-poor interventions funded by Water for Life Foundation, and in 2011 she became responsible for pro-poor co-ordination.

She accompanied Water and Sanitation for Urban Populations (WSUP) on visits to Uganda, Zambia and Kenya and led studies in Accra and Kumasi that highlighted that high connection fees were counter-productive, resulting in high levels of non-revenue water.

The chief manager of the utility's Low-Income Customer Support Unit, recalls that they had to build a case to convince the top management that there was an untapped potential market. "There was this perception that when you extend services to these areas they will not pay." But the poor people were already paying. "These people were using water but paying their bills to third party vendors who took water from Ghana Water, added their own margins and then sold it on to their neighbours. They were paying 15 to 20 times more for water sometimes of lower quality."

A Low-Income Customer Support Unit was established in 2015 and upgraded to a Department in 2021. Ghana Water Company began to close the gaps in urban water services and successfully argued for pro-poor issues to be included in the national water policy. They moved from standpipes to providing household connections within each yard – meeting the SDG safe water standard for water at the home, and the social target set by the Ghana Public Utilities Regulatory Commission (PURC).

Unit's staff use focus groups and social mapping in each new area to find where the need is greatest and encourage communities to form water user groups. "Before we lay pipes, we build trust and listen and explain what the utility can do and can't do." By May 2025, the Department had connected more than 37,000 households in seven regions including the cities of

Accra, Kumasi and Wa. Each compound household houses between 12 and 22 people, so these taps provide water for more than 500,000 people.

Improving universal and equitable access to safe and affordable water has expanded the revenue base for GWCL, turning non-paying consumers into meter-based paying customers. The chief manager says: "We are promoting health and dignity in high-risk communities. We are directly contributing to public health, especially reducing waterborne diseases and the burden on women and girls. We are building trust between the utility and customers, which is essential in a fragile setting or in informal urban areas. Without our work many of our cities in Ghana would face deep inequalities, higher risk of water insecurity and missed opportunities for utility growth and community development."

Poor households pay 25 per cent of the connection charge and pay for metered water at a lower rate than charged by informal suppliers. The connection charge is paid into a revolving fund to finance pipes and fittings for new connections.

The Unit also has an impact on sanitation, working to extend water and toilets in schools, health centres and marketplaces. The chief manager recalls that almost every year there were cholera outbreaks in Accra, but regular outbreaks no longer occur.

The Low-Income Customer Support Unit was borne out of partnerships with WSUP and utilities in the Gambia, Kenya and Zambia. Ghana Water Company is now making its own contribution through the European Union Water Operators' Partnerships Programme, supporting Guma Valley Water in Sierra Leone to strengthen water services for low-income urban communities.

"Our work is not just about putting in pipes," says the chief manager. "It is about building relationships that last."<sup>4</sup>

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4 This case study is based on an interview with Faustina Boachie, Chief Manager, Low-Income Customer Support Unit, Ghana Water Company Ltd.

Joint technical inspection at Mwanza Urban Water and Sanitation Authority water plant in Tanzania.  
Photo: Sascha Jensen/Hamburg Wasser



### SDG 3 action points



Work with national and local government to close the gap between public works and public health

The WHO and UNICEF set an eight-step agenda for countries to improve WASH in healthcare facilities (WHO 2019). Of these, five require the involvement of water and sanitation utilities



A situation analysis to examine health and WASH policies, governance structures and funding streams



A roadmap for WASH improvements defining responsibilities, targets and budgets supported by an intersectoral national team



National standards for design, costing, implementation and operation of WASH services



Improvements in infrastructure to meet national standards, accompanied by policies, resources and strategies to keep infrastructure and services operational over time



Integration of WASH indicators into routine data collection

WHO and UNICEF called on water and sanitation ministries to track and share data from utilities and regulators on WASH services provided to healthcare facilities



## SDG 3: Good health and well-being

The link between contaminated water supplies and the spread of disease has been known for at least 170 years, when London doctor John Snow published a paper showing that the city's recurrent cholera outbreaks were linked to polluted water in the slums of what was then the largest city in the world (2019 Science Museum, London). Improvements in sanitation and the chlorination of water supplies, have been key innovations that sit prominently alongside vaccines in improving global health.

Separate governmental structures result in water, sanitation and hygiene becoming relatively marginalized within health programming. In 2019, the Joint Monitoring Programme by UNICEF and WHO estimated that 896 million people were using healthcare facilities with no water and 1.5 billion people were using healthcare facilities that lack safe sanitation services.

The Director-General of the WHO and Executive Director of UNICEF made a joint call for urgent action.

## SDG 4: Good quality education

Education is denied when children get sick as a result of poor water, sanitation or hygiene facilities at schools, or when children, usually girls, are busy collecting water for the household, or when girls do not have access to menstrual hygiene facilities. According to the most recent JMP estimates, achieving universal coverage in schools will require a twofold increase in the current rate of progress on basic drinking water, a twofold increase in progress on basic sanitation and a fourfold increase in progress on basic hygiene services. Based on current trajectories, only 86 per cent of schools will have a basic water service, 87 per cent will have a basic sanitation service and 74 per cent will have a basic hygiene service in 2030 (JMP 2024).

### SDG 4 action points



Utilities to work with education ministries, local government and civil society to close gaps so that children have access to good quality water at school, clean toilets and menstrual hygiene services



Utilities to support schools' efforts to promote hygiene and educate children about risks to safe water and how to protect it



### SDG 5 action points



Utilities can integrate gender perspectives into their sanitation services by designing systems that account for the specific needs of women and girls. This includes creating safe and accessible sanitation facilities in public spaces and ensuring that water governance systems involve women in decision-making



Promoting gender equality in employment within water utilities — especially in managerial and technical roles — will strengthen the work of utilities in support of SDG 5



## SDG 5: Gender equality

Water, sanitation and hygiene are fundamental to ending discrimination against women and girls. When utilities improve access to safe water and sanitation, it reduces the time women spend on unpaid care and domestic work.

Women especially benefit from having water in the home, since they are usually responsible for cooking and most childcare. Girls especially need safe toilets in schools.

Utilities are also places where women can develop skilled and well-paid jobs with equal pay and status to men. Yet, a 2024 Editorial in *Nature Water* concludes that “women are underrepresented at all levels in the formal water workforce, yet overrepresented in the unpaid work of managing water, sanitation and hygiene resources at the household level” (Nat Wat Sept 2024).

According to a 2018–2019 World Bank survey of water and sanitation utilities in 28 countries, only 18 per cent of the workers were women (World Bank 2019a). On average 23 per cent of the engineers and managers were women and 12 per cent of utilities had no female managers at all.

“Moving forward, efforts to eliminate gender inequalities in the water domain are crucial. Women must not only be able to have equal access to water, but also have equal influence over its governance and management.” The report adds: “Utilities can play an important role in reducing and eliminating barriers faced by women.” (World Bank 2019a).

### Case study: Utilities recommend gender equality

*In 2017, the Danube Water Programme and the World Bank Global Water Security and Sanitation Partnership collaborated with utilities in the Danube region to look at gender equality in the workplace. Three utilities, with a combined workforce of more than 2,500 employees, took part in a gender assessment survey.*

The survey showed that women held more than a quarter — sometimes more than half — of junior management positions but utilities were failing to retain women in top management positions. Women represented less than a quarter of upper management staff in the Tirana Water Utility in Albania, but the middle management team included more than 50 per cent women, demonstrating a promising pipeline for future leaders.

The utilities had examples of flexible working and childcare support, but women were less positive than men about their career prospects and equal pay. In workshops at the end of the study, the utilities themselves recommended the following actions:



Conduct yearly gender pay gap assessments



Improve transparency for promotions



Implement a system to identify top talents.

The Danube Learning Programme (D-LeaP) includes a module on diversity and gender equality in its human resources management course for utility managers. The World Bank and partners established the Equal Aqua Platform that provides tools, resources and services to support gender equality efforts among water institutions. The platform updates a database on women in water jobs and offers a human resources survey that was completed by more than 200 institutions, including utilities. The platform offers support in achieving a better gender balance, partnerships and knowledge exchange. (World Bank 2019b & Equal Aqua)

## SDG 7: Affordable and clean energy

Water and sanitation utilities are big energy consumers. The World Bank estimates that electricity costs for water production, distribution and treatment can range from 33 per cent to 82 per cent of non-labour operating costs (World Bank 2019c).

A shift from fossil energy technology to renewables and boosting energy efficiency will make it easier to achieve objectives related to water access, scarcity, management and pollution. If wastewater utilities capture greenhouse gases (notably methane) and use it to generate electricity, they can contribute towards nationally determined contributions to the Paris Agreement on climate change, rather than being part of the problem.

By 2022, the Rzeszów Water Utility in Poland was already generating almost half of the energy it consumes through biofuel and solar power. It is working on alternative energy sources to reduce power consumption and transition faster to clean energy. In parallel, the utility optimizes equipment performance to become more energy efficient. These efforts translate into reduced operating costs (Jha et. al 2022).

The city of Monclova, Mexico installed variable speed drives at its water utility, improved pumping efficiency, replaced old pumping equipment with more energy

efficient pumps and optimized operational schedules, and succeeded in reducing the energy intensity of its water network by 23 per cent, paying back on its investment in less than two years (World Bank 2019).

Seeking alternative sources of water does not come without cost. Desalination, for example, demands high levels of energy. Improving motor efficiency in a desalination plant by less than 1 per cent can lead to significant savings in energy consumption and operational costs; in one example reducing carbon emissions by more than 2,000 tons a year (Smart Water 2025).

Utilities not only consume energy, but they are also affected by the vast amounts of water used by the energy sector and the thermal and chemical pollution that the energy sector releases into aquatic ecosystems (ICSU 2017). The International Council for Science recommends that the two sectors, energy generation and water and sanitation utilities plan and work closely together.

#### SDG 7 action points



Utilities to invest in alternative energy sources to reduce power consumption and transition to clean energy



Government oversight and funding will be required to accelerate progress in this area



Utilities to prioritize efficiency to reduce overall power consumption



Closer collaboration between energy and water sectors to protect nature and water reserves



Encourage peer-to-peer water operator partnerships to spread good practice



### Case study: Luapula Water Supply and Sanitation Company, Zambia: Harnessing biogas for a sustainable future

Zambia faces an energy crisis as climate change and drought reduce the reliability of hydroelectric power sources, giving urgency to the drive for alternative solutions. Luapula Water Supply and Sanitation Company (LpWSC) developed a biogas power project at a newly constructed sewage treatment plant, demonstrating that sustainable energy can enhance service delivery and mitigate the utility's impact on climate. The treatment plant contributes to national SDG 6 targets while addressing Goal 7 (Affordable and Clean Energy), Goal 9 (Industry, Innovation and Infrastructure), and Goal 13 (Climate Action). It also demonstrates the power of international partnerships (SDG 17).

The Luapula Water Supply and Sanitation Company (LpWSC) biogas plant in Mansa, Zambia, converts wastewater sludge into methane gas to power the facility, reducing dependence on the national grid, protecting the local environment and improving efficiency.

The plant, which receives sewage from more than 38,000 people in Mansa city, needs a reliable source of power since power outages are common. The LpWSC water treatment plant – on a different site 18 km away – relies on the national grid and has at times only been able to supply water for five hours a day.

The company's Director of Technical Services, says that the biogas plant has increased sanitation coverage in Mansa from 12 per cent to 38 per cent in a few months. More than 1,800 households and businesses are directly connected to the plant through a piped sewerage system.

Sludge is also collected by vacuum tankers from septic tanks. The Technical Director expects a thriving private sector to emerge to empty the VIP latrines.

The biogas plant uses advanced digestion technologies to convert wastewater sludge into renewable energy from the decomposition of organic waste. The power not only runs the treatment facility and its lighting and pump stations but has the potential for future expansion to serve the local community. As the plant increases its capacity it will look to supply local homes with electricity and biogas for cooking.

The GWOPA/UN-Habitat-managed European Union Water Operators' Partnerships (EU-WOP) programme linked LpWSC with three utilities from Germany and supported training in wastewater treatment technologies and the development of monitoring and evaluation systems to track performance<sup>5</sup>.



Instead of allowing methane – a potent greenhouse gas – to escape to the atmosphere, the utility harnesses it for energy production, mitigating environmental impact.



The plant significantly reduced electricity costs. Since March 2025, it has been powered exclusively by biogas, enhancing the company's financial sustainability.



The initiative ensures that organic waste is effectively utilized rather than harming the environment. The sludge by-product can also be processed into organic fertilizer, promoting circular economy practices.



The biogas project has created employment in plant operation, maintenance and related value chains, contributing to local economic development. It fosters skills in renewable energy and wastewater management, creating a knowledge base for future expansion.



The independent renewable energy source ensures uninterrupted operations and improves service reliability for communities.

## SDG 8: Decent work and economic growth

There is a positive link between utility services and national and regional economic performance. The overall wealth of society affects its ability to contribute to the costs of running water and sanitation utilities and create the conditions needed for long-term investments in infrastructure. The provision of reliable and safe water

and sanitation services supports a healthier society able to learn and work more effectively. A review of water use and circular economy notes: "The positive nexus between the urban water cycle and socio-economic development can provide financial gains for the public and private sectors, promote development, reduce unemployment, and create conditions for better public health." (Balata et al. 2022).

Pollution control measures have the twin benefits of enhancing water quality and protecting economic growth, as highlighted in a World Bank analysis that concludes "water pollution can wipe away over 33 per cent of a region's growth, depending on specification and country income level" (Desbureaux et al. 2019).

SDG 8 requires water and sanitation utilities to protect workers from risks and remunerate staff properly. Those who work in the construction and repair of water systems are vulnerable to what the US Occupational Health and Safety Administration (OSHA) calls the fatal four workplace accidents: falls, struck by objects, electrocution, and caught in between accidents, including trench or excavation collapses. (OSHA 2024).

A systematic review of occupational risk factors among sanitation workers and the effect of occupational exposure to human faecal sludge and wastewater on health outcomes suggests an elevated risk across a range of health conditions (Oza et al. 2022).







These include exposure to a range of biological and chemical agents, risk of injury including from work in confined spaces and psychosocial stress. "These risks are exacerbated for various reasons including poverty, illness, poor nutrition, poor housing, social stigma and societal neglect. In many low- and middle-income countries (LMICs), sanitation workers are more vulnerable due to unregulated or unenforced environmental and labor protections, and lack of occupational health and safety measures."

The review found "a clear need for further investigation and quantification of the health risks faced by sanitation workers, ...particularly in low-income countries, and of the effectiveness of governmental policies and other efforts to mitigate these risks."

Acute risks are faced by manual pit emptiers and others who work in sewers and pits without protection. A joint study from the World Bank, WHO, ILO and WaterAid in low- and middle-income countries called for more rights and better protection for sanitation workers. (World Bank, ILO, WaterAid & WHO 2019).

5 This case study is based on interviews with Golden Manyanga, Director of Technical Services at the Luapula Water Supply and Sanitation Company.

### SDG 8 action points

-  Water and sanitation facilities should be high status, high value and high welfare jobs in line with their valuable role in society
-  Utilities to invest in alternative waste of dealing with human excreta. Innovative technology methods are highlighted in Chapter 3
-  Where modern methods have not yet been employed, there must be protection and health provision for workers
-  Accidents and health risks should be monitored and Government protection for water and sanitation workers enforced
-  Regulatory bodies should play a role in improving working conditions
-  Action points listed under gender equality apply in full here. Without equality for women in employment utilities are wasting talent and creativity



In India, only 39 per cent of an estimated 20,000 decentralized sewage treatment plants meet regulatory norms, mainly due to inadequate infrastructure and improper operation (ASCI 2024). The Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013, seeks to end the unsafe and dehumanizing practice of manually cleaning, carrying, disposing of or handling human excreta in insanitary latrines.





One of the most contentious policy issues related to water utilities over the past 30 years has been over privatization. Proponents argued that privately owned utilities would be more efficient and lead to greater investment. Opponents stressed water as a public good and that profit could not be the driver for safe and universal services. Internationally, most utilities remain not for profit and owned by national or local government and there has been a shift from seeing privatization as a progressive model. In the United Kingdom, for example, where almost all water utilities were privatized in the 1990s, there has been increasing criticism of discharges of effluent into rivers, lack of investment and lack of democratic control.

### SDG 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

Since utilities have high infrastructure costs and need to modernize and ensure that infrastructure is resilient, SDG 9 is a daunting set of targets. However, as with SDG 8 (decent work and economic growth) there can be a virtuous circle as utilities improve performance, raise revenue and become more attractive propositions for investment. Measures to address climate change challenges apply here – to protect infrastructure from flooding and pollution.

Target 9.b is to support domestic technology development, research and innovation, industrial diversification and adding value to commodities. By engaging with local technology enterprises and universities, utilities can foster innovation to improve service delivery and efficiency. As utilities provide adequate supplies of water to new industries and better customer service they increase revenues. Innovation in water utilities is covered in depth in Chapter 3, including examples of working with high-tech start-ups.

### SDG 9 action points

-  Assess what is required to ensure that infrastructure is resilient, especially to climate change effects, and is protected from flooding, salinization and heat. See Chapter 3 for innovations
-  Introduce realistic and costed plans for improvement and seek investment
-  Partner with start-up and established technology enterprises to seek mutually beneficial projects
-  Establish a high-level group within the utility to assess potential innovations



## SDG 10: Reduce inequality within and among countries

The uneven and incomplete provision of quality piped water results in an unfair health risk to consumers who do not have access to a safe, reliable piped supply, and a cost burden where they turn to more expensive, possibly unsafe alternatives. The growth of the bottled water industry (Bouhlef et al. 2023) has been cited as an indicator of inequality.

Water and sanitation utilities help to reduce inequalities when they target services to vulnerable populations and underserved areas. This requires planning for the needs of different populations, by age, gender, disability and housing conditions and status, which in turn needs the ability to collect good quality data.

Competition for water resources can contribute to conflict between countries and displacement of populations. In the second decade of this century, water crises often appeared as one of the top five global risks identified by the World Economic Forum (WEF). In 2017, water was a source of conflict in 45 countries. A WEF commentary highlighted water-related insecurity as exacerbating friction within and between countries. "It can be weaponized; nefarious actors can gain control of, destroy or redirect access to water to meet their objectives by targeting infrastructure and supplies." (Van Der Heijden & Stinson 2019). The commentary also raised concern over the threat to water security from cyber-attacks.

By 2025, the World Economic Forum report no longer isolated global water risks but sees them as an integral part of the top four global risks over the next ten years: extreme weather events, critical changes to earth systems, biodiversity loss and ecosystem collapse and natural resource shortages (World Economic Forum 2025).

### SDG 10 action points



Utilities to play an active role in and support bodies that negotiate between sectors for use of water and to protect lakes, rivers and groundwater



Governments to ensure that intersectoral bodies and transboundary water organizations function well and are inclusive of utilities and citizens



## Case study: Utility-led water services for refugee and host communities

*The Itang Town Water Utility (ITWU) in Gambella, Ethiopia delivers cost-effective, reliable water services that foster social cohesion and improve public health. ITWU has an impact on Good Health and Well-Being (SDG 3), Clean Water and Sanitation (SDG 6), Affordable and Clean Energy (SDG 7), Climate Action (SDG 13), Reduced Inequalities (SDG 10), Peace, Justice and Strong Institutions (SDG 16).*

More than 60 per cent of all refugees are displaced for decades, served by under-resourced humanitarian systems that were designed for short-term responses (UNHCR/UNICEF 2020). The ongoing costs of providing water and sanitation can be crippling to humanitarian agencies and service levels are often low. Itang is hosting over 235,000 refugees from South Sudan alongside 26,000 members of the host community. Treated water from the Baro river was trucked to three refugee camps since 2014, but this was costly, unreliable and unsustainable. ITWU was established in 2017 to transition to a more sustainable service.

Further capital investments (totaling 32 million USD by 2024) included the development of a piped network, new storage facilities and a move towards grid and eventually solar power. Safe drinking water is now consistently available to both refugees and host communities.



A 92 per cent reduction in water service costs, from USD 11.38 per m<sup>3</sup> to USD 0.93 per m<sup>3</sup>



A significant increase in water production, from 700 m<sup>3</sup>/day to over 4,100 m<sup>3</sup>/day, improving both service reliability and access.

Improved water access in the refugee camps and host communities has reduced the incidence of waterborne diseases (SDG 3) and reduced the time children and families spent collecting water, freeing time for education and livelihood activities.

Transitioning from diesel-powered systems to solar energy reduced operational costs, improved energy efficiency (Target 7.3) and increased the share of renewable energy in the utility's operations (Target 7.2).

Solarization is less vulnerable to fluctuations in fuel costs and availability but is not a complete solution. The ITWU manager says: "Sustaining the utility in a place like Itang is tough. We pump water over 27 km and rising fuel and electricity costs make it harder every day. Solar power helps but it can't provide the same level of pumping throughout the year."

Before the utility took over, unequal access to water services had led to tensions between refugees and host communities, as both competed for limited resources. The transition to a utility-led model has ensured equitable access to essential water services. The cost per capita has been reduced by 82 per cent making water more affordable for low-income households in both communities.

The integration of services under a single utility significantly reduced tensions and increased social cohesion, key goals of SDG 16 (reducing conflict and violence).

The ITWU manager said: “Water provision should never be a source of conflict. In Itang, water brings different tribes together. Even in times of conflict, they protect our utility team, showing the community’s understanding of our role. The key is fair distribution; as long as we ensure that, water remains a unifying force, not a point of contention.”

Itang Town Water Utility has demonstrated that utilities can go beyond basic service provision, and impact on social cohesion, climate resilience, inequalities and health. The water manager says: “Water is everything in Itang. It connects various sectors, especially health and education, providing a foundation for better community well-being.”

The utility remains dependent on UNHCR to pay for the camps’ water supply and it will be a challenge to switch to a self-sustained service within the camps. Nhail said: “Refugees may not be willing to pay for services, which, combined with rising fuel costs, makes it critical to have a flexible business plan. We need to increase production to meet the demand of around 12,000 m<sup>3</sup> per day.”

This case study illustrates how utility-led models can contribute to the local realization of the SDGs even in remote and fragile contexts. By providing vital services, utilities can have an important role in managing the impacts of conflict and in preventing further conflicts<sup>6</sup>.

## SDG 11: Make cities and human settlements inclusive, safe, resilient and sustainable





Access to safe water and adequate sanitation is fundamental to the realization of the human right to adequate housing – these three human rights are interrelated. Without water and sanitation housing cannot be considered adequate, as these services prevent disease, ensure privacy, and enhance quality of life.

SDG targets 11.1, 11.3, 11.5 and 11.9 all relate to areas of immediate concern for water utilities, their levels of engagement with urban planning, the significance of any pro-poor policies and their overall service levels. Target 11.1 is access for all to adequate, safe and affordable housing and basic services, and to upgrade slums. As stated in the introductory chapter to this report, more than 1.1 billion people live in slums or informal settlements (UN-Habitat 2024).

Target 11.3 aims for inclusive and sustainable urbanization while target 11.8 calls for economic, social and environmental links between urban, peri-urban and rural areas. Utilities have a specific role in collaborating with local government and others on targets that require the improvement and expansion of services. They need to be involved in strategic planning and investment to address these targets.

Target 11.5 is about reducing harm from disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations, while 11.9 seeks increases in the number of cities implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change and resilience. It seeks to increase the number of towns and cities with strategies for disaster risk management. Integrated planning led by regional and city authorities requires the full involvement of water and sanitation utilities.

### SDG 11 action points

-  Utilities to have an implementable policy of leaving no one behind – providing services irrespective of the status of housing and land tenure
-  Governments to integrate water and sanitation into housing and urban policies and actively involve utility companies in urban planning processes
-  Utilities to be involved in disaster risk planning bodies at national and regional levels
-  Utilities to be integrated into climate mitigation and adaptation bodies and supported with climate finance to mitigate harmful effects and improve resilience



<sup>6</sup> This case study is based on UNICEF and UNHCR initiated and funded research under the Regional WASH Programme for Refugees, IDPs and Host Communities in East Africa (R-WASH) (Pearce et al. 2024). It is also based on an interview with ITWU General Manager Nhail Pal.

## Case study: How a 2000-year-old aqueduct can help ease city heat islands

*Like many cities, Athens is facing a water crisis. Climate change and the continuing increase in tourism put resources under pressure. Greater use of wastewater can save drinking water (SDG 6), support clean energy (SDG 7), stimulate industry, innovation and infrastructure (SDG 9) and strengthen sustainable cities and communities (SDG 11).*

In April 2025, the Athens Supply and Sewerage Company (EYDAP) reported a 30 per cent drop in Attica's water reserves compared to 2024 and announced contingency plans to charter tanker ships. EYDAP is planning a 20-km tunnel to transport 200 million m<sup>3</sup> of water per year from Lake Kremasta to secure the future water supply in the Attica region, which includes Athens, Piraeus and nine islands.

EYDAP is also taking measures to save water and reduce non-revenue water by replacing old pipelines, introducing smart meters and exploring modern desalination techniques.

At the same time, the utility and the Municipal Council of Athens are exploring ways to contribute to climate change resilience and develop new industries by making better use of water that currently runs to waste. Using treated wastewater for industrial and irrigation purposes helps to protect drinking supplies, creates more green and blue spaces, reduces heat levels and contributes to circularity. In 2024, the city and 75 partner organizations signed a climate neutrality agreement to make the city climate neutral by 2030. This includes developing an integrated water management strategy to prevent flooding, cool the city, reuse water, highlight water sources, restore natural water flow corridors, reduce water consumption from the municipal network and save energy.

These plans demand innovation, finance and cross-collaboration between sectors. And one Athens project is pointing a way to protect the future by looking to the past.

The 2000-year-old Hadrian Aqueduct was part of a 23.7-km tunnel constructed by the Roman emperor to bring

water to Athens in the second century CE and it continued to supply water to Athens until the 1930s. Water collects in the aqueduct from underground aquifers and streams, flowing beneath eight municipalities, reaching the central Athens area of Kolonaki.

EYDAP worked with the Municipal Council for the Halandri area of Athens to build two underground concrete storage tanks (with capacities of 90m<sup>3</sup> and 135m<sup>3</sup>) to collect water from the ancient aqueduct. The water passes through filters and UV treatment before flowing to parks and gardens through 4.2 km of new irrigation network.

The original aqueduct has a capacity of 800,000 m<sup>3</sup>, of which up to 120,000 m<sup>3</sup> will be available for greening the city and industrial use – expected to result in tripling the amount of green space in Halandri.

Reviving the aqueduct has been a joint effort involving the Ministry of Culture, the Urban Innovative Actions programme, the Municipal Council for the Halandri area of Athens and EYDAP, alongside cultural groups, schools and students. EYDAP hopes to expand the pilot to the entire Attica region, engaging all eight municipalities along the aqueduct's route to harness this valuable natural resource. More than 55 organizations are engaged in this initiative.

The costs for this urban innovation have been shared and include EUR 3.13 million from the European Union and EUR 453,000 from EYDAP's own funds.

Hadrian's Aqueduct makes a modest contribution to the bigger picture of Attica. But the Director of Strategy and Innovation at EYDAP, and one of the original team that inspired this initiative, sees it as a way to highlight innovations that create more green space in densely populated cities and can tackle the urban heat island effect that sees temperatures in cities soar.

"Climate risk management is high on the agenda of cities. Everybody looks to the water companies to find solutions for water-related risks that were not a traditional part of their agenda and mission. Water companies need to solve flood problems and go into rainwater management, controlling water resources at source, quantitatively and qualitatively."

Section of the Hadrian Aqueduct near the ancient Agora, Athens.  
Photo: Carole Raddato



Creating green and blue spaces in cities is part of climate change resilience and environmental protection and requires collaboration between governance institutions and the water utilities in urban development planning. "All of the decisions were taken together with the municipality, the Ministry of Culture, active citizens undertaking social and educational activities around the aqueduct and researchers," says the EYDAP Director of Strategy.

Greece has had a policy in favour of urban wastewater reuse for non-drinking purposes since 2011, but the EU does not yet have one. The EYDAP Director of Strategy believes that the EU can play a leading role by promoting engagement and creating incentives to stimulate demand for wastewater. "We need to think of new ways of funding and making it sustainable. Not everything can come from water tariffs because the scope is much larger and water resource management is traditionally paid for through taxes not through your water bill."

He says that the public is already ahead of the game. "In my part of the world, water is such a big issue that it has opened the minds of people to other sources of water. I view citizens and associations and community groups as ambassadors, as people who vote and can change the minds of cities. I do not think it is hard to convert them. I see them as champions."

The EYDAP Director of Strategy emphasizes that Athens is just at the start of this journey, which will involve everyone stepping out of their traditional roles. "We should be discussing with municipalities how to create more green spaces, given the heat island effect. We should be telling them: "Come on guys. We will bring water, you will bring greenery and we will join forces?"

## SDG 12: Ensure sustainable consumption and production patterns

Target 12.2 is to achieve sustainable management and efficient use of natural resources, a central objective for utilities both in the production of safe water and in effective sanitation to prevent pollution.

Careful wastewater treatment and chemical treatment of drinking water utilities impact on target 12.4 – the environmentally sound management of chemicals and all wastes.

Target 12.8 places demands on utilities to ensure that people have relevant information and awareness for sustainable development. Utilities play a key role in explaining the financial and environmental costs of safe water to local populations, and the damaging impact of

wasted water, unsafe sanitation and poor hygiene. By engaging with schools and universities they can help to build a generation of younger people with a better understanding of the water cycle and a commitment to sustainable consumption.

### SDG 12 action points



Utilities to work to reduce non-revenue water and encourage sustainable use by consumers



Modalities to be adopted for fairly sharing the responsibility and cost for preventing and treating water pollution, including with industry



Utilities to engage with citizens to build a society that is knowledgeable about the need to protect water from waste



Utilities to include sustainability reports in their reporting



## SDG 13: Take urgent action to combat climate change and its impacts

Utilities have a central role as water stewards and sanitation service providers in addressing challenges of operating in climate-stressed areas with increasing pressure on resources.








Strategies that include resilience and adaptation measures are required to adapt to water scarcity and extreme weather events, and to protect and restore water-related ecosystems, such as rivers, flood plains and dammed areas. Drought reduces fresh water availability while flooding and storm surges damage water quality and increase the risk of contamination through algal blooms and microbial contamination. Rises in sea water levels leads to the salinization of groundwater. Extreme events put critical infrastructure at risk.

Sanitation and wastewater systems contribute to greenhouse gas emissions both directly through breakdown of excreta and treatment processes, and indirectly through the energy used in treatment.

The International Water Association (IWA) estimates that total emissions from water and wastewater could exceed 7 per cent of total greenhouse gas emissions if off-grid residential areas, untreated sewage discharges into rivers and industrial treatment are taken into account.

7 This case study is based on published material, concerning the Halandri Aqueduct extension, an interview with Giorgos Sachinis, Director of Strategy and Innovation at EYDAP, and follow up exchanges with EYDAP staff.

### SDG 13 action points

-  Improve efficiency of water and sanitation infrastructure
-  Ensure that plans to improve utility infrastructure, performance and resilience are included in nationally determined contributions and use this as a launching pad to bid to access climate mitigation funding
-  Reduce reliance on fossil fuels and plan technology that will reduce greenhouse gases
-  Diversify water sources to include rainwater harvesting and wastewater reuse
-  Improve sustainable groundwater management
-  Improve monitoring and early warning systems to track climate-related water risks
-  Support nature-based solutions such as conserving and restoring wetlands, forests, coastal mangroves and natural floodplains



A paper in *Nature* (Dickin et al. 2020) estimates that energy recovery from wastewater systems could provide over 55 per cent of the electricity required for municipal wastewater treatment by 2040. It also highlights the significant potential for recovery of nutrients in waste, reducing dependency on fossil-based chemical fertilizers.

Significant amounts of greenhouse gases from wastewater and faecal sludge can be reduced through improved design, management and operating conditions at wastewater treatment plants. Emissions from untreated wastewater are estimated to be three times higher than emissions from conventional wastewater treatment plants (Ingemarsson et al. 2023). Yet opportunities to take action to improve utility infrastructure and performance are being overlooked in nationally determined contributions that set each country's aims to reduce national emissions and adapt to the impacts of climate change. "The limited inclusion of sanitation within the nationally determined contributions and climate finance indicates little awareness of the linkages between sanitation and climate change among stakeholders, and a need to strengthen this evidence in terms of impacts, as well as mitigation and adaptation opportunities." (Dickin et al. 2020).

Decisions have a particular significance as utilities expand wastewater systems and replace ageing facilities which generate more greenhouse gases and use fossil fuels. Planning more efficient and less polluting infrastructure can be an entry point for utilities to access climate mitigation funding. Climate-resilient infrastructure will help utilities adapt to changing weather patterns and mitigate operational risks. Nature-based solutions find ways to use the natural resilience of the earth to reduce risks and mitigate damage. They involve measures to protect, restore and manage the natural capacity of ecosystems to absorb and store

atmospheric carbon, while maintaining or enhancing biodiversity and ecosystem services (Ingemarsson et al. 2023).

These include conserving and restoring wetlands, forests including coastal mangroves and natural floodplains in water courses to protect these net sources of greenhouse gases. For example, peatlands only cover about 3 per cent of the world's land surface but store at least twice as much carbon as all of Earth's forests, while mangrove soils can sequester up to 3-4 times more carbon than their terrestrial counterparts (Ingemarsson et al. 2023).

Utilities can be directly involved in disaster risk reduction (Target 13.1), providing early warning via monitoring.

### Case study: Improving resilience

*The Climate Smart Utilities Initiative urges utilities to commit themselves to improving resilience and mitigation to reduce GHG emissions. The initiative was launched by the IWA to inspire leadership on climate change and to promote peer-to-peer exchanges. In 2024, 25 utilities from 20 countries were recognized for their actions, 16 of them in the 'most inspiring' category.*

Action taken by utilities included reducing water use, diversifying water sources, adapting sanitation strategies to accommodate fluctuations in water flow, providing adequate drainage to reduce the risk of flooding and supporting a robust asset management and maintenance programme for infrastructure. Mitigation measures include adapting wastewater and biosolids management, maximizing resource recovery, achieving high energy efficiency and investing in low-energy and low-carbon infrastructure<sup>8</sup>.

8 Source IWA: Climate Smart Utilities <https://iwa-network.org/projects/climate-smart-utilities/>

## SDG 14: Life below water

Conserving and using oceans, seas and marine resources sustainably, places demands on utilities near coastal areas to reduce maritime pollution (Target 14.1) and help to maintain coastal ecosystems (14.2). Optimizing water treatment technologies and implementing stricter pollution controls will minimize wastewater runoff.

## SDG 15: Life on land

Wastewater pollution impacts adversely on ecosystems and biodiversity. These are areas where utilities can play a role in partnership with other institutions and communities – especially in relation to sustainable management of freshwater ecosystems (Target 15.1) and by monitoring water use and extraction rates.

### SDG 14 and 15 action points

Action points to combat climate change and its impacts (SDG 13) will also work to protect life below water and life on land. In particular, they:



Improve sustainable groundwater management



Improve monitoring and early warning systems to track climate-related water risks



Support nature-based solutions such as conserving and restoring wetlands, forests, coastal mangroves and natural floodplains



## Case study: Utilities in Costa Rica raise funds to protect ecosystems

*Utilities in Costa Rica are playing a leading role in protecting ecosystems, focusing on target 6.6 to protect and restore water-related ecosystems and 6.8 to strengthen the participation of local communities in water and sanitation management. This supports Costa Rica towards meeting SDG 13 on climate action and meeting SDG 15, in particular 15.1, to conserve and restore freshwater ecosystems, 15.9 to integrate ecosystem and biodiversity values into local planning development processes and 15.10 to mobilize financial resources for biodiversity and ecosystems.*

Costa Rica is recognized as a world leader in sustainability. In 2019, it generated more than 99 per cent of its electricity from renewable resources and it currently achieves 97.8 per cent household water coverage for its five million plus population.

Progress is, however, threatened by poor waste management and water contamination, along with the pressure of urban growth. Costa Rica is one of the world's largest consumers of agrochemicals, risking contamination of aquifers and water sources. Moreover, a large fiscal deficit has affected social programmes and deepened inequality.

Despite this, water utilities have pioneered a water resource protection tariff to play their part in sustaining ecosystems and aquifers. The tariff enables water

service operators to add a small amount to bills to finance activities that protect, restore, preserve and improve aquifer-related ecosystems, and to promote more sustainable water use in communities.

Utilities can invest in projects that restore and protect aquifer recharge areas and the ecosystems that sustain them, and in projects that promote climate change adaptation.

The pioneer was Empresa de Servicios Públicos de Heredia S.A. (ESPH), a public utility that provides electricity, public lighting, drinking water and sewage services to 66,000 users in Heredia, San Rafael and San Isidro de Heredia. In the 1990s, it assessed the environmental costs of drinking water provision, and in 2000 the Autoridad Reguladora de los Servicios Públicos (Regulatory Authority of Public Services, Costa Rica, or ARESEP) approved a request to charge a protection tariff.

ESPH uses its extra tariff funds to protect micro-basins for six rivers through a programme that includes buying up degraded land, creating inter-institutional partnerships and promoting participatory management and environmental education.

ARESEP later established a scheme under which other operators can implement a tariff if they submit a five-year strategy to protect areas strategically important for water recharge, drainage or catchment for aqueducts. So far, the tariff has been applied by only three operators, but numbers are set to grow.

ARESEP is building the capacity of more than 50 community water and sanitation providers (ASADAs) so that they can apply the tariff in their communities. One ASADA has won approval to study the vulnerable River Blanco sub-basin, protect ecosystems and raise awareness of water protection and contamination issues.

Convincing users about the tariff is difficult during an economic crisis, even when it is modest and for a good cause. Many ASADAs already encounter difficulties in collecting regular tariffs. Utilities are working to raise public awareness of the need to take collective responsibility for water protection and ensure greater participatory management<sup>9</sup>.

## SDG 16: Peace, justice and strong institutions

Scientists convened by the President of the UN General Assembly before the Global Water Conference in 2023 warned that conflict over water will become more common without science-based water diplomacy, but pointed out that commissions and conventions provide a framework for nations to negotiate over water – there are more than 120 river basin commissions around the world which represent a successful example of international partnerships (UN press release 2023).

The UN World Water Development Report, Water for Prosperity and Peace, concluded that the relationship between water and peace/conflict is complex and difficult to establish (UNESCO 2024). The report offers examples where cooperation over water resources generated positive and peaceful outcomes, from participatory, community-led initiatives that relieved local tensions to the contribution of transboundary water organizations in dispute settlement and peacebuilding.

Utilities have an opportunity to contribute to the overall strength of civic society and reduce political tensions around the use and distribution of water as a critical

### SDG 16 action points



Support transboundary platforms to agree on water sharing and reduce tensions



Introduce integrity measures that promote trust in utilities



human resource. The goal of promoting peaceful and inclusive societies, providing access to justice for all requires (Target 16.6) institutions to be effective, accountable and inclusive. Utilities need to combat all forms of corruption and bribery (16.5) and ensure responsive, inclusive, participatory and representative decision-making (16.7). The funding of utilities and the proportion of the population satisfied with public services contribute to indicators for this SDG. Utilities with strong customer engagement enhance transparency and build trust.

## SDG 17: Partnerships for the goals

Utilities rely on partnerships, international cooperation and capacity-building to meet water and sanitation needs, improve services, and address broader sustainability challenges. International partnerships, loans and grants are all vital to mobilize resources for water and sanitation utilities and fund large-scale projects in water conservation and management.

Within countries, important partnerships described in this report are those between utilities and local government and between the water and sanitation sector and sectors focused on public good such as health and education.

The work of Water Operators' Partnerships described in this report is one way that water utilities in low- and middle-income countries benefit from access to

### SDG 17 action points



Support and build collaborative partnerships between governance bodies, utilities and citizens to promote inclusive, safe, resilient and sustainable cities



Invest in utility capacity development to enhance the effectiveness and sustainability of improvements



Support and take part in peer-to-peer and country-to-country partnerships



Introduce integrity measures that promote trust in utilities



<sup>9</sup> This case study is based on a UN-Water SDG 6 Country Acceleration Case Study published in 2022. The full report can be found at [https://www.unwater.org/sites/default/files/2022-08/CountryAccelerationCaseStudies\\_2022\\_Costa%20Rica\\_ENG.pdf](https://www.unwater.org/sites/default/files/2022-08/CountryAccelerationCaseStudies_2022_Costa%20Rica_ENG.pdf)

relevant and innovative technologies for water treatment, metering and resource management. By 2025, GWOPA/ UN-Habitat has supported more than 750 utilities across 119 countries, coming together in more than 490 Water Operators' Partnerships, which benefited 58 million people with improved services as a result.

## Case study: Nepal progress on SDG 6 addresses major hurdles

*The World Organization of United Cities and Local Governments (UCLG World) promotes voluntary sub-national reviews to strengthen reporting at a national level and ensure that the targets and goals are aligned at local and sub-national levels. The Nepal voluntary sub-national review analyses progress by Nepal's sub-national governments in achieving Sustainable Development Goal 6. It demonstrates the power of partnerships in strengthening progress.*

Nepal is a country of 29.1 million people of rich ethnic and linguistic diversity with the ambition to become a middle-income country by 2026 and to achieve the SDGs by 2030.

In 2015, Nepal became the first country to set a baseline for tracking progress on the SDGs. It mainstreamed SDGs into national planning and budgeting, established an SDG Steering Committee chaired by the prime minister and published a national strategy for evidence-based monitoring and reporting.

The Nepal voluntary sub-national review 2024, prepared by the Municipal Association of Nepal (MuAN) in collaboration with UCLG World and regional bodies, details challenges Nepal faces in providing equitable access to top water and sanitation services, particularly in rural and underserved urban areas.

Despite significant progress, there are still obstacles. As of 2022, more than 96 per cent of households had access to a basic water supply. However, little more than a quarter of households had drinking water of good enough quality. Of 42,000 water supply systems, only 28 per cent are fully functional.

In 2019, Nepal became the first country in South Asia to declare itself open defecation free and is very close to achieving its safely managed sanitation target. However, only 11 per cent of the population has sewerage sanitation and only 2.1 per cent of wastewater is treated. Persistent waterborne diseases underline the need for improved sanitation practices.

Urbanization is mounting pressure on services while droughts, floods, fires and landslides have damaged water and sanitation infrastructure, especially affecting marginalized communities.

Each of Nepal's seven provinces is responsible for the development of water resources, including planning, regulation and management of water supply and sanitation services. The country's 753 local governing bodies, 6 metropolitan cities, 11 sub-metropolitan cities, 276 municipalities and 460 rural municipalities are each responsible for implementing WASH initiatives.

Provincial disparities indicate the need for targeted interventions to strengthen provincial and municipal capacities to address local challenges. Challenges at the sub-national level include policy fragmentation, implementation hurdles, resource constraints, capacity gaps and environmental vulnerabilities.

Local governments, especially in rural areas, over-rely on federal, government and external resources rather than municipal resources. Only 0.3 per cent of provincial WASH funds went to sewerage management; five of seven provinces made no allocation.

Sub-national and local governments have limited skills, knowledge and institutional capabilities required to implement and manage WASH services. There is a shortage of skilled workers and insufficient resources for long-term WASH facility maintenance.

### Recommendations for improvements

-  Province-specific SDG 6 progress assessments and public expenditure tracking
-  Immediate preparation of municipal WASH plans to close resource gaps
-  Targeted capacity-building programmes for SDG 6 planning, monitoring and implementation
-  Addressing the funding shortfall and leveraging private sector financing
-  Enhancing WASH programmes in schools and healthcare facilities
-  Targeting provinces that need to expand access and repair water supply systems
-  Increasing the percentage of households with private water taps
-  Leave no one behind, focusing on marginalized groups
-  Promoting climate-resilient infrastructure and sustainable water management



These weaknesses have resulted in delays and insufficient focus on unserved and unreached populations. The review concludes that Nepal needs to tackle policy, resource, capacity and environmental constraints to advance more effectively towards

universal, equitable access to safe water and sanitation<sup>10</sup>.

10 Source: Nepal's 2024 Voluntary Sub-National Review Ensuring Clean Water and Sanitation for All, prepared and submitted by the Municipal Association of Nepal (MuAN) in Association with the United Cities and Local Governments (UCLG World), Kathmandu, June 2024.

Water treatment plant in Mardan, Pakistan.  
Photo: Ikram Ullah/Water and Sanitation Services Company, Mardan



## Conclusions

Connections between SDG 6 – safe water and sanitation for all – and other SDGs are powerful and dynamic given the central role that water plays in the lives of people and the environment, and the challenge of providing safe sanitation and the safe management of faecal sludge.

This chapter illustrates the linkages between meeting SDG 6 for safe water and sanitation and the goals for poverty, health, climate, biodiversity, cities, food, decent work, peace and other related goals and targets. It shows that progress towards the global goals largely depends on action at the localized level where decisions are taken by cities, towns and communities about how they are implemented.

Locally, water and sanitation utilities can be agents of change, so long as they are not working alone. Maximizing synergies and minimizing any negative trade-offs, as development takes place, requires negotiation and partnership between sectors and institutions that traditionally have worked in their own silos. At national and local level, governments play a central role in bringing these sectors together. With support and good leadership, utilities can respond.

The case studies and examples in this chapter suggest that utilities can inspire new ways of working when they make partnerships – whether through contact with utilities in other countries, as in Ghana, through partnerships with other sectors, as in Athens, with refugee camps as in Ethiopia, or through sharing expertise through Water Operators' Partnerships, as in Zambia. In all these cases, water and sanitation utilities have been able to break free of some of the shackles of conventional thinking and adopt new practices that promise a way forward.

There are increasing opportunities to become more connected and less isolated, opportunities within the sector, through Water Operators' Partnerships, and in cross-sector movements that seek to make growing cities healthier, safer and better places to live. Voluntary local reviews provide entry points for utilities to have a greater input into sustainable development and to maximize support for their services.

The links between the SDGs are not academic or theoretical. They are practical and they invite action. When supported, utilities can play a far greater role in planning the future of urban development with approaches that do not exclude areas, populations or demographics, but provide services for everyone, forever.

Climate change is one of the most profound challenges facing utilities. This chapter briefly touches on actions that utilities and governments can take. These are expanded on in Chapter 4.

Global targets for SDG 6 are currently not being met which means that many millions of people are not achieving their human rights to access safe water and sanitation, and are not seeing any of the benefits that they bring, especially in cities. These benefits justify raising the ambitions, range and delivery of water and sanitation utilities. This will undoubtedly require increased finance at a time when some avenues of international transfer are being closed off, but it also requires a high level of leadership within utilities to improve performance and break out of silos (a focus of Chapter 3) and improvements to the enabling environment/systems in which they operate, which is the focus of Chapter 4.

A worker at Lusaka Water Supply and Sanitation Company  
Photo: Lior Sperandeo/BORDA/GIZ



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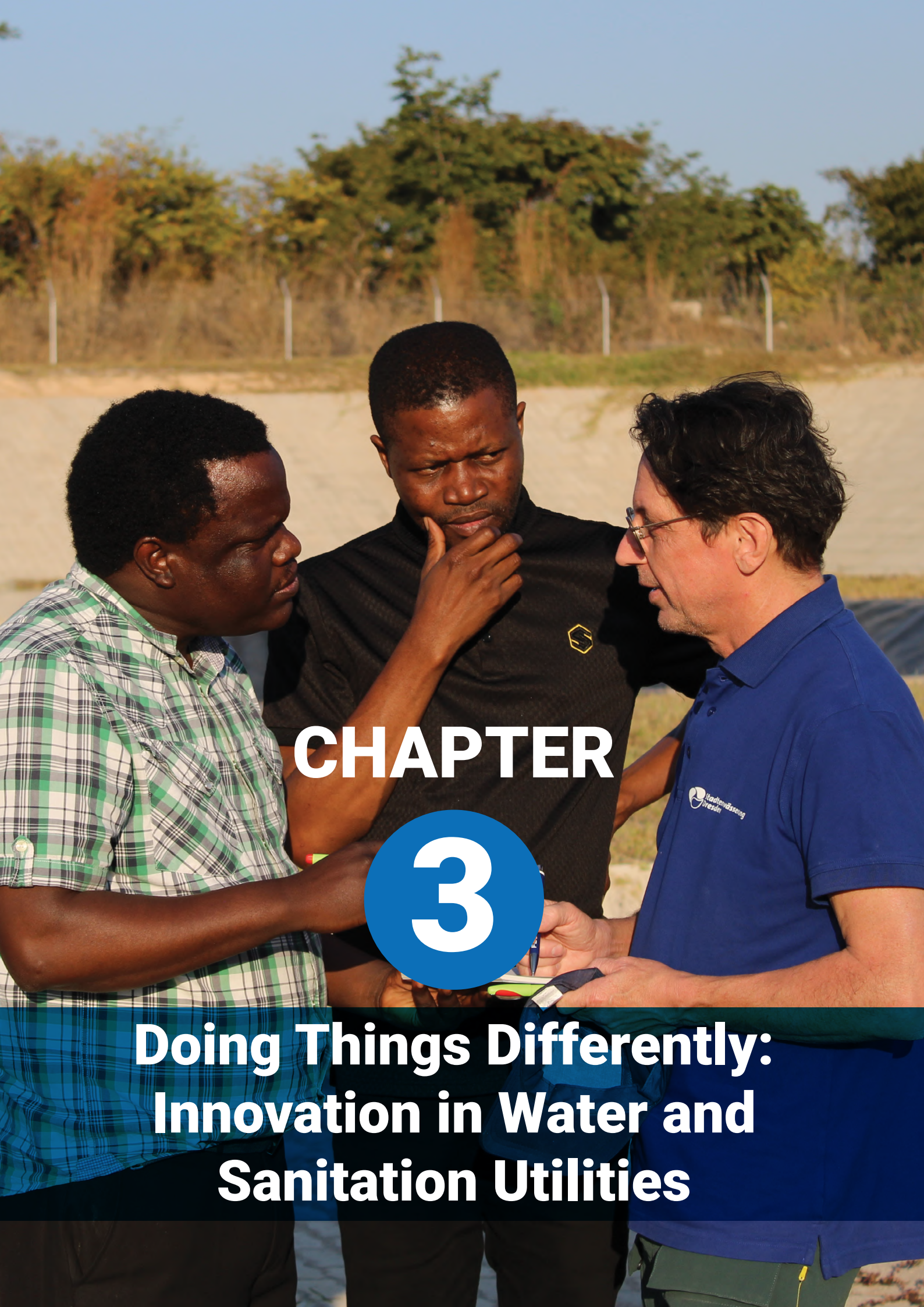
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Water tower at borehole in Kawambwa, Zambia.  
Photo: Lothar Mikulla/GWOPA/UN-Habitat





# CHAPTER

# 3

## Doing Things Differently: Innovation in Water and Sanitation Utilities

## Introduction

This chapter focuses on innovation within water and sanitation utilities, in a context where many face huge financing challenges and are not able to even cover the costs of operations and maintenance. Performance in terms of delivery and financial stability is often low. Innovation, doing things differently to bring about improvements, requires changes internally within the utility itself and externally within the wider enabling environment. This chapter describes some of the changes that are possible within utilities, discusses how such change can come about and what difference it can make to utilities and their performance, while Chapter 4 explores solution pathways within the wider system boundaries.

Making improvements, whether in managerial changes, capacity development, integrity strengthening, customer relations, efficiency or new technology, has to be managed so that change is embraced by the utility, relations with the wider enabling environment are clearer and stronger, the public and customers have more trust in services and technology is targeted where it gives greatest benefit. A service provider needs to get the basics right before introducing greater complexity.

For example, it is not helpful for what the World Bank calls a basic or elementary utility (World Bank 2021) to be overwhelmed with innovative technologies in advance of having a viable tariff and revenue collection system to fund basic tools and spare parts. Technical innovation is initially more costly, and while new equipment or technologies ideally pay for themselves over time, scarce capital for investment has to be carefully deployed.

Innovation can build on what is in place and become progressively more sophisticated. To detect leaks, staff may use listening sticks (acoustic first, then electronic), before thinking about electronic leak noise correlators and then acoustic loggers to pinpoint leak locations. Eventually, with investment, a utility may be able to introduce systems with thinking smart meters with built-in acoustic leak detection supported by artificial intelligence data analysis and distribution network optimization. Other technologies, such as mobile billing and mobile money micro-payment systems, enable service providers to leapfrog a level of development with a more efficient and effective system.

This approach to technology can provide a lesson for broader changes in the way that utilities develop, from simpler smaller providers, to complex and sophisticated utilities with thousands of staff and millions of customers who rely on them for these fundamental services. Sometimes the issues that utilities have to address are not about technology at all.

If the underlying challenge is society not wanting to pay for (safe) water, let alone safe sanitation, then a different approach to innovation may be required. Where utilities are not financially viable, even with some agreed level of ongoing subsidy from government, then the services they are contracted to deliver are less likely to effectively reach the poorest, or to be resilient or sustainable, irrespective of new technology. The reality is that when water and sanitation utilities are under-performing, improvements will usually come first from managerial or capacity-building changes. These organizations of people have to manage capital-intensive systems to deliver improved water and sanitation to cities and towns and villages. They need to increase professionalization and skills as their service areas and populations expand and the cost of accessing additional water resources increases in a period of climate change. Sometimes the innovation consists of making those improvements.

Case studies in this chapter take account of contexts and show that there are nevertheless innovations that can help service providers accelerate their development in both management and technological approaches at the utility level.

This chapter draws upon four main case studies: Chan & Mukherjee 2009, Mugisha 2019, Muhairwe 2009 and Vathanan 2024. They represent innovative middle-sized public utilities, predominantly focused on piped water supply. Many of the lessons originate from publications written by or interviews with their managing directors. These leaders understand the bureaucratic and system challenges, the extent to which the enabling environment helps or hinders, the never-ending small and large challenges of corruption, the need to manage technological innovations and how to motivate an institution to operate beyond the current accepted level of service. This chapter attempts to amplify their voices.



## Systems thinking and change within utilities

This chapter takes a systems approach to investigating utility challenges. A systems approach recognizes that the reason for poor performance is often found in a mixture of weaknesses within utilities themselves and of limited sectoral and governance capability in the wider environment.

Some key performance indicators by which it is possible to measure the strengths and weaknesses of utility services include coverage, quality, non-revenue water, non-treated wastewater and return on capital employed. Systems thinking approaches are useful to help identify what has to be addressed to improve these indicators.







Three decades ago, the World Health Organization (WHO) concluded that lack of effective management had the greatest negative impact on water supply and sanitation services, “particularly evident when there are no clearly defined objectives, no long-term planning and no short-term programming or budgeting” (WHO 1994). In short, the WHO identified in a guide for managers that




“the prime factor responsible for poor operation and maintenance is a lack of operational and management control combined with limited leadership and directorial skills and aggravated by poor information systems on which to base sound decisions.” They recommend a systems approach that enables managers to describe and reorganize the service framework of a water supply and sanitation utility and allocate resources so that targets can be achieved efficiently.

Over time, a utility may develop from a single source groundwater local supplier to one that supplies water across a region, using multiple sources of groundwater and treated surface water. However, the underlying systems and functions remain the same. The 1994 WHO insights can be set alongside its more recent *Utility of the future* document (World Bank 2021), that seeks to support a utility to become “a future-focused, action-oriented and continuously improving utility that provides reliable, safe, inclusive, transparent and responsive water supply and sanitation (WSS) services.” It is possible to identify nine key groupings of functions that need to function well:

Figure 3.1. Building blocks for water and sanitation services at the utility level



-  **Infrastructure planning and development** – to make decisions about investments in capital expenditures and capital maintenance expenditures that enable improved and more efficient services.
-  **Operations and minor maintenance** – to sustain high quality services to all while using operational expenditures efficiently.
-  **Customer services** – to engage with customers in ways that ensure satisfaction, generate revenue and enable wise water use.
-  **Finance and accounting** – to mobilize efficient cost-reflective tariffs in conjunction with subsidies.
-  **Administration and human resources management** – to have the right people in the right place at the right time with the right skills and resources.
-  **Information technology** – to enable the uptake of appropriate digital solutions.

-  **Benchmarking, monitoring and evaluation** – to understand how the organization is performing and promote action.
-  **Board and corporate affairs** – to ensure high quality leadership and effective management.
-  **Leadership** – to create change and inspire action at a utility-wide scale.

These functions (Figure 3.1) are the building blocks of any public service utility. Managing a single source village supply may appear straightforward but as demand increases, more sophisticated organizational structures can lead to bureaucratic procedures, silo thinking, stagnation and reduced efficiency. By contrast, many of the innovations described in this chapter come from new, dynamic leadership having the confidence to challenge the existing systems and empower junior staff whilst introducing new control mechanisms. This chapter examines each of the building blocks.

## Innovations in Planning and Development

Infrastructure planning and development are shown at the centre of figure 3.1. Infrastructure-related decision-making accounts for the largest proportion of total costs in almost every utility and will define major parts of the system for years and decades.



### Setting service objectives at utility level

Utilities have to be clear about what they are trying to achieve. The Ugandan national utility in its most recent three-year corporate plan (NWSC 2024) had clear measurable goals of increasing the customer base from 950,000 to 1,135,000 water connections

and growing the population served from 19 million to 22.6 million people. It is possible to better understand the value and scale of such targets when recognizing that the utility served just over 50,000 connections in 1998. By 2017, it had increased ten-fold to 530,000 connections.

The Water Corporation of Odisha (WATCO) in India had been facing severe water supply challenges for decades and the water supply infrastructure could not cope with the pace of urbanization. There was poor service coverage, poor water quality, intermittent supply and high-water losses. The objective became: “improving the level of urban drinking water services in the state for universal coverage with adequate quantity and acceptable quality of drinking water supply, with easier and equitable access of the services to all categories of people in the society” (Vathanan 2024). Early in the reform period, the department took a bold decision to provide two taps per household for the urban poor people, one in the kitchen and the other in the toilet. This was believed to be “real empowerment, especially for the women of the households.”

NYEWASCO, Kenya, extended its successful urban coverage into low-income areas and informal settlements in 2019 by radically rethinking its customer service charter and making a pro-poor policy central

to its decision-making strategy (GWI 2020a). Some governments have believed that it is inappropriate for state utilities to service illegal slums and settlements. However, including the poorest urban dwellers in the benefits of a piped on-premises supply can be seen as the complete justification of having a state managed or supervised supply.

It is relatively straightforward at global level to make promises of services for all. Delivering on universal supply targets at utility level and serving those whose revenue contributions rarely cover costs, is a critical innovation completely in line with SDG 6.

### Water safety planning and continuous water supply

Water safety plans are risk assessment and management strategies for ensuring the safety and quality of drinking water supplies from catchment to consumer (WHO 2023). They aim to prevent contamination of water resources, ensure water is treated and prevent re-contamination during storage, distribution and handling. The overall aim is to ensure “a continuous supply of safe drinking water to safeguard public health.” For each defined objective, measurable indicators are developed, with corresponding goals that allow progress to be measured.

In Odisha, India, the leadership of the utility questioned why people were continuing to drink bottled water instead of tap water. WATCO realized the value not only of making sure that their water was of good quality, but of ensuring that people understood that it was safe to drink from the tap without filtering or boiling.

Supplying continuous pressurized water on a 24/7 basis prevents contamination and results in household savings for low- and middle-income groups who otherwise spend a significant portion of their monthly earnings on buying drinking water. Households no longer need to (illegally) pump water from an intermittent piped supply into storage tanks to ensure that they have a reserve which may be of doubtful quality.

### Project preparation

Innovations in project planning can reduce costs and speed up implementation. In Odisha external consultants prepared detailed project plans, typically resulting in long preparation times and unrealistic cost estimates. Training their own staff engineers to use planning software led to faster and better-quality preparation, saving time and money. WATCO engineers were familiar with field conditions which resulted in greater accuracy and more realistic estimates.

In Uganda, new management at NWSC implemented a revised infrastructure planning policy, focusing on capital projects which had previously been outsourced to consultants to design. Using their own engineers to develop and design all small- and medium-sized projects reduced unit investment costs. As their design skills strengthened, corporation engineers gained a strong sense of satisfaction and career enrichment.

### Right-sizing procurement processes

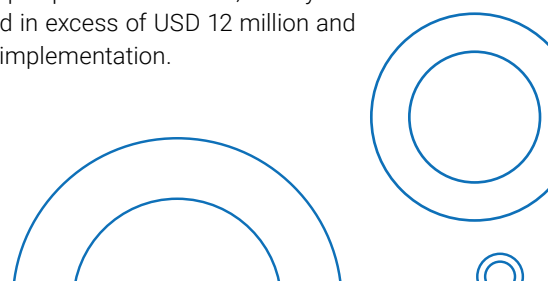
In Uganda, NWSC found that illicit collusion with contractors could be greatly curtailed by using direct labour, involving local staff and communities. Material costs were reduced by developing framework contracts with pipe factories and other suppliers. Collaboration with local political leaders and in-kind support from communities allowed the corporation to implement projects more quickly and with greatly reduced capital expense. NWSC established a quality assurance committee to manage all contract variations to ensure that costs did not overrun.

WATCO used local area managers and engineers to manage projects in Odisha. They took ownership of the work, which helped speed up implementation, reduced administrative costs and reduced the blame game that used to arise if problems occurred.

WATCO also found that small- and medium-sized projects are preferable to large contracts of higher value. Large contracts limit competition to larger companies, often attract high premiums, and can stall projects if disputes arise. Splitting large water supply projects into smaller parts allowed smaller local enterprises with the right skills to bid for elements such as intake wells, pump houses, water treatment plants, or pipelines, leading to more effective competition and timely completion. WATCO introduced regular Saturday meetings at chief officer level to address challenges (Vathanen 2024).

### Improving pipe procurement

In a distribution network project, pipes and fittings make up about 70 per cent of the components. WATCO decided to procure pipes centrally rather than outsourcing procurement to the contractor. This gave better control over quality and reduced costs. The State Finance Department had to give permission for this change since in the past there had been instances when pipes had been stacked in a field and never laid and others where the money had been paid but the pipes had never existed. WATCO committed to third party verification of pipes procured and laid, and by the end of year one saved in excess of USD 12 million and sped up programme implementation.



In Uganda, a small minority of NWSC suppliers turned out to be unscrupulous. One supplier delivered 180-metre rolls of high-density polyethylene (HDPE) pipes instead of 200-metre rolls specified in the purchase order. Some storekeepers were tempted to cut deals with unscrupulous suppliers and to take bribes to condone undersupply, over invoicing or even outright supply of air. One supplier was caught delivering boxes of stones instead of computers.

A decade later, as Mugisha (2019) highlights, the utility has reduced materials costs through extensive use of framework contracts, which allow for flexible ordering within an overall limit. Unit investment costs were reduced by about 25 per cent enabling more investment for infrastructure expansion. The rate of pipeline extensions increased from about 120 km per annum in 2013 to more than 1000 km per annum in 2017.

### **Simplifying household connections**

In Odisha, a large number of projects were completed without a proportional increase in household connections, despite WATCO's best efforts. The householder was expected to arrange the connection but the process involved submitting 14 documents, including proof of ownership or a lease or rental agreement. Slum households, often located on government lands without documentation, were ineligible. Once the process was simplified and the number of documents was reduced, household connections increased from 300,000 in 2018 to more than 900,000 in 2021.

The utility in Odisha secured political support from the State's chief minister to exempt the poorest households from connection charges. The case demonstrates that with committed political leadership, universal access to piped water services on premises is achievable, including for the poorest families living in slums.

### **Developing and implementing standards**

Ferrules are the unremarkable parts used to connect pipes but they have proved a challenge for many water utilities. In one pilot in a slum area of Odisha, water consumption was twice as high as expected. An external team found that failing ferrule joints at the household connection point were leading to huge water losses and potential contamination. It turned out that making the consumer responsible for their own connections was jeopardizing the safety of the system, as the customer was tempted to order cheaper low-quality materials and engage untrained plumbers. Subsequently, the process was streamlined with standard fittings and materials, and the work was done in-house, charging all except the poorest households. After the inferior ferrules were replaced, water losses drastically decreased.

### **Meters and behaviour change**

Metering is a way to measure what each consumer uses and, when linked to payment levels, can reduce waste and overall consumption. However, it is not always beneficial.

Vathanen (2024) describes how WATCO in India felt under pressure to use smart meters by agencies showcasing the latest technologies. The technical committee decided to go for smart meters that cost around six times more than the mechanical meters they were using. This decision was challenged by a Member of Parliament and reviewed. This revealed that fees collected over the five-year life of a smart meter would cover the cost of the meter, but not the cost of the water it was measuring. The smart meter project was not extended.

The decision to revert to mechanical water meters proved a smart move, since they provided reasonable accuracy and succeeded in giving a clear message to the consumer that their consumption was being measured and they would have to pay for the consumption including the leakages and wastages at their end. Positive behavioural changes resulted and consumption patterns became more regular. Odisha now has 100 per cent household connections with 100 per cent metering (Vathanen 2024).

There are some situations when meters may not be cost-effective at all. In England, universal service was achieved with domestic metering below 5 per cent of households and cost-reflective tariffs were being charged and collected, through bi-annual taxes based on property valuations. A consultation in 1990 about whether metering was the best way to reduce demand found that at the time it would not have been cost-effective.

Utilities need to consider meter location and security. VEI in Nakuru County, Kenya, found that meters needed to be located within two metres of the customer's boundary, to avoid bypass issues (GWOPA 2022). Meters are sometimes installed within walled compounds to minimize meter theft, but cannot be read when householders are out. Some countries install water meters in boxes attached to a wall of house or compound with key-controlled access.

Challenges with meter reading, billing and bill collection have led utilities to consider pre-paid meters, where customers use tokens, paid for at local shops or water company offices, or, more usually now, through mobile money systems. A study into prepaid meters across East and Southern Africa (World Bank 2014) found that prepayment can benefit customers and most seem to like this option so that they do not fall into debt.

A mechanical pre-paid meter can be a robust and cost-effective solution, particularly for the poorest people.

However, challenges have also been observed. In Lusaka, for example, the utility's introduction of 14,000 prepaid domestic meters, financed through a high-interest commercial loan, resulted in increased maintenance needs, supply interruptions and reduced water pressure. Customer dissatisfaction led to meter tampering, ultimately forcing the utility to remove the meters while still servicing the outstanding loan.

Overall, the World Bank (2014) study found that prepayment meters show a net revenue loss across most applications, except in the case of large institutional and commercial consumers. However, over the last decade, prepaid meters have been evolving and improving, becoming more robust and easier for customers to use, particularly with mobile money payments.

Utilities have long used standposts to serve a large number of households, minimizing connection costs whilst meeting public health needs. However, standposts can lead to water being wasted when taps are left running and loss of revenue if there is no mechanism for collecting payments. They almost always involve women carrying heavy containers of water home, with the risk of contamination from the containers. Employing a person to collect user charges does reduce water usage but is expensive and requires a kiosk. In donor funded projects the costs of such kiosks can be greater than the cost of supplying piped connections to each household.

Smart pre-paid standpost meters can use mobile phone payments to recharge the tokens that allow the water to flow and are appreciated by consumers who do not have household taps. Some women have appreciated being able to use a system without male vendors.

The NWSC experience in Uganda confirms the benefits of such systems but highlights the cost of maintenance and of imported spare parts that are not always available even during the relatively short life of such standposts, leading to costly replacement (WEDC 2025).

## Road-cutting

Road-cutting is required for the installation of new water mains and new household connections. Road authorities can be zealous in protecting their roads, demanding that permission is sought before cutting, excavation and pipe-laying and expecting reinstatement to their specifications, with significant

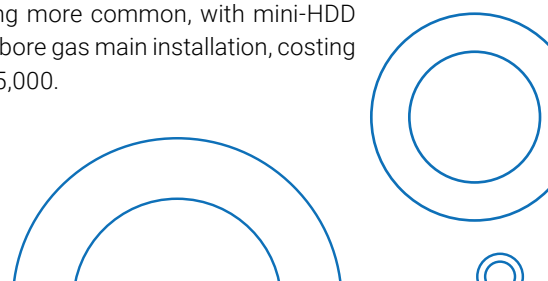
costs. Connections are particularly challenging when the water main is on one side of a road and half the households wanting connections are on the other.

Delays of up to a year in granting permission for road-cutting can frustrate and delay water programmes. NWSC found it embarrassing that in some parts of Kampala it took more than 30 days for a customer to get a new connection. Delays entailed excuses such as seeking permission to cross roads or failure to locate customers. Problems were harder to overcome where highway or local government agencies delayed road-cutting permission (NWSC 2022a). In Odisha, the system of obtaining road-cutting permissions for household connections was costly. Householders had to rely on contractors and middlemen, which encouraged some householders to resort to illegal house connections with the help of bribes for field level functionaries (Vathanan 2024).

One contractor working for WATCO was arrested for allegedly unauthorized road-cutting. The state secretary had to intervene, negotiating with the Public Works Department and the police commissioner to release the contractor. This sent a clear message that the provision of piped water supply to every habitation was a top priority for the Government, whilst also ensuring that would be completed at the right quality and at the sponsoring department's cost. Ultimately in Odisha, the state decided to exempt the public from paying charges and eliminated the need for permissions. The loss of revenue for road restoration was compensated by providing funds to Urban Local Bodies for road construction and maintenance – overall an example of an enabling environment.

An increasingly common method of overcoming some of the challenges is the use of directional drilling under the road for larger diameter mains installation, river crossings and even household connections where reinstatement is seen as too costly or road authorities have not given timely permission. A surface-mounted drill rig with tracking and steering capabilities launches a drill string at a shallow angle, tracking the path of the pilot bore using a manually operated overhead receiver or a remote tracking system (Slavin 2022).

There is limited research on the use of this technique. Atalah and Kariuki (2009), reported on the first trenchless drilling project in Nairobi, found it cost about 12.5 per cent more than an open cut. However, the approach is becoming more common, with mini-HDD rigs, as used in small bore gas main installation, costing in the region of USD 5,000.



## Energy planning

Infrastructure planning includes long-term energy management and optimization. For water, the proportion that energy makes up of total operating costs, including pumping water from boreholes or distant surface water reservoirs through the operations of treatment systems and into the distribution system, can be 45 per cent of total operating costs.

It has been found to be more efficient to build in energy minimization at the planning and design stage than through trying to retrofit systems. One factor is the extent to which gravity flow from distant sources can be utilized through innovative engineering. NWSC reported improvements after conducting energy audits and optimized energy use at the water production plants (NWSC 2024).

It should be noted that innovative treatment technology may demand greater energy inputs and much older technologies should not be ignored. Settlement basins and slow sand filters might be considered as innovative in energy terms where land costs are low.

In Nakuru County, Kenya, energy audits were carried out for all three utilities at the request of the three managing directors, as electricity costs were a substantial part of their operation and maintenance costs. Proposals for improvement included more efficient pumps and solar panels (GWOPA 2022).

In India, a Kerala water-treatment plant is trialling a programme to improve efficiency and productivity and to give early warning for proactive maintenance. The SCADA system features an interactive dashboard and data analytics to give better performance, reduce downtime, improve sustainability and reduce costs (ASCI 2024). Similar programmes exist with an increasing potential for artificial intelligence to optimize systems. However, in countries where only a handful of cities and towns achieve continuous 24/7 water supply, there may be simpler innovations to attempt first.

Solar-powered borehole pumping becomes economic and becomes more common as the costs of solar panels decrease, particularly when matched with an elevated water storage tank to benefit from continuous pumping through the day. This is also a means of converting operational costs (grid or fuel powered electricity costs) to capital costs (the cost of the panels). NWSC (2021) reported that more than 18 production wells were also using solar energy for water production in 2020 and this was being scaled up.

Floating photovoltaic panels are starting to be introduced on water reservoirs to make use of what can

be thought of as free land and to take advantage of the water-cooling effect which improves energy generation efficiency and reduces evaporation loss from the reservoir (Agrawal 2022). Singapore opened its first large scale floating solar farm at Tengeh Reservoir in 2021, with 122,000 solar panels giving a peak capacity of 60MW (The Straits Times 2021).

There is an ongoing debate about the use of water towers – also known as elevated service reservoirs – to deliver pressure for water distribution. In one major city in south Asia, a researcher found that only five of 24 water towers were working, and that with an intermittent supply the reservoirs never actually filled. Designing for continuous supply saves energy as it avoids the cost of pumped water going to waste and allows for pressure management within the distribution system to minimize burst pipes and leakage.

Variable speed pumps can match their speed to the needs of the system and improve efficiency at partial loads. Some researchers have found reductions in electrical consumption of 58 per cent compared to a fixed speed pump (Salmasi et al 2022). However, these pumps have higher capital cost whilst water towers can be used for emergencies and firefighting. It is suggested that the optimal solution involves a combination of variable speed pumps and elevated storage.

## Mechanical, electrical, instrumentation, control and automation

Control in small systems can simply involve the pump attendant pushing the on-button in the morning and turning it off again some hours later. However, there is an increasing move towards electronic sensors and computerized automation, combined with artificial intelligence optimization.

Mechanical, electrical, instrumentation, control and automation (MEICA) systems can be used in pumping stations, control systems, repair and maintenance processes and innovative designs. However, these may need continuous power supply or a power source in potentially challenging settings. The use of standby power generation also has to be considered. WATCO found that to ensure a 24/7 supply and to maintain public confidence in quality, a generating unit had to be installed for each district metered area, to ensure continuous pressure and accurate chlorination.

The system architecture for each newly established district metered area in Odisha includes monitoring systems linked through fibre-optic communications to the WATCO server which is linked to the National Data Center Cloud. Managers can access information,

control pumps and valves through their mobile phones (CPHEEO 2021). Similar systems are now available as packaged solutions.

West Bengal began providing 24/7 piped water to 1.65 million households in 2022, with more than 30 per cent of the mini utilities operated by women. The project uses digital technology-driven smart water management to improve efficiency, customer service, resilience and public participation. Water sources are monitored using internet of things technology, SMS-based maintenance and water-accounting systems are being developed. Leak detection and water quality monitoring are provided through real-time sensors and mobile phone reporting. A command and control centre collects data for decision support. Successful

approaches will be scaled up to all 66 Gram Panchayats (village councils), each with about 5,000 households (ADB 2021a).

The Asian Development Bank (ADB) confirms that local utilities no longer need massive digital infrastructure to oversee smart water services, which are increasingly being delivered via mobile phones and managed by low-cost devices. They advise that implementation should start with simple cases that demonstrate value for users. As those most affected by water service gaps, women should be approached as the most likely adopters of digital improvements. Paying attention to user needs and wants will help in adopting relevant new technology, to improve services for those who most need them (ADB 2022).

## Innovations in Planning and Developing Sanitation Infrastructure



A common pattern for urban water providers is to focus on the need to deliver relatively clean water to a good proportion of the city's inhabitants – while their sewerage system links a small part of the business, commercial and government central district to an increasingly dilapidated wastewater treatment works. The largest proportion of development funding and talented staff is focused on water. Unsewered sanitation and drainage is usually expensive to build and regarded as the responsibility of the municipality since the City Water and Sewerage Corporation, by its very name, suggests a focus on pipes. The Zambian water and sanitation regulator, NWASCO, has required urban water service providers to be renamed from Sewerage to Water and Sanitation Companies (NWASCO 2021).

Global institutions have promoted citywide inclusive sanitation (CWIS), aiming to ensure everyone has access to safely managed sanitation by promoting

a range of solutions – both onsite and sewerage, centralized or decentralized. “CWIS means focusing on service provision and its enabling environment, rather than on building infrastructure” (World Bank n.d.).

The UN-Habitat global report on sanitation and wastewater management based on investigations in 18 cities highlights raised awareness in about turning wastewater and faecal sludge into an economic opportunity (UN-Habitat 2023). They report that despite being vital to individuals, cities, societies and environmental ecosystems, sanitation continues to lag behind. Governments and intergovernmental organizations lack critical data on the status of wastewater and faecal sludge treatment, and there is a need for greater clarity and guidance on what a public service approach to sanitation involves in practice. The report highlighted: “There are many cities across regions taking effective measures to improve sanitation – but guidance is needed to make universal access a reality” (UN-Habitat 2023).

### Making on-site sanitation safe and sustainable

The Zambian regulator, NWASCO, champions the regulation of urban on-site sanitation and faecal sludge management to achieve universal access to safely managed sanitation services. Crucial elements include collaboration with stakeholders, setting out clear roles and responsibilities, the use of GIS mapping for data collection and management, and the development of business models for faecal sludge management. Collaboration would ensure, for example, planners design city roads to make collection by vehicles possible. Increased funding for on-site sanitation

(primarily pit latrines) and complementary faecal sludge management would ensure safe removal, transport and treatment of latrine waste and this service would also benefit middle-income households with septic tanks. Faecal sludge management is essential to achieve national aspirations and SDGs (NWASCO 2021).

Bangladesh faces a major sanitation problem, with only 20 per cent of its population connected to a sewer system. This leads to unsafe waste management methods, affecting health and the environment. In 2015, a sanitation waste collection service was developed, using vacuum tanker trucks and serving over 2.6 million residents in Dhaka, Chattogram, Rangpur and five other municipalities. It is reported that the service has generated USD 350,000 revenue for the private sector and safely treated 29 million litres of human waste. The service offers three key benefits: a safe and affordable service for low-income customers, profitability for private sector operators and the ability to meet the responsibilities of the public sector. The scale-up of enterprises like sanitation waste collection service would help address the growing population of urban slums and ensure that the citywide sewerage network can connect all toilets (WSUP 2022a).

### Container-based sanitation

The costs of accessing domestic pits and removing variable material sometimes make it less costly to remove buckets directly from households rather than empty poorly constructed pit latrines. There has been a resurgence of interest in container-based sanitation, defined by the Container Based Sanitation Alliance as “a sustained sanitation service, featuring toilets with containers that are frequently sealed and collected, so that the waste can be safely treated, reused or disposed of” (CBSA n.d.). The Container Based Sanitation Alliance points out that such sanitation does not require digging and has found a niche in hard-to-reach or underserved contexts: densely populated informal settlements, refugee or transitional settlements and areas with rocky ground, high groundwater, droughts, hills or frequent floods.

One approach has been to attempt to make this self-sustaining through household payments made directly to private pit emptiers and transporters. Some might see this as a strange policy when the better-off, who are the only people with access to sewerage, are, to quote one observer, “subsidised to excrete in convenience” (Narain 2002) due to the failure to charge cost-reflective tariffs for sewerage.

The Clean Team Container-Based Sanitation approach in Kumasi, Ghana, provides a service to households

at less cost than their previous sanitation option. In Kumasi, 36 per cent of residents use public toilets and were previously typically paying more than USD 10 a month to access public toilets compared to USD 7.40 a month for Clean Team services – a saving of over 25 per cent. Since the study was completed, “the price to use a public toilet in Kumasi has doubled, while the Clean Team cost has not changed, further magnifying these savings” (WSUP 2021a).

WSUP found that customer satisfaction was high. “The vast majority of users reported significant reductions in the smell of their toilet and experienced increased pride in their toilet, 93 per cent reported being satisfied or very satisfied with the smell when not in use, only 3 per cent reported excessive smell when the CTG toilet [composting toilet with greywater separation] was open, none reported toilet leaking.” (WSUP 2021b).

This illustrates how container-based sanitation can provide high levels of satisfaction, but it is not a new approach. For example, Singapore had a Double Bucket Collection Service for households in the lowest income areas until 1987 when sewerage and septic tanks reached 100 per cent coverage. The service was managed and delivered by the city council and was free at the point of collection – cross-subsidized by the local taxation.

In some areas of England, bucket emptying services were managed by some local councils until they ended around 1973, acting as a temporary parallel service in some districts whilst village sewerage was being introduced.

### Innovations at the household level

Flush and forget toilets remain the default goal of most householders. An acceptable alternative, typically in lower density areas but also widely used in high-density east Asian cities, are flush toilets that discharge to septic tanks that can be desludged, have drainage fields and, increasingly, some form of aerobic treatment.

The Johkasou approach in Japan uses septic tanks to improve household wastewater treatment plants in lower-density peri-urban areas. The government supports on-site upgrades to safe systems, with a 40 per cent subsidy for enhanced septic tanks. Government-supported training programmes and certification systems ensure quality assurance, with annual inspections for effluent. Households fund annual desludging and maintenance by trained technicians (ADB 2021b).

The WASH Innovation Hub reports that the Nellore Municipal Corporation in Andhra Pradesh, India, is believed to be the first to geotag septic tanks and digitize data

for scheduled desludging. The corporation has 3,500 ward-level volunteers working on municipal issues, including geotagging the septic tanks. The corporation supports sanitation workers' livelihood and social security by subsidizing desludging vehicles. It provides restrooms, refreshments and better working conditions at faecal sludge treatment plants and offers social benefits to help sanitation workers become entrepreneurs with a regular income (ASCI 2023).

Sedron Technology (through the Gates Foundation) has piloted the Omni Processor as a ground-breaking solution for water and waste management. Reportedly it can convert human waste into clean drinking water in minutes, producing 6,000 gallons of clean water and 100-200 kilowatt hours of electricity per day. The process involves boiling solid waste, filtering it, heating it to generate steam, and reusing any leftover electricity in the community (Burga 2021).

In India, JalSevak Solutions offers a scalable grey water recycling system that reportedly conserves 35-40 per cent of fresh potable water. The company's JalWASH and Washroom Wastewater Recycler simplifies toilet flushing and landscaping, ensuring high-quality recycled water (ASCI 2023).

### Innovations in sewerage

Toilets and grey water discharging directly into a sewerage network incur high capital expenditure and operating costs as the population of cities increases. An illustration of the challenge comes from Lusaka, Zambia, where the Lusaka Water and Sanitation Company attempted to develop a condominium sewerage scheme. Although 94.7 per cent of Kalingalinga's residents expressed support in a willingness-to-pay survey, the donor-funded project achieved a disturbingly low 3 per cent connection rate after two years (World Bank 2015).

In a follow-on project in Mtendere, a low-income community of 100,000 people in Lusaka, a Millennium Challenge Corporation scheme was designed to

provide water and sewerage services, with sufficient water to flush sewage to a rehabilitated wastewater treatment works. More than four years after the target completion date, with fewer than 400 households were connected and due to inadequate water supply and power outages, flushing had become increasingly challenging (MCC 2023).

The Mtendere project also illustrates the cost to users. Although the donor provided piped water as part of the project and reduced the household connection charge to new sewers, the cost of building a toilet, with showering and laundry facilities, was still USD 1,000 per household. If tenant households on the shared plot were to continue to use unimproved latrines, that would defeat the objective of protecting vulnerable groundwater.

Direct reuse is the process whereby municipal wastewater from a sewage treatment plant is treated to a level suitable for drinking and then pumped directly back into the drinking water distribution system. This compares to indirect-potable reuse, whereby treated wastewater is put back into the environment or into mixed water sources, before being treated again for distribution.

The Goreangab Water Reclamation Plant supplies 25 per cent of the water consumed in Windhoek, the capital of Namibia, one of the driest countries south of the Sahara. It includes the world's first large-scale direct potable reuse project. A USD 43 million investment from German Development Bank KfW will fund a second phase of the treatment plant through the Namibia Water Corporation, NamWater, increasing the supply of drinking water from the reclaimed water plants in Windhoek to 50 per cent (Aquatech 2023).

It is also worth noting the potential for resource recovery, particularly the ability of utilities to become more energy-efficient through biogas recovery in sewage systems. An example is given in Chapter 2 of this report from the Luapula Water Supply and Sanitation Company, Zambia.

Sanitation workers handling faecal sludge in Lusaka, Zambia.  
Photo: Lior Sperandeo/BORDA/GIZ



# Innovations in Utility Management for Water and Sanitation Services

If infrastructure is the largest and most expensive consideration for utilities in trying to address water and sanitation service challenges, the other eight building blocks for an effective system can be just as challenging.

## Operations and (minor) maintenance



Operations and maintenance ensure ongoing production and quality of drinking water, including the protection of water sources and the production, storage and distribution of water.

## Non-revenue water management: Leakage control and pressure management

Reducing technical water losses (commercial losses are discussed below under customer services) starts with fast fixing of visible leaks to save water and to signal to customers that water wastage is unacceptable in the street as well as at home.

A quick response team was created in Odisha to react to leak notifications (CPHEEO 2021). Odisha reported that detection and resolution times were reduced from a few days to a few minutes.

Quick response cells need access to an adequate number of shut-off valves to allow for quick isolation of leaking pipes, to minimize water loss and enable repairs. The next priority is to find and fix non-visible leaks through acoustic detection. Listening sticks are still in use in higher-income countries, along with next generation electronic leak noise correlators, which use acoustic sensors in contact with the pipe on both sides of the suspected leak.

The electronics detect sound waves produced by water escaping from pipes and gives an operator an approximate location of the sound.

Service providers in most towns and cities divide the network into manageable areas of 1,000 to 2,500 connections (district metering areas), each of which can be monitored separately. This allows for easier detection and isolation of leaks, particularly where bulk water meters help to identify unusual flow patterns.

Early leak detection is further enhanced with hand-sized battery powered acoustic loggers that can be placed on an accessible part of the pipe network to listen for characteristic noise waves. Data from these devices is retrieved manually or transmitted to a vehicle, sending alarms to the control centre that sends technicians to repair the leak. A trial of 2,000 loggers in two city centres in England reportedly saved five million litres of water daily (Shrestha 2019).

In water-scarce and high-cost water areas, acoustic loggers with continuous SMS data transfer are becoming permanent fixtures on the network. A further innovation is for acoustic loggers to be integrated into each smart water meter. Artificial intelligence or machine learning can predict and locate leaks and optimize maintenance schedules and resource allocation.

Odisha has been using IT innovations and customer service initiatives to target non-revenue water in combination with efficient incident management and quick problem-solving, including effective systems to address customer complaints (CPHEEO 2021).

In its first district metered area in Odisha, WATCO reached 2,000 people in a low-income community in 2019 with continuous potable water. By end of 2022, WATCO had established new district metered areas supplying water to 750,000 in 20 cities across the State (Mathi Vathanan 2024).

Per person costs for the development of the DMAs, including flow control valves, bulk flow meters, pressure reducing valves and replacement of house service connections with mechanical water meters were the equivalent of USD 25.75 or USD 82.15 at purchasing power parity exchange rate. This is about one fifth of the overall per capita cost incurred for creating infrastructure in those areas.

Using similar techniques, the Water Operators' Partnership (GWOPA 2022) in Nakuru County, Kenya, was successful in improving water loss ratios across its three service providers, each using slightly different approaches.

One service provider replaced asbestos pipes with high-density polyethylene HDPE pipes, which helped to reduce non-revenue water in the central business district from 40 to 11 per cent. The key finding of another utility was that most losses were from commercial leakages due to undeclared connections (GWOPA 2022).

In Kampala, an asset management approach involving regular inspection and maintenance of pipes and infrastructure, made it possible to prioritize the replacement of aging or high-risk assets. Where necessary, sections were replaced with durable (but costly) new corrosion-resistant pipes. However, it is an indicator of the challenges of managing an ageing water distribution system with ageing meters that NWSC noted that non-revenue water in 2021 remained at 36 per cent, the same as over a decade earlier, despite a huge increase in customer base (NWSC 2024). It fell slightly to 34 per cent in 2024.

The concept of calm networks is now being recommended, in which a network is optimized to maintain a steady equilibrium with fewer variations in pressure, lowering stress on the pipes (WRC 2024). However, water networks are intricate systems that in practice are difficult to optimize fully without unreasonably high costs.

## Operation and management

Many service providers suffer from small-scale corruption in day-to-day operations, which leads to a lack of trust from customers and reduces revenue for the utility.

In Zambia, the regulator NWASCO reported (2017) that corruption can include underreporting of meter readings, plumbers using company materials for private jobs, inflated invoices, leaking contract information, and stealing tender documents. Other corrupt practices included accepting substandard work, misusing funds for personal gain, purchasing used equipment, creating false receipt books, hiring unqualified personnel, under- or over-depositing of collected funds and failures by the board of directors to oversee company policies and strategies. It was indeed an innovation for a water regulator to report so clearly on these issues and demand that service providers address them.

In Uganda, NWSC introduced their own version of performance-related operation and management contracts, initially focused on operations and maintenance, with strong incentives to manage well and honestly, and practising delegation, decentralization and empowerment. It posed a challenge in exercising appropriate oversight without undermining partnership or acting contrary to contractual provisions. The system was designed to be transparent, objective and cost-effective, each division taking responsibility for the outcomes of performance monitoring activities.

The new contract type resulted in increased staff productivity, increased revenue collection, reduced arrears and improved customer satisfaction. NWSC continued to evolve their management aiming at consistent good performance, innovation, service coverage and stakeholder engagement with internal management contracts outlining performance targets, operational risks and responsibilities (NWSC 2021).

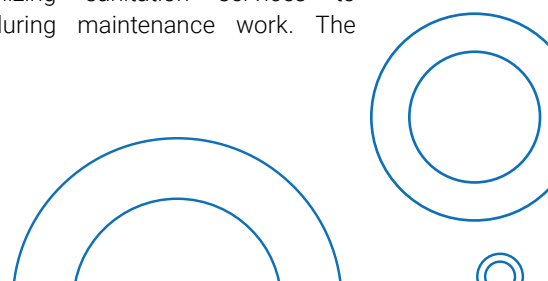
NWSC has been on a path of continuous innovation over two decades, extending service coverage from nine major towns in 2000 to 276 towns in 2024, while registering a customer satisfaction index of 80 per cent and an increase in staff engagement with the process (NWSC 2024).

## Maintaining sewers

In India, only 39 per cent of an estimated 20,000 decentralized sewage treatment plants meet regulatory norms, mainly due to inadequate infrastructure and improper operation (ASCI 2024). The WASH Innovations Hub has been tracking innovations with the potential to do things differently and benefit sanitation staff and customers.

Paryaavarneer Engineers combine internet of things technology with environmental engineering operations to optimize processes and precision. Once a treatment plant is automated, real-time data is transmitted to a cloud server. Engineers report that where the system has been installed, facilities consistently provide good quality of treated wastewater, with 50 per cent lower operating costs. Return on investment is achieved within one to three years, depending on the treatment capacity.

The India WASH Innovation Hub also reports on ideas to assist in sewer management and maintenance. Several innovators want to convert manholes into machine-holes, in line with the national government focus on mechanizing sanitation services to prevent fatalities during maintenance work. The



Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013, seeks to end the unsafe and dehumanizing practice of manually cleaning, carrying, disposing of or handling human excreta in insanitary latrines.

Aumsat Technologies is piloting a Sewer Line Monitoring system in Rajasthan, using solar-powered sensors to monitor 45 manholes. The sensors detect debris obstructing sewage flow, alerting the authorities and preventing potential flood hazards during heavy rains.

Drona Automations is addressing build-up in sewer pipes, containing salts and carbides, due to improper waste disposal. Drona has developed a manhole sewer robot, which can enter the sewer, detect blockages with a camera and clean pipes of any dimension between 6 and 13 inches.

Nimble Vision also has a manhole monitor that can be retrofitted beneath manholes with a submersible sensor that uses 4G connectivity to display real-time sewage levels and flow rates on mobile and web dashboards.

Additional sanitation and sewerage innovations are described by ASCI (2023):

Surat Municipal Corporation divided the city into nine zones and provides quick responses to sewer cleaning complaints through a 24/7 helpline. The corporation set up a monitoring system and now owns 170 hi-tech sewer cleaning machines and since 2005 has introduced 3,228 safety aids, such as gas detectors, gas masks, breathing apparatus and personal protective equipment kits.

Genrobotic Innovations developed the Bandicoot cleaning robot, to eliminate manual scavenging in urban sewage management. The robot has human-level flexibility and can move around in sewer holes using multi-functional robotic arms and legs. It is capable of performing tasks such as grabbing, shoveling, and unblocking in hazardous or corrosive environments. Genrobotics is active in over 16 states, working to eliminate manual scavenging and hazardous cleaning. They are also aiming to retrain sanitation workers to operate the robots.

The Thamate Centre for Rural Empowerment is working to eradicate manual scavenging in Karnataka through preventive, rehabilitative and affirmative action. Thamate forms community-based monitoring groups to organize the Safai Karmacharis, who work

as manual scavengers, to claim their rights in the areas of labour, health and housing. Groups are organized under the Safai Karmachari Kavulu Samithi (SKSS), a state-level collective of unions. They use legal interventions to enforce the provisions of the 2013 Act which provides for the identification and rehabilitation of manual scavengers. Thamate and SKSS are pushing Urban Local Bodies to identify and rehabilitate manual scavengers, which involve retraining, subsidies and health insurance.

## Customer services



## Meter reading and customer engagement

Meter reading is often the primary contact between a water provider and the customer. Accurate and timely meter readings are critical for billing and payments.

NWSC found commercial losses arising from illegal water use and old meters that under-reported consumption. Water losses were estimated to average 36 per cent of water supplied, with Kampala Water registering 42 per cent. Muhairwe (2009) describes how at the beginning of his directorship some people were engineering illegal connections, tampering with meters or paying compensation to staff to misreport.

Initially this was addressed through a systematic strengthening of meter reading by diploma graduates, followed by the empowerment of area management, staff paid bonuses to meet bill collection targets. In Kampala, a specific Water Loss Prevention Unit was developed.

Customer interaction was also strengthened. The call centre was expanded in 2014, with new equipment, call agents and performance indicators. A computer-aided customer relationship management system was introduced for quick feedback and easy monitoring of actions. The front desk office was transformed, with

staff who have good knowledge, skills and attitude acting as the first point of contact. Interaction sessions (barazas) were introduced to discuss performance and create social contracts with customers.

An NWSC Area Manager commented: “Leaders and their immediate field managers have routinely been given warnings that meter-reading irregularities would attract tough sanctions, including employment terminations.” (Mugisha 2019). Anti-corruption and anti-bribery messages were promoted, with contact details displayed on field vehicles for reporting bribery.

Customer surveys were conducted to assess service quality and alert managers to warning signs about staff soliciting bribes. A different approach was taken by WATCO, Odisha. A women’s self-help movement, Jal Sathis (Water Partners), was created to serve as a bridge between consumers and the provider. Jal Sathis were found to provide consumer-friendly services and were more accountable to their own communities.

The initiative reached all Urban Local Bodies across the State by August 2022, with over 900 Jal Sathis established. Jal Sathis earn an average monthly income of USD 500 to 750, based on a percentage of revenue collected from consumers. This approach was complemented by the establishment of a customer care centre with complaint logging and online tracking of complaint resolution.

Overall, it was found that the Jal Sathi initiative significantly improved water supply and management in urban areas where the 24/7 Drink from Tap initiative had been implemented. It achieved 100 per cent house connections, improved revenue collection and improved customer trust. It increased direct feedback on water supply issues, while customer-friendly services increased awareness on water conservation and eliminated unauthorized connections.

Researchers found that Jal Sathis in the State capital Bhubaneswar, as well as Puri, have become “water professionals, witnessing personal transformation through economic and social empowerment.” The Central Public Health and Environmental Engineering Organization found that Jal Sathis working in the newly rehabilitated town of Puri achieved 97 per cent efficiency in revenue collection (CPHEEO 2021).

Other innovations include geolocation tools and mobile money. Lekhnath, Nepal, installed an asset management system that allows a water users committee to manage and monitor resources. This

system tracks the geolocation of every meter, linked to the billing system. An app allows customers to report pipe leaks or bursts, with accurate location and photos. The system helps utility managers make evidence-based decisions and has significantly reduced time for addressing payment, water quality, pipe leakage and meter issues (ADB 2023).

In the early stages of mobile money, a study of 20 urban water service providers, serving over 12.5 million customers, found low adoption rates, with only one provider achieving over 10 per cent coverage. However, a small Kenyan scheme showed 76 per cent adoption, with time and cost savings being primary motivations. The study highlighted the importance of scheme ownership, size and location (Hope et al. 2011).

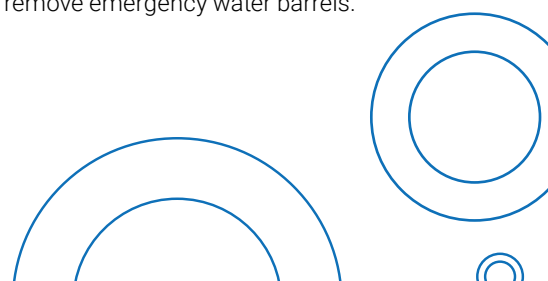
However, mobile technology has since been embraced quickly by the general public. Customers are using mobile money and e-billing, and responding positively to handheld billing and receipting. Some service providers are even allowing cumulative micro-payments, so that the poorest can pay when they can, rather than paying a larger amount at the end of the month.

### Communication policies and practices

Many of the measures described in the preceding sections depend on active communication with customers. In Odisha, for instance, WATCO and its partners UNICEF and IRC developed a comprehensive communication strategy to support customers transitioning from an intermittent to a continuous water supply under the Drink from Tap initiative.

The strategy aimed to familiarize users accustomed to disrupted service with the principles of 24-hour supply and to discourage household water storage, which poses contamination risks. It required sustained engagement by service providers to help customers understand metering, tariffs, billing and payment processes, as well as complaints mechanisms, while reinforcing trust that water supplied from the tap is safe for drinking and contributes to improved health outcomes.

In another Indian State, it was reported that customers initially understood 24/7 to mean 7 hours of supply in 24 days – because that was the level of supply customers had become accustomed to. In Odisha it took two to three years for households to trust the continuous supply, so that middle-income customers began to remove ground tanks, and low-income households began to remove emergency water barrels.



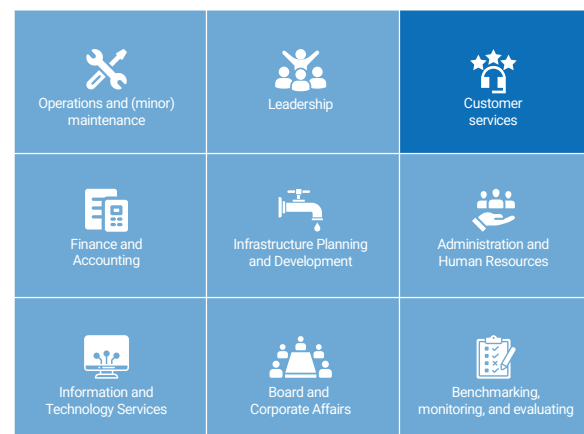
Odisha adopted a personalized communication approach through the Jal Sathis using short video clips in the local language, handouts with dos and don'ts for water handling and community influencers to talk about Drink from Tap during regular meetings. In the tourist town of Puri, WATCO used LCD screens to show real-time water quality data (Government of Odisha n.d.). Maharashtra-based Jalsmruti, encourages communities to protect water, vegetation and soil in their local areas. Jalsmruti hosts youth champions to promote water literacies. A citizen scorecard helps individuals, communities and urban bodies assess water usage and make informed decisions. The initiative aims to create passionate youth water leaders and promote decentralized water management policies (ASCI 2022).

As utilities face resource-stressed futures, consumer behaviour is becoming a critical issue. Shifting demand for electricity helps alleviate pressure on network capacity. Similarly in the water sector, reducing demand through campaigns, seasonal tariffs and interruptible supply tariffs for large users may be needed to maintain sustainable supplies for a growing population where water distribution networks need renewal.

Consumer groups like the England and Wales Consumer Council for Water emphasize the importance of messaging and changing social norms to encourage positive behaviour. South West Water research in England suggested that almost eight in ten customers planned long-term changes to reduce water consumption after drought was declared.

However, a study by CCW found a significant difference between consumers reports about their kitchen sink habits and actual actions. It advised that consumer messaging for small, non-burdening changes be targeted at specific audiences with consumer incentive schemes. With storage levels within the water company's main reservoir in Cornwall falling to their lowest recorded levels in 2022, the utility offered customers a GBP 30 bill credit if the reservoir reached 30 per cent storage capacity by the end of the year (Cousins 2023)

## Finance and accounting



The WHO (1994) defines a finance system as including “all policies and standards established by the agency to carry out its financial tasks, together with the procedures used for recording and evaluating financial operations and reporting on their results.”

Inspecting of a vertical turbine well pump by a Belize Water Services team.  
Photo: Belize Water Services



## Accounting

One innovation that all public service providers appear to consider at least once a decade is updating and systematizing their accounting procedures, particularly in light of ever more sophisticated software for accounting.

In the first stage of revitalizing the National Water and Sewerage Corporation in Uganda, a series of internal reforms were implemented in financial controls and regulations in compliance with the best international accounting standards and practices (Muhairwe 2009).

NWSC prioritized procurement and accounting processes to improve efficiency and responsiveness. This involved rewriting guidelines, overhauling information systems, and eliminating unnecessary bureaucracies.

The accounting system was customized to make outstanding payments more visible and address supplier complaints about delayed payments. Weekly meetings were held to plan timely payments to suppliers.

## Tariff setting, funding and financing

Providing water and sanitation services is extremely capital-intensive, particularly when piping to and from all premises. In the early stages, this service provision requires significant funding from governments and

donors, supplemented by loans as it matures. The provider must generate enough revenue to cover staffing and energy costs, vehicles and tools.

Even smaller providers need financial support. A study of 20 smaller successful community-managed rural water supply utilities across 17 States in India found that after government funded over 90 per cent of the initial capital expenditure, approximately 50 per cent of recurrent costs for piped supply still came from government, often unrecognized in the form of reduced public service power charges or the provision of bulk water. There was also substantial external support for capital maintenance, enhancement and expansion at approximately 85 per cent of the total costs (Hutchings et al. 2017).

A study focused on delivering global SDG targets highlighted the need to define a financing strategy based firstly on achieving efficiency gains through capital expenditure efficiencies and lower operating expenditure and maintenance costs (World Bank 2016). The next step is to mobilize domestic revenue sources, such as tariffs and user charges, also using an appropriate level of domestic taxes and catalytic loans and grants to ensure viability. From that base, the needs for service expansion, service enhancement and the ever-necessary capital maintenance can be addressed by mobilizing financing from multiple sources. Commercial finance, blended finance and concessional sources remain innovative, at least for this sector. This is further explored in the finance pathway in Chapter 4.

Pontsticill Reservoir, Brecon Beacons National Park, Powys, Wales, United Kingdom.  
Photo: Bernd Brueggemann



Figure 3.3. Proposed financing path to break out of the unsustainable status quo to meet the water Sustainable Development Goal (SDG 6) (reproduced) World Bank, 2016

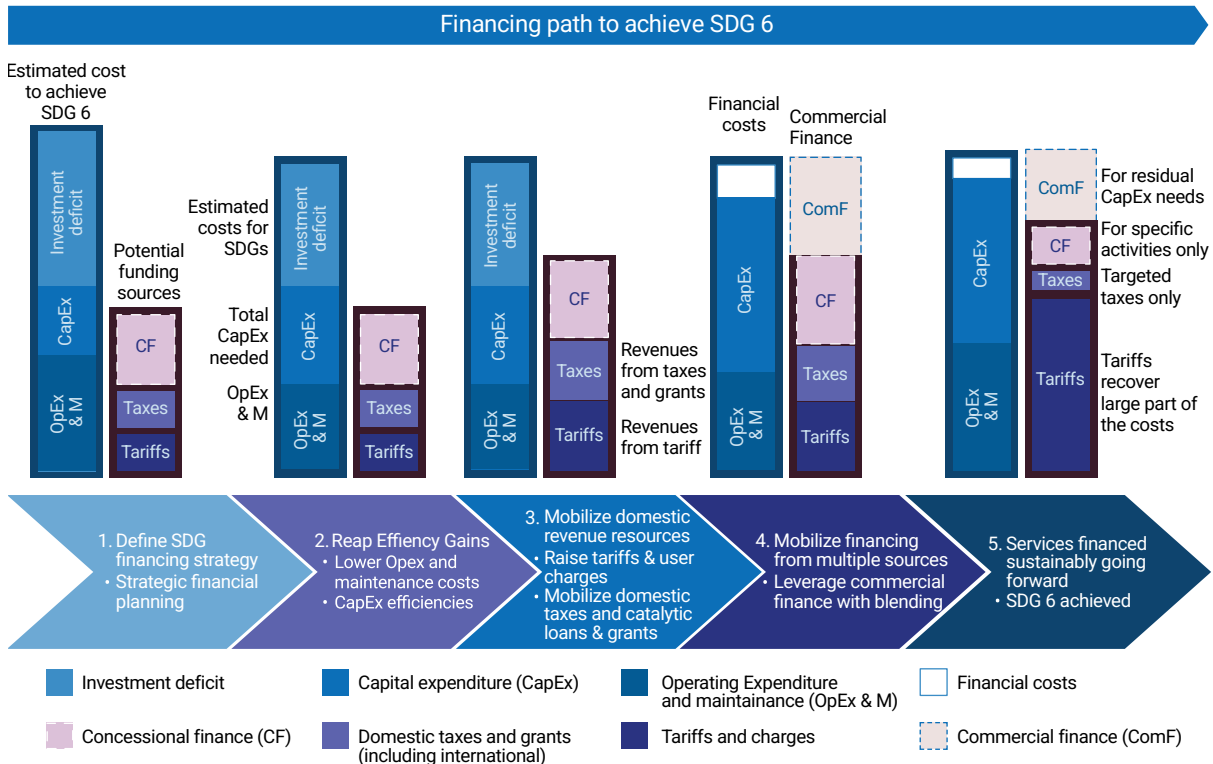


Figure 3.3 indicates how a utility can reach a state whereby tariffs recover a large part of the costs, tax-based support from government is needed only for specific activities and commercial finance becomes available for residual capital expenditure needs. These steps are valid and critical. However, they presuppose sufficient wealth within the customer base to fund this level of tariffs. Some analysts suggest that sustainable financial performance might only be reachable at or above the boundary between upper-middle and high-income countries. However, all utilities can benefit from starting on the journey.

The extent of cost recovery is dependent upon overall national income levels, habitation size and cost of water resources. Although grants and subsidized loans from government and donors remain critical to achieve SDG 6, much more can be achieved through developing efficient providers. Irrespective of the level of cost recovery achieved, tariffs remain an important signal to customers of the value of water and the need to avoid wastage.

Phnom Penh Water Supply Authority (PPWSA) was able to recover from a crisis with the help of significant external funding. By using funds effectively, it no longer needs subsidies from central government, which allows PPWSA to distance itself from political pressures. After paying taxes, PPWSA revenues are channeled divided

into investment accounts. The utility is also willing to loan to other government agencies (Chan & Mukherjee 2009).

PPWSA managed to reduce non-revenue water from 72 per cent in 1996 to 6 per cent in 2010, and to keep tariffs at a reasonable level, only needing two out of the three increases initially planned. With international funds supporting various aspects of their work, the Authority was able to take out loans for capital expenditures improvements and in 2012 became the first domestically listed company on the Cambodia Securities Exchange.

PPWSA has come a long way but will still face challenges in treating wastewater and building climate resilience. However, it has designed a new tariff system knowing full well that it has increased its revenue by over 200 times in 25 years (Park & McGregor 2021). The listing provided PPWSA with a platform for increased financial transparency, accountability and potential access to capital markets. Revenues increased by a further 60 per cent by 2021, achieving a return on assets of 6.2 per cent.

In Uganda, the Board of the National Water and Sewerage Corporation have for several years prioritized expansion over recurrent expenditure. The company reduced consultancy services and developed its own

web-based customer billing system. When they faced challenges in 2019/20 for critical capital projects, the Ministry of Finance, Planning and Economic Development authorized the Corporation to borrow the equivalent of USD 40 million from Commercial Banks. NWSC's tariff levels are sufficient to support such loans (Mugisha 2019).

The Corporation plans to use a mix of financing options over the next five years, including internally generated funds, for operations and maintenance costs and minor investments and external funds for capital-intensive water and sanitation infrastructure (NWSC 2021).

In 2024, the Ugandan Government reduced funding for major infrastructure projects due to increasing demand from other sectors and changing priorities. This necessitates a prudent exploration of alternative financing options and adaptation of investment plans and execution methods. NWSC expects a total funding of USD 1.2 billion over a five-year period starting from 2024/25 comprising 6.9 per cent from the Government of Uganda, 82.2 per cent from donors and 11.0 per cent from market finance.

Mugisha (2019) notes that the NWSC tariff is only able to cover operation and management, depreciation and minor investments, due to having to cross-subsidize many smaller towns which do not break even. Domestic tariffs were in 2024 USD 1.16 per 1,000 litres with public standpipes set at one quarter of that rate. Institutional and commercial tariffs average USD 1.29.

NWSC also reported in 2024 that revenue collection from government agencies remained a big challenge. Domestic arrears rose from USD 4.2 million in 2018 to USD 19 million in 2023, with the maturity of government arrears standing at 12 months.

WATCO has depended upon various National and State level government transfers to fund a USD 31 million expenditure (USD 100 million at purchasing power parity exchange rate). The domestic tariff being USD 0.26 (at purchasing power parity exchange rate) per 1,000 litres for domestic connections and USD 0.86 for institutional and commercial connections.

This shows that even successful, innovative utilities, in lower-income economies, continue to have funding and financing challenges. However, banks are understandably more confident in lending to successful utilities rather than taking on the challenge of the average utility.

## Administration and human resources



An human resources system includes all rules, guidelines and practices that guarantee the agency has sufficient properly trained staff (WHO 1994). A technical task analysis should lead to classification and grading of posts. Addressing social welfare, workplace safety and workers' health is essential, alongside the need for an appropriate pay structure.

The Human Resource Plan for PPWSA in Cambodia outlines: "Effective working performance is fundamental by continuing to implement measures on annual incentivization to promote the organization's work on human resources." Plans included upgrading pay scales for officers and employees; recruiting 131 new contract employees; organizing 44 domestic and international training courses; selecting 120 employees each year for outstanding performance; requesting achievement medals for officials and employees who have excelled in their duties; requesting annual incentive bonuses for all officials and employees; and offering seniority allowances for officials and employees (PPWSA 2024).

In Uganda, The NWSC Corporate Plan (2021) recognizes that the top priority is the health and safety of employees, customers and the public. The Corporation has developed occupational safety and health guidelines, provided protective wear and uniforms and regularly services firefighting equipment.

The Corporation introduced far-reaching reforms to address organizational culture and human resources management. It introduced performance-based competitions among its area, fostering motivation and a spirit of excellence among staff. Mugisha (2019) observes that senior utility staff valued the capacity-building programmes, which included training opportunities both within and outside the country.

These initiatives enhanced staff competence and strengthened their ability to apply critical thinking in developing practical solutions to operational challenges.

In 1993, the Water Supply Authority of Phnom Penh, Cambodia, faced a dilemma when it became apparent that employees were working for their own profit, not for the organization or its customers. This led to a challenging restructuring process which ultimately strengthened the new management. To overcome corruption, the authority implemented an incentive system, with an internal discipline scheme for those who did not respond. This changed the water supply culture in Phnom Penh, offering more money to those who took on more responsibilities.

### Addressing gender gaps

The *Women in Water Utilities* report found that in a global survey of 64 water and sanitation service providers, utilities reported that on average only 18 per cent of their workers are women (World Bank 2019b). The World Bank advocated that “women are an untapped pool of talent for the water sector.” The Asian Development Bank (2014) similarly found a gender gap in water management leadership at all levels of government – national, municipal and local – and it encompasses water utilities and water supply community governance groups. The ADB report concluded: “To narrow the gender gap in leadership at all levels of the water sector, and to ensure water security for all, there needs to be more equity, and women need to have greater involvement in decision making.” Addressing gender gaps in utilities is an important and necessary innovation to tap into the best available skills.

In Nakuru County, Kenya, a gender and inclusion needs assessment was prepared for the three utilities and guidelines for gender and inclusivity were developed to promote change. Across the country, the project promoted an anti-sexual harassment policy to comply with the requirements of the new regulator, directly contributing to gender and inclusion in the utilities (GWOPA 2022).

NWSC included strategic actions in its 2024-2027 Corporate Plan to ensure gender mainstreaming in its operations with a corresponding performance indicator for gender balance. Currently, women make up 33 per cent of the Board of Directors, 38 per cent of executive management and 33 per cent of other staff.

In England, of the nine major water service provider companies, six had female Chief Executive Officers (CEOs) in 2023 (five in 2025) and two also had female Chairs of the Board. One company had an all-female Board. The CEOs of the top two French water companies were also female.

Leaders today have often come from those with financial expertise or promoted through the customer services route. Global Water Intelligence comments that this completely changes the face of the private water industry.

Global Water Intelligence (GWI 2022) concludes: “It isn’t the fiefdom of the water barons anymore. It is also a challenge to the public utility sector and to the water technology sector. The public water sector is nearly ten times the size of the private water sector, but there are fewer women in top positions.”

*(See Chapter 2 case study, Utilities recommend gender equality and links between SDG 6 and SDG 5 on gender equality.)*

### Capacity development

In Uganda, NWSC has invested significantly over three decades, enabling virtually all middle managers and technical officers to obtain master’s degrees, initially abroad, but more recently through in-country and distance learning. With World Bank funding, a modest training centre was built in the early 1990s, with study rooms and a technical area where staff could search for leaks in an underground distribution network and operate a scaled-down treatment unit. Within two decades, this was replaced by a multi-storey International Resource Centre. Staff are also able to learn from and provide support to utilities in other countries through capacity-focused Water Operators’ Partnerships. WhatsApp groups have been established for each directorate and department, where area activities and service delivery interruptions are reported daily, to speed corrective action.

The leadership of Phnom Penh Water in Cambodia, as Chan and Mukherjee (2009) describes, set up a training centre to respond to in-house training needs. Staff now receive an average of 12 days of training annually. Staff saw salaries increase by about 20 per cent annually over two decades, making their pay levels comparable with and sometimes even better than private sector remunerations (ADB 2012).

## Information technology

### Internet-of-things-based monitoring systems



Sensors which communicate through the internet have become more common in all aspects of the physical infrastructure of water supply and sanitation. They are increasingly used in leak detection, water quality monitoring, pumping equipment, water and wastewater treatment systems. They can save energy and operational costs and predict maintenance needs by forecasting equipment failure.

Balanced against this are high capital costs, a critical need for effective communication systems for the sensors, the lack of international standards leading to compatibility issues, and a requirement for significant data storage. The management and analytical challenges require a high level of expertise within the utility to make such systems worthwhile.

Anglian Water in England anticipates handling 19 billion smart meter readings per year by 2030. This is expected to lead to the emergence of data lakes and the need for significant cloud-based storage systems and artificial intelligence to extract meaningful insights from such vast volumes of data (Spencer 2021).

The Government of India has begun a multi-State pilot programme for smart water supply monitoring systems. Several types of sensors have been deployed, including flow meters, groundwater level sensors, chlorine analysers, pressure sensors, pump controllers to measure and report all relevant aspects of water service delivery – quantity, duration, quality, pressure and sustainability – in addition to providing operational efficiencies. The Government of India (GOI 2024) observed: “This approach will not only allow effective monitoring and management on-ground with a futuristic vision to ensure regular tap water to every home, but real-time measurement and monitoring [which] is also critical for rural drinking water supply

schemes, with enormous gains in terms of operational efficiencies, cost reduction, grievance redressal.”

Pilot programmes have already helped identify water distribution issues, such as outages, leakages and low pressure and have led to solutions, rather than just information to display on a website. Nine States have either issued tenders for internet of things based remote monitoring systems or are already implementing the approach.

### AI optimization and risk management

Halliday (2024) suggests that the water sector is “on the brink of a technological revolution” with the rise of variable speed drives and AI-powered processors to meet the cost challenges of pumping. Despite budget constraints and the initial costs of sensors and systems, smart variable pumping speed drives that use AI and machine learning are reported to save 40 per cent in energy. They can analyse and correlate data in real-time, detect patterns, identify anomalies, and predict potential issues before they escalate into costly downtime.

This optimism is tempered by the need for cybersecurity. Manufacturers claim to be integrating robust features into their products and some smart drives enable utilities to harness the power of advanced machine learning and data processing without relying on external computing power or cloud systems.

Drive manufacturers are partnering with utilities to develop tailored solutions and provide ongoing support. The automation of operations and processes and use of artificial intelligence and machine learning is one component of the NWSC strategy in the context of the Uganda Government’s *Digital Transformation Strategy and Roadmap* (NWSC 2024).

However, cybersecurity is a growing global threat and NWSC has not been spared. In August 2022, after the Corporation experienced a ransomware attack, NWSC concluded the need to step up IT and cybersecurity risk mitigation measures in order to minimize financial loss and data loss while maximizing business continuity.”

Although AI is increasingly used by utilities, especially in higher-income countries, to detect leaks, forecast water demand, warn of flooding risks and monitor water quality, it has not, so far, been used on a broader scale in everyday operations.

The key is to start small, focus on achievable goals and leverage the low-hanging fruits of AI to cultivate a smarter, more sustainable water management.

## Monitoring and benchmarking



A water service provider has decision-centres at three levels – strategic (senior management), tactical (middle management) and operational. Each requires different information.

Monitoring tools should capture both quantitative and qualitative data for a global performance evaluation. In addition to metrics, process benchmarking is crucial for broadening knowledge and enabling local managers to implement tailored innovations and performance improvement initiatives.

Real-time communication platforms like WhatsApp have enhanced day-to-day performance sharing and this can facilitate benchmarking.

In Kenya, the Water Services Regulatory Board (WASREB) requires the 92 water service providers in the country (88 publicly owned, four private) to collect data on a wide range of performance indicators: service coverage, unaccounted for water, water quality, hours of supply, level of metering, revenue collection coverage, operation and management cost coverage through tariffs and staff productivity. Like other regulators, WASREB is taking increasingly robust measures to uphold data quality standards and prioritize integrity and is highly critical of data inconsistencies submitted by utilities. “[Utilities] are providing different datasets for licensing, tariff evaluations and sector reporting which leads to inconsistency errors and discrepancies.” (WASREB 2024).

WASREB hosts Kenya’s Majidata initiative which provides a georeferenced information system on water and sanitation services, including data on utility distribution networks and sewer networks, as well as maps of all small-scale service providers across the

country. While such initiatives are very positive, they pose challenges in time and resources to ensure that information is systematically updated.

The Government of India, through its Jal Jeevan Mission, has a portal reporting on the number of households by State, which allows for performance benchmarking across the country, placing service providers in five categories: front runners, high achievers, achievers, performers and aspirants. It shows the cumulative results of the Jal Jeevan *Water to Every Household* Mission, which by 2025 had connected more than 124 million households to piped water at a cost to central government of over USD 100 billion (USD 840 per household served at purchasing power parity exchange rate)<sup>1</sup>.

### Water quality monitoring

In Odisha, Jal Sathis water partners were trained to test household water quality using Tamil Nadu test kits and supported by small vans, popularly known as labs on wheels for onsite water quality testing, surveillance and monitoring to give new customers reassurance, particularly in lower-income areas. Water is tested at the consumer’s doorstep on request, to reassure customers who had no experience of continuous water supply, that the Drink from Tap 24/7 supply is indeed safe.

The government used a public-private partnership to set up nine state-of-the-art water quality laboratories, fully independent of the water provider, with the ability to undertake continuous monitoring of water and wastewater quality.

Odisha uses IT innovations to ensure integrity in leak-proof pipe networks that deliver smart water management to monitor critical parameters. This includes real-time data analysis and decision-making for uninterrupted water supply, data capture for preventive maintenance, on-the-spot automated testing and chemical dosing and real-time water quality monitoring without human intervention.

### Sanitation monitoring

Zambia’s water and sanitation regulator NWASCO (National Water Supply and Sanitation Council) monitors faecal sludge management, reporting results from each of the responsible service providers in its annual sector report. A geographic information system collects baseline data on the status of sanitation facilities and services, recording 241,963 sanitation

1 <https://ejalshakti.gov.in/jjmreport/JJMIndia.aspx>

facilities in nine urban towns during an initial pilot phase. The 2024 report found that 51 per cent of the population used pit latrines, 14 per cent accessed sanitation through septic tanks and 34 per cent used offsite sanitation systems connected to sewers. It found that 1 per cent of households did not have any sanitation facilities and were assumed to practice unsafe methods. In one of the nine towns, it was found that almost half of the households did not have stable on-site sanitation facilities, posing a risk to users, public health and the environment. NWASCO (2024) finds: “Enforcement mechanisms by various actors that have a stake in each of the stages of the sanitation service chain will be key to ensure the provision of safe, affordable, efficient and cost-effective OSS and FSM services.”

India has developed standard operating procedures (CWAS 2020) for septic tank desludging, recommending that Urban Local Bodies maintain a database of households to ensure quality of demand-based and scheduled desludging. A digital data SaniTab tool monitors desludging and provides spatial mapping of toilet facilities, geotagged for each household. The tool can also be used to monitor vacuum tankers and to track where sludge is being discharged.

The Tamil Nadu Government has instructed septic tank truck operators in Chennai to install GPS devices in their vehicles to prevent trucks dumping waste in vacant plots (Times of India 2024).

India’s Ministry of Housing and Urban Affairs has partnered with Google, as part of the Swachh Bharat Mission, to map all community and public toilets in Swachh Bharat towns and cities. More than 2,300 towns and cities have registered over 57,000 public toilets, with citizens encouraged to rate and review cleanliness and maintenance online (Swachh Bharat Mission Urban 2025).

## Board and corporate affairs



This overview of innovation in water and sanitation services provision has followed a systems approach by looking at each of the main functions of water service provision. Achieving results from innovations linked to any of the building blocks requires effective management at the functional or building block level, as well as high-quality leadership at senior levels. It is at this level that systems thinking, along with the ability to identify and implement strategies to manage a complex set of interacting changes and innovations across all parts of the utility, becomes critical. Leadership, in the context of the Board and Corporate Affairs function of a utility, is the final issue to address.

This chapter has highlighted the role of leadership in innovation. However, the systems approach needs to deliver quality services in many circumstances as, by definition, not all 285,000 service provider entities in the world can have exceptional leadership. There is a danger that it could become bureaucratic without, at least, good enough leadership. Such leadership needs to be supported by a capable Board of Directors and an effective Chair.

## Boards of directors and organizational autonomy

At an early stage of revitalizing NWSC, the Ugandan Government appointed a Board of Directors comprising permanent secretaries from the Ministries. This led to the Corporation operating more as a government department than a commercial public utility. Lack of independence hindered the Corporation’s ability to deliver services effectively. Subsequently, in 1995 Parliament granted the Corporation institutional autonomy, transforming the Board from a government-dominated entity into a more representative group of professionals (Muhairwe 2009).

Muhairwe (2009) reports that the Board and management of NWSC in Uganda frequently undertook joint visits and workshops. On one occasion, a programme was launched at a hostel, chosen partly to reduce costs but also “to emphasise the equality of all participants regardless of their individual positions.” Senior managers and Board members shared rooms and meals, reinforcing this sense of equality. The Board was involved in all major undertakings, “not only to secure their guidance and support but also to dispel any possible suspicion or accusation of the management operating behind their backs.”

In Cambodia, where a water services provider was established after a period of national emergency, Chan and Mukherjee (2009) describe how the new Board and management of PPWSA faced an urgent challenge to turn the corporation around. PPWSA’s internal reforms were made possible by its significant degree of autonomy granted by the Cambodian Government.

The seven-member Board of Directors met every three months to discuss progress and approve budgets and investment programmes. The General Director was responsible for day-to-day operational and organizational decisions, except for decisions on water tariffs (ADB 2012).

In 2024, PPWSA's Board comprised two Secretaries of State, a Departmental Director, a Deputy Governor of the Municipality, the Director General of PPWSA and two independent Directors with financial backgrounds, one elected "to represent private shareholders." With 85 per cent of the shares owned by the State (represented by the Ministry of Finance), this balance seems appropriate.

The Board of WATCO in Odisha comprises seven senior government officers, two independent directors – both retired from senior government positions – one academic, and the Chief Executive Officer. Vathanan (2024) describes how the utility's leadership engaged directly with the Chief Minister, leveraging political will to overcome institutional hurdles. As he observed, "conventional bureaucracy has the tendency to kill such high-stake initiatives in the budding stage itself, without appreciating the social impacts." Political will, when effectively mobilised, can help to surmount bureaucratic barriers, unlock resources for transformative initiatives, and generate a ripple effect across stakeholders, fostering collaboration and public support.

One issue that required high-level political backing was the extension of services to slum dwellers and urban poor people. Providing free water to low-income households and relieving women of the burden of daily water collection represented a transformative step, yet it demanded a substantial financial commitment. Securing endorsement from the highest political levels was therefore essential before the initiative could advance through regular administrative channels.

## Board authority and responsibilities

PPWSA in Cambodia describe the Board roles, duties and responsibilities and performance as follows:



Define enterprise development projects in accordance with guidelines set by the Government



Define annual budgets, investment programmes and reserve financing for investment programmes



Approve accounting statements



Define the organizational structure and salaries of employees at the request of the Director General



Allow the purchase of real estate



Select the audit commissioner



Decide on other contracts



Regularly review objectives set for the enterprise and take corrective measures on requests for amendments to the statute

In some countries, the Board is also responsible for recruitment and termination of the chief executive or managing director.

Among the critical issues that a Board must consider – beyond those outlined above – are the scope and responsibilities of the utility itself. These include whether the entity is mandated to provide water supply alone, or water together with sewerage, sanitation and drainage services; whether it manages bulk water resources; and whether its remit extends to the financing and delivery of capital works. The Board must also determine whether the utility's operations are confined to a single city or expected to expand to additional urban centres and surrounding rural areas.

The Board is responsible for signing off on the service strategy, the customer focus and the standards to be delivered, particularly to the lowest-income consumers. The Board should know the percentage of the lowest-income quartile who receive improved water and sanitation services. If management cannot provide this information, the Board should demand it, since "what is not being measured is not being managed." It can be argued that the key objective for having a public water and sanitation provider is to serve the poorest, where the public need is greatest and where public health is most at risk. The rich can always look after themselves, although its involvement is certainly needed to cross-subsidize services.

## Financial transparency

It is the Board's responsibility to understand and control the financial well-being of the utility. An effective accounting system that can deliver an annual financial statement of accounts is critical, to include an income and expenditure statement, including asset depreciation and a surplus or profit (or loss) for the year. A Balance Sheet explains the assets in use and how they have been funded, including outstanding loans and levels of customers bad debts. A Statement of Cash Flows

shows how much revenue has been collected, funds received from donors and government etc., and how it has been spent on capital maintenance. However, delivering an annual Financial Statement would be a significant innovation for the majority of water service providers.

### Organizational structure, partnering, out-contracting

This chapter has tended to assume the conventional structure of a full-service provider, incorporating all the main functions within a single organization. However, there are many possible variations. Management contracts have been a means of re-invigorating services over a shorter period with key performance targets for the new management.

Design, build and operate approaches and similar contracts are all means of attempting to ensure that more of the risk passes to the contractor to ensure that they provide higher quality outputs than through conventional contracting.

Performance-based partial services contracts, contracting out elements of a utility's functions to private businesses or social enterprise partner can be innovations. These forms of outsourcing are intended to improve quality of service provision in terms of adequacy and reliability. This can already be seen in the non-sewered sanitation businesses, particularly in pit emptying and container-based sanitation removal and transport.

These are challenging decisions for any Board, uncertain whether the costs of paying a private provider or contractor and the loss of direct control are worth the possible benefits.

### Leadership



The leadership and governance of water and sanitation utilities have long been recognized as decisive factors in determining service quality and institutional performance. Utility managers, regulators and researchers consistently emphasize that technical and financial inputs alone are insufficient without a strong organizational culture, ethical foundations and committed leadership. This perspective is clearly articulated by the Nyeri Water and Sanitation Company Managing Director who sums up the most pressing governance challenge as follows: "A utility must be run by a competent management team and must have staff that are guided as much by ethics as they are performing their duties. A utility may get finance or have a state-of-the-art technology but without the right people it's impossible to attain the right level of performance." (GWI 2020b).

The importance of leadership as a catalyst for institutional transformation is further reinforced by Muhairwe (2009). Reflecting on his experience in driving change within a public utility, he underscores that leaders must model the cultural shift they wish to see and remain steadfast in their commitment to reform. He stresses: "Encourage participation across the board and identify lead champions to drive change. Implement short, high-impact programmes with clear priorities, inputs and outcomes. Avoid capacity and resource constraints and maximize available resources. Remember that success comes from hard work, teamwork, competition, fair play, accountability and transparency. Celebrate every achievement by involving high-profile persons and all stakeholders."

Building on this, Mugisha (2019) underscores the importance of managerial initiative and continuous learning. His analysis suggests that sustainable improvements are more likely when managers actively seek solutions, test new approaches and invest in ongoing capacity development. He observes that utility management benefits from a do-it-yourself mindset, in which continuous capacity-building leads to more sustainable, predictable and cost-effective results. Such an approach, he argues, nurtures openness to change, encourages process innovation and helps cultivate a participatory culture among staff.

Chan and Mukherjee (2009) provide further insight into leadership practices that place customers at the heart of service delivery. Drawing on the transformation of the Phnom Penh Water Supply Authority in Cambodia, they note that the leadership placed a strong emphasis on understanding the lived realities of consumers, particularly those experiencing vulnerability. As they report, the utility's guiding principle was: "we never disconnected a single connection of the poor."

## Conclusion

This chapter provides a range of examples of utilities that have innovated in both their management and technological approaches. If there is a central lesson, it is that there are many ways to improve efficiency in utilities, to reduce costs and improve services. Utility leaders are coping with uncertainty and extreme pressure in both the physical and financial environment and must take decisions without being certain about outcomes. Technology offers some potentially exciting opportunities for solving some decades-old problems such as how to reduce the high levels of non-revenue water that is lost to leaks or theft. Artificial intelligence could become a game changer for anticipating demand, for preventative maintenance, while new techniques for managing faecal sludge could turn today's risks into tomorrow's commercial opportunities.

None of this will happen unless managerial and technical skills are embedded within utilities so that

they become organizations that are well connected, are always looking to improve, innovate and learn and are excited to meet their challenges.

The reality is that many of the world's utilities, the service providers, are presently underperforming – and there is no alternative but to find ways for improvement. If utilities are not financially viable, even with some level of ongoing subsidy, the services they are expected to deliver are less likely to effectively serve the poorest, who are most likely to be left behind. These services are also less likely to be sustainable and resilient enough to meet their objectives.

This chapter provides a range of examples of utilities that have innovated in both their management and technological approaches. The stakes are very high because the services that utilities provide are absolutely central to achieving the goals set out in Agenda 2030 for Sustainable Development.

Concrete outfall structure with multiple flap gates.  
Photo: Siyanight/Shutterstock



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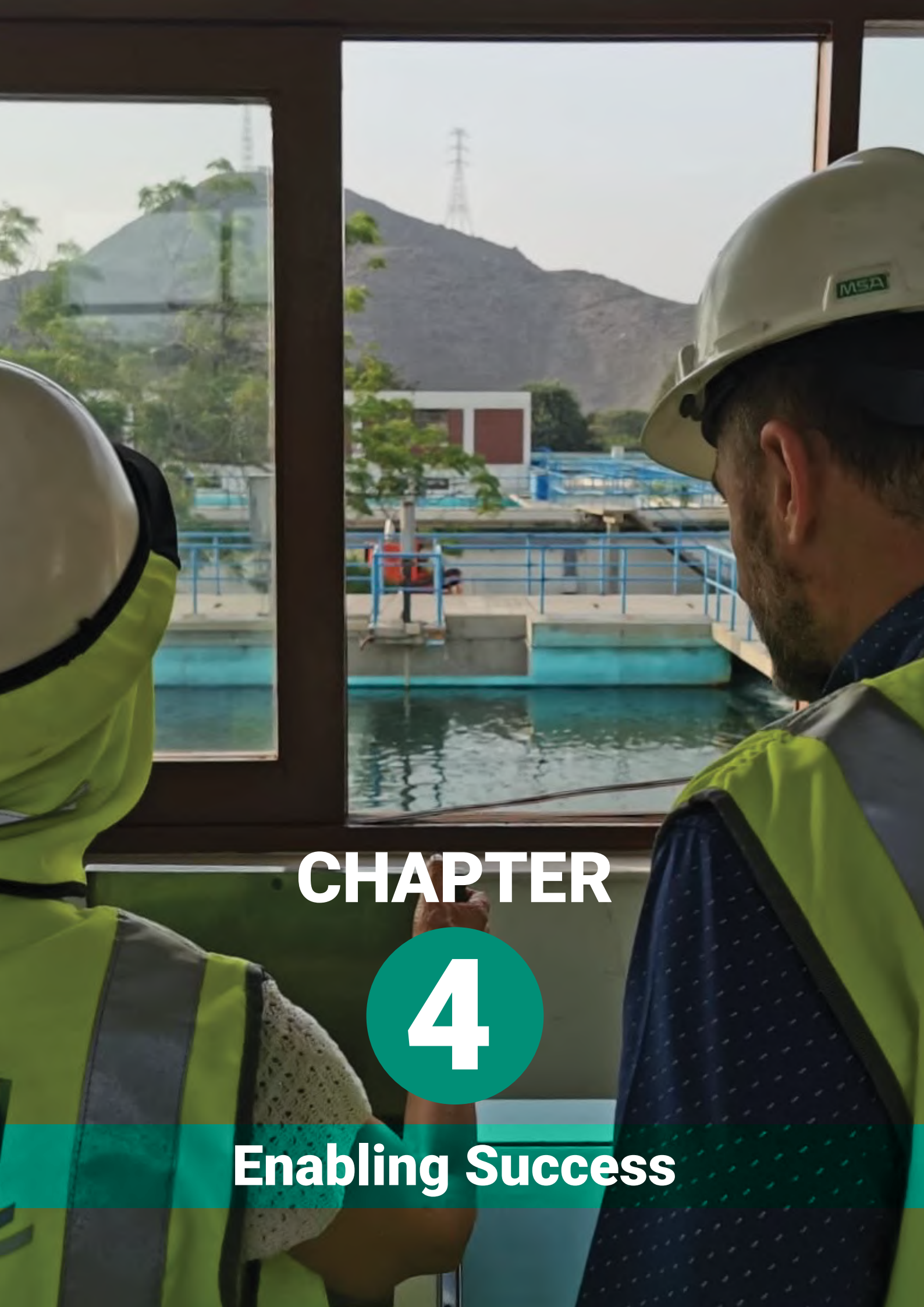
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# CHAPTER

# 4

# Enabling Success

## Introduction

This report has shown that the performance of water and sanitation utilities is critical to meeting people's human needs and rights, to economic and social development within countries and to meeting the global sustainable development goals. It has shown some of the challenges that utilities face and that, despite these obstacles, there is a sense within these organizations of a determination to improve.

In the 2025 Global Survey on Water and Sanitation Service Providers conducted for this report, a majority of respondents said that the number of people receiving services in their utilities has increased. In many cases, this expansion has also resulted in an increase in services for people living in poor and marginalized communities. To the best of their abilities and capacities, utilities are doing their jobs. As one person put it during a consultation session for this report: "Utilities are frontline actors not just service providers."

However, the survey also shows high levels of concern. Those working within and closely with utilities expressed frustration at lack of investment, lack of organization, lack of clear and helpful rules and regulations and lack of capacity in terms of staff, skills and equipment.

Utilities can only achieve their potential by functioning within an environment that addresses these issues and supports attempts to innovate and solve them. A shift is needed, not only within utilities, but also by the external bodies and forces that make up the wider environment. Major economic and demographic shifts threaten

utilities' financial sustainability, compromising their ability to reach everyone with services. Many people moving into cities or refugee camps experience severe poverty and are unable to pay a market rate for water, construct safe toilets or connect to existing systems. In areas that are depopulated as people move out, utilities lose revenue and find it even harder to sustain services.

Another fundamental challenge is the escalating effects of climate change, comprising drought, floods, urban heat islands, and salinization and pollution of fresh water. Indeed, UN-Water says: "Climate change is primarily a water crisis" and "sustainable water management is central to building the resilience of societies and ecosystems and to reducing carbon emissions." (United Nations/UN-Water 2023). Utilities are simultaneously victims of and a source of solutions to the climate crisis, both in terms of mitigation and adaptation. The enabling environment has a major role to play globally in terms of climate action. Treaties such as the United Nations Framework Convention on Climate Change – and the degree to which subsequent advocacy and negotiations are successful – can pave the way for meaningful progress within regions and individual countries by utilities.

Chapter 3 of this report sets out ways in which utilities can innovate and improve. They cannot do this alone and need to be integrated into a coherent national and local pattern of policies, regulations, funding, partnerships and support to develop capacity and meet their responsibilities.

## Seven pathways for change

This chapter identifies key entry points to address such systemic challenges. We call these Seven Pathways for Change. These pathways are routes towards system-level action to support utilities, improving their enabling environment and ability to adapt and innovate, thus allowing greater contributions toward the SDGs.

Pathways combine concepts of a sense of direction and a destination. They signpost routes to progress through the maze of institutional and individual responsibilities and challenges. They highlight durable areas of action that will work for all utilities, whatever their size and sophistication in terms of technologies and resources. In this report seven pathways are suggested. These are not alternative routes to full coverage – they are critical areas for addressing challenges and strengthening approaches. The final Sustainable Development Goal relates to partnership. Utilities do not walk these paths

alone. They must be accompanied by institutions, sectors and individuals to achieve lasting change.

Identifying these pathways and the actions within them has itself been a participatory process involving people with experience and knowledge and a willingness to learn together.

Overall, these pathways illuminate system-level action to support utilities and to improve the enabling environment and ability to innovate, facilitating stronger contributions toward the SDGs. System-level reforms can prove an untapped accelerator of progress towards numerous development goals. The stakes are high and time is short, and it is critical to narrow in on the most promising solution pathways, relevant across a wide range of structures, sizes and settings.

## Political and systems leadership

Within the framework for accelerating progress toward SDG 6, “the need to dramatically increase political commitment to drinking water is clear” (WHO 2022). Political support for water and sanitation, from municipal leaders to heads of state, is critical to mobilizing additional resources for utilities and driving change across governments to enhance the enabling environments in which utilities operate. This includes decisions about subsidies and investments derived from taxes made by government and their finance ministries, changes in tariffs where increases will usually be politically sensitive, the use of investments from development partners including grants and loans, as well as policies addressing new challenges in areas like climate change and environmental protection. Political leadership plays a critical role in reaching the underserved and in leaving no one behind.

Chapter 3 showed how, with political support, it is possible to deliver universal piped on-premises services, even to the poorest families living in slums. Odisha in India included poor families in the Drink from Tap Programme at zero cost for new piped connections. On being approached the Chief Minister of Odisha approved an exemption from mandatory charges the same day without question or discussion.

By initiating the Swachh Bharat Abhiyan (Clean India Mission) in 2014, India’s Prime Minister Narendra Modi’s political leadership transformed sanitation in India. The Mission became the largest toilet-building

initiative in the world and prompted the construction of more than 95 million household sanitation facilities (Behera et al., 2021).

Nigeria has replicated this approach in its Clean Nigeria: Use the Toilet campaign, which seeks to end Open Defecation in the country by 2025. Jigawa, a state that had been described as one of the most difficult settings in which to eliminate open defecation, achieved landmark success in 2022 by becoming the first state in Nigeria with ODF status. Among contributing factors, strong political leadership at national, state and local levels strengthened commitment and unlocked critical funds for success (Ogunjobi et al. 2023).

Muzaffargarh State, Pakistan, is another example where a WaterAid project that constructed 1,400 demonstration latrines, backed by political leadership from the state and the backing of a financial institution and the Public Health Engineering Department, led to the construction of another 80,000 toilets and the whole district of four million people being declared open defecation-free.

The global Sanitation and Water for All partnership (SWA) has developed a Heads of State Initiatives (HOSI) to encourage political leadership for WASH. Presidents and prime ministers from Ghana, Indonesia, Malawi, South Sudan and others have embarked on the processes ambitious commitments to change systems and to deliver action at the highest levels, reflective of national contexts and systems of government.

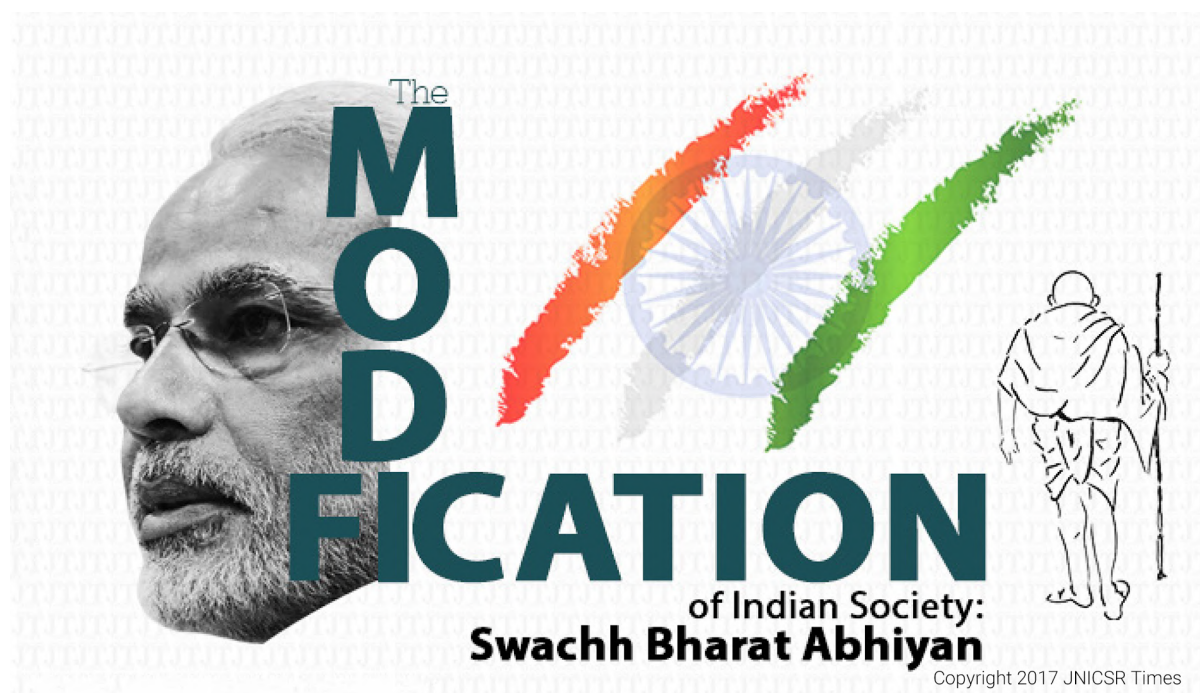


Figure 4.1: A banner promoting Swachh Bharat, highlighting the transformational change sparked by Indian Prime Minister Modi’s vision for WASH

City mayors play an increasing role in addressing the water crisis. According to C40 – a network of nearly 100 mayors pledged to act on climate issues – one in four of the world’s largest cities is currently water stressed. Changing climate conditions will mean they face more frequent and intense impacts on their water, increasing water scarcity, drought and deteriorating water quality. C40 launched a Water Security Network to focus on four areas – reuse and recycling; demand management; integrated water and data management; and watercourse management.

In 2022, The Organization for Economic Co-operation and Development (OECD) and United Cities and Local Governments (UCLG) Africa gathered mayors, local and regional elected officials at the 9th World Water Forum in Dakar. The Roundtable of African Mayors for Water Security signed an Action Plan for Water Security that proposes concrete actions for local and regional governments to drive water security. The 10th World Water Forum in Bali, Indonesia, in 2024 included 300 representatives from local and regional governments and basin authorities.

They made a declaration supporting moves towards making the right to water enforceable. They pledged to give priority to securing resources and infrastructure to deliver drinking water and treat wastewater, optimize irrigation systems and repair leaks, to reduce the water

footprint, and to implement nature-based solutions that protect aquatic ecosystems to preserve and restore sustainable biodiversity.

## Climate action and environmental management

Climate change is transforming the context in which utilities operate, placing them at the frontline of its impacts. They must act on both mitigation – for instance by reducing energy consumption – and adaptation to ensure resilient service delivery.

As shown in Chapter 1, the survey conducted for this report showed very high levels of concern from water and sanitation utilities about the impact of climate change on their ability to increase coverage and improve quality. This concern is similarly reflected in survey results from 61 water operators of varying size across 11 countries in Latin America and the Caribbean (Solís 2023). Though not large enough to serve as a globally representative sample, water operators in the region are acutely feeling the effects of climate change, with the most common impact being a reduction in river flows (cited by 77 per cent of surveyed operators). Beyond the issue of greater competition for water resources fueled by increasing scarcity, utilities will also have to contend with higher operating costs.

### City leadership averted a crisis

In 2018 Cape Town shocked the world when it predicted that it would run out of water on Day Zero in April. Panic hit the city as residents lined up to collect water and businesses and tourism were hit.

Day Zero never quite arrived although there is still a major shortage of water and the reservoirs are still below safe levels. Government intervention made the difference.

The national government reduced water earmarked for agriculture, allowing more to flow to urban residents. The regional government of Cape Town launched a campaign to reduce water consumption and warn people that the reservoirs were drying up. Monitoring systems were put in place to measure water usage. Media urged people to reduce consumption to 50 litres a day, Cape Town banned use of water for swimming pools, lawns and other non-essential uses and increased water tariffs and implemented a new water-pressure system. The city government demonstrated that political leadership can bring positive change, when supported by communities and businesses. Peak use was cut by half in three years.

Although the crisis was averted shortages persist, disproportionately affecting low-income residents. While wealthier households have drilled private wells, poorer communities continue to depend on shared public taps for their daily water needs.

Cape Town is making a longer-term effort to diversify but alternatives like desalination and tapping deeper aquifers are expensive. Keeping public confidence and cooperation is still a major challenge for political leaders.

Sources: WaterAid (undated) and Alexander, C. (2019)

### “Polluter pays” principle coming into play in the European Union

In Europe, legislation is catching up to the global reality of growing environmental and health concerns from unsafe wastewater.

Effective in January of 2025, the European Union adopted new urban wastewater rules. The updated Wastewater Treatment Directive creates stricter standards in an effort to modernize treatment practices across the region. Notably, the Directive stipulates that cosmetics and pharmaceutical industries must pay 80 per cent of costs to remove chemical and microplastic pollutants, employing a principle of climate justice known as “polluter pays.”

Source: EU Directive 2024/3019 of the European Parliament and of the Council of 27 November 2024 concerning urban wastewater treatment <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32024L3019&qid=1734080677883>

These cost increases could result from increased need for water treatment due to contamination, increased turbidity or saline intrusion, partly linked to climate change impacts, such as flooding, storms, sea-level rise and heightened rates of water-borne disease. Additional costs result from damage to utility infrastructure, more intensive operation and maintenance needs and revenue shortfalls due to intermittent service. Finally, there are mounting risks to do with emerging pollutants, such as PFAS – commonly known as forever chemicals.

Since water is a finite resource, the global water and sanitation system needs to be seen as a circular process. As long ago as 2016, the International Water Association (IWA) predicted “Water, sanitation and wastewater utilities can become engines for the circular economy. Water utilities have an opportunity to start to see water as a medium of valuable resources and more significantly have an important role to play as resource stewards” (IWA 2016).

IWA proposes three pathways towards a circular system. The *water pathway* is seen as a closed loop with diversified sources, including rainwater harvesting, a demand management strategy, greywater recycling and water quality options depending on use, providing reused water for agriculture and industry. The *material pathway* involves developing new markets for sludge and other waste products in agriculture, parks and industry, with suitable treatment and regulation. The *energy pathway* reduces reliance on carbon-based energy, increases renewable energy use, produces renewable energy and makes a contribution to zero-carbon cities. This overall strategy requires stronger interaction with the public over water use, and alliance with city leaders, civil society and industry to influence change. As regulatory standards have a strong influence over the development and use of waste products, dialogue is also required between regulators, civil society representatives and utilities.

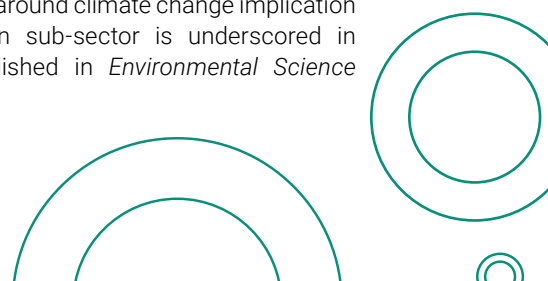
Prioritization of fit-for-purpose water is another opportunity for economic and environmental efficiency.

Provided that governments can overcome challenges with public acceptance of reclaimed water, the practice of differentiating standards and processes for treating water according to its intended purpose can have enormous economic and ecological benefit. A fit-for-purpose regulatory framework, “combined with financial incentives, such as reduced tariffs for reclaimed water use or subsidies to companies can open up pathways for circular practices, according to a UN University policy brief.” (Caucci & Ozkul 2024).

Converting waste products into material that can be safely stored or has value and can be used (e.g. as fertiliser) makes a strong contribution to a circular system. However, there are profound differences in how sanitation waste is managed in high-, middle- and low-income countries, especially where there are rapidly developing cities with less developed sewerage systems. Global estimates of emissions of greenhouse gases do not take into account the complex service chain in rapidly growing cities in low- and middle-income countries. A paper in Communications, Earth and Environment (Johnson 2022) analysed emissions from all stages of the sanitation-service chain, using Kampala, Uganda, as an example. It shows that long periods of storage of faecal waste in sealed anaerobic tanks, discharge from tanks and pits direct to open drains, illegal dumping of faecal waste, leakage from sewers, wastewater bypassing treatment and uncollected methane emissions at treatment plants contribute to high levels of greenhouse gas emissions. In Kampala, emissions from the sanitation chain may represent more than half of the total for the city.

The authors call for significant work to update estimates of greenhouse gas emissions from sanitation systems globally, an opportunity where climate funding would be well-placed to support.

The lack of research around climate change implication within the sanitation sub-sector is underscored in another article published in *Environmental Science*



& Technology, where this evidence base is described as weak. “The implications of climate change for urban non-sewered and complex, fragmented and (partially) decentralized sanitation systems remain under-researched. In addition, the understanding of the impacts of climate change on urban sanitation systems fails to take a comprehensive citywide perspective considering interdependencies with other sectors and combinations of climate effects” (Evans et. al. 2022).

Innovation in addressing these challenges can invigorate utilities and drive them to become leaders in making cities and countries more climate change resilient. Climate-driven policies can become enablers for utility success and sustainability. Jobs in utilities should be seen as green jobs with high social value and prestige, and staff should receive dedicated training on climate resilience and risk reduction. Nationally determined contributions offer a key entry point to recognize utilities as key stakeholders in national and local climate action.

Climate change will increase costs and risk for utilities, but innovations in financing can support how they manage this new environment. As shared in IDB’s 2023 report entitled *Under Pressure: Effects, Impacts, and Adaptation to Climate Change in Latin America and Caribbean Water Operators*, climate change impacts the demand and supply of water services, but water operators have several options for adapting to these impacts, including: “diversifying sources and investing in system redundancy, increasing operational efficiency, managing demand, incorporating resilience throughout the investment project cycle, performing adequate maintenance to counteract asset wear and tear, and implementing nature-based solutions” (Solís 2023).

Though utilities currently invest most climate funding in adaptation of grey infrastructure, attention must also be paid to nature-based solutions). These were defined by the International Union for the Conservation on Nature and Natural Resources as “solutions that address societal challenges through actions to protect, sustainably manage, and restore natural and modified ecosystems, benefiting

people and nature at the same time.” The approaches that utilities can take to succeed in a changing climate do not have to be pitted against one another nor should they be considered mutually exclusive. In fact, some will have complimentary impacts across dimensions of a utility. Nature-based solutions approaches future-proof infrastructure and decrease operating costs over time by building resilience within a service delivery system and contributing to disaster risk reduction.

Utilities have an important role to play in National Adaptation Plans and in preparedness for disaster response and should be able to access climate funding for this purpose. Currently, cities are recipients of less than 10 per cent of direct climate finance from multilateral banks, and furthermore, the least developed countries can see as little as 1 per cent of climate finance for cities. Adaptation funding must be able to reach the municipal and local level where it is most urgently needed. “Infrastructure and basic services can play an essential risk-reducing role – but in many informal settlements, these infrastructures and services are strikingly absent. Simply increasing the coverage of these essential services like water, energy, sanitation, waste disposal, transportation, and thus access to education, jobs, health or telecommunication will improve the adaptive capacities of the communities and reduce the impact of climatic hazards.” (UN-Habitat 2023).

If these sources of funding are reformed to become more accessible, it is important to recall that they are considered vulnerable to integrity risks and steps need to be taken to ensure transparency of spending once allocated. The Water Integrity Network has a full set of tools geared toward utilities, regulators and partnerships to support integrity management and help address these risks.

Manila Water Company, Inc. in the Philippines is an example of one utility that has managed to successfully combine multiple approaches to climate action through leadership, mitigation and adaption including nature-based solutions. Early recognition of operational risks led them to adopt a Climate Change Policy in 2007.

### Diverse benefits of nature-based solutions

In their 2025 report entitled *Doubling Down on Nature*, *The Nature Conservancy helps to characterize investments in nature-based solutions. They also developed WaterProof, a free online platform which provides stakeholders with an opportunity to explore pre-feasibility and estimated return on investment of nature-based solutions. While “some nature-based solutions generate a financial return, most deliver benefits in the form of cleaner or more reliable water supplies”. Notably, certain nature-based solutions also help avoid treatment or rebuilding costs, thus, investment in these approaches carries important economic incentives in addition to the positive environmental impacts.*

Source: The Nature Conservancy 2025

Their climate-related actions have comprised vulnerability and resilience assessments, prompting retrofitting and new asset construction. By 2021, they had supported the rehabilitation and protection of over 2,400 hectares of watershed areas and planted 1.25 million native trees. The utility also focused on mitigation, avoiding carbon emissions through wastewater treatment and prioritizing renewable energy use. Manila Water has been featured in the Climate-Smart Utilities Initiative spearheaded by the International Water Association.

There is an urgent need for greater communication and awareness-building among both governments and citizens of the critical linkages between water and sanitation utilities and climate change. These links should be explored from a mitigation standpoint, understanding the role of utilities in contributing to climate change and as an adaptation opportunity. Increasingly, political decisions will be influenced by the changing climate. Utilities have an important role in talking directly to their customers about the challenges and solutions. They can be part of a process of building public understanding of the need to protect water resources and the environment. The extent to which national governments are able and willing to prioritize and protect the resources that utilities need for service provision will determine if countries are able to ultimately achieve SDG 6.

## Regulation and performance monitoring

The beneficial role of regulation is increasingly recognized as a key driver for achieving the SDG 6 targets of universal access to safe water supply and sanitation. This is now backed by a multi-partner Global Call to Action for Strengthening Water and Sanitation Regulatory Systems. The number of countries with a regulatory framework for water and sanitation services is increasing. An independent and strongly established regulatory entity is a crucial building block to enable lasting water and sanitation services for all users.

Regulation may take place through an independent regulator or designated government structure. Examples include the National Water Services Commission (SPAN) in Malaysia, the Water Services Regulatory Board (WASREB) in Kenya and the Water Services Regulation Authority (Ofwat) in the United Kingdom.

Many countries have an independent regulator for urban utilities. In rural areas, regulation is often the responsibility of local government.

Eastern and Southern Africa Water and Sanitation Regulators Association (ESAWAS) highlights the potential for regulators to improve overall system

strength (ESAWAS 2024). Coordination can be especially valuable in the sanitation sub-sector, where mandates and responsibilities are not always clearly defined. In 2022, ESAWAS, which represents 14 water supply and sanitation regulators, studied the water and sanitation regulatory frameworks in 54 African countries, finding a diversity of frameworks. ESAWAS concluded that regulation by an independent agency performed considerably better than other regulatory models in terms of strong legal backing, the regulatory mechanisms developed and overall sector performance (ESAWAS undated).

Independent regulation has helped many utilities make strides in fulfilling their mandates. However, some countries, like Uganda, have embedded regulatory responsibilities within the government. This may illustrate that there is room for flexibility or could potentially compromise objectivity.

Performance monitoring, such as annual benchmarking or municipal scorecards, can have a positive impact on service levels and enhance accountability. The World Bank points to a “growing recognition that PIR [policies, institutions and regulation] – and water governance more generally – is the missing link for resolving some of the chronic challenges undermining water supply and sanitation services” (World Bank 2022).

Regulation can become a key driver of system-level change for utilities. However, the Water Integrity Network says that legislative measures such as regulation and performance monitoring have a role in enhancing accountability, but may not be able to embed it deeply within the system (WIN 2024). It is important to supplement these formal measures with creative, grassroots mechanisms that can enhance transparency, integrity and accountability from a different angle. For example, in Zambia, NWASCO publishes an annual performance report on the status of the sector. It also facilitates grassroots engagement through established volunteer Water Watch Groups to inform communities about their rights and enhance citizen demand.

## Digital transformation

This concept holds the promise that utilities can embrace new and emerging technologies to improve efficiency and resilience. As one team of experts concluded: “Digital transformation can help water utilities and municipalities better understand water supply and demand patterns, identify inefficiencies and opportunities for optimization of water usage, reduce water losses, embrace water reuse and circular economy principles at every scale and develop more effective water management strategies.” (Aboelnga 2023).



### Mitigating risks in digitalization – People-centred smart cities

While the myriad benefits to utilities of digitalization in the WASH sector are ever more apparent, a revolution does not come without risk. Data governance, environmental impact, equity, and privacy are prime concerns. The challenges are not insurmountable but will require a coordinated approach among all stakeholders. The People-Centred Smart Cities Programme provides a series of playbooks, such as: *Addressing the Digital Divide*, to “empower local governments to take a multi-stakeholder approach to digital transformation that realizes sustainability, inclusivity, prosperity and human rights for the benefit of all”

Source: <https://unhabitat.org/programme/people-centred-smart-cities>

IWA which has established a Digital Water Programme to promote innovation, knowledge and best practice, published a series of White Papers in 2022 as a guide to utilities, water managers and others interested in digital transformation. (IWA 2022). One paper notes that the water industry has been labelled data rich, but information poor, collecting a mass of data (e.g. from metering) that it does not yet have the capacity to use effectively. “The management of data and its quality are the first challenges of Digital Transformation. Without good quality and accurate data, the Digital Transformation of the water industry is doomed to fail.” (IWA 2022).

A survey of progress being made by water utilities notes that uptake is relatively slow compared with uptake in electrical grids. A Smart Water Survey of 64 (mainly public) utilities from 28 countries that have started on this journey found that most progress has been made in water distribution, with less in wastewater and rainwater management and least progress in customers and demand management. However, it concludes that “the introduction of digital technologies to water supply and distribution systems is the entry point that leads to the further adoption of key-enabling technologies in the entire urban water system.” (Daniel 2023).

Thus, regulatory change is needed to encourage digital innovation. “In the absence of common regulation on the installation of digital technologies, water utilities may simply refrain from upgrading to digital technologies while the adoption of new, digital technologies is currently stuttering due to long replacement times and lack of individual affinity for innovation.”

It cannot be down to water and sustain utilities alone to drive the process of digitalization. Daniel et al. (2023) note that more progress will be made if utilities work together. “By working together, water utilities can pool resources and expertise to develop more effective and efficient water management tools and strategies. For example, utilities can partner in implementing sensing networks throughout their watershed and manage their reservoirs and groundwater basins collaboratively while meeting environmental needs.”

It will no longer be enough to optimize internally: the water and sanitation sector needs to plug in to a larger platform that enables the integration of all utility services in a city. There needs to be a cultural shift both internally (by sector leaders) and externally, especially to create a policy and regulation environment that will encourage a digital water future, led by champions who are able to drive change. Utilizing the People-Centred Smart City guidelines, a flagship programme of UN-Habitat, will help utilities form part of a holistic and equitable ecosystem serving urban populations.

Finally, the water sector needs to support the role that trained water professionals and engineers play in applying the right (digital) solution in the correct step of the water cycle. Technical and engineering skills need to be recognized as fundamental, together with operational management skills, to address the technical skills gaps that the industry is currently suffering. There is a need for water professionals to develop their training and education to improve technical skills together with soft skills (e.g. problem solving, self-management, interpersonal skills) which are also fundamental in adapting to change. With the huge potential of AI and new technologies, come associated risks of losing control of systems that are largely automated. Professionals with high levels of skills, motivation and awareness will be needed to guide systems that remain environmentally responsive and people-centred.

### Economies of scale and collaboration

A trend in the current phase of progress toward SDG 6 is the consolidation of utilities to achieve economies of scale. Consolidating and extending utility mandates is a transformative approach to addressing inefficiencies and achieving universal access to water and sanitation. The key drivers include:



*Optimizing resources:* combining urban and rural services under one mandate allows for shared infrastructure, reduced redundancies and enhanced cost-efficiency.



*Resilience and scalability:* integration strengthens service delivery systems, reduces operational risks, and facilitates cross-subsidization, ensuring financial sustainability without compromising affordability.



*Addressing service gaps:* utilities often prioritize urban areas, leaving peri-urban and rural regions underserved. Consolidation bridges this gap, promoting equity and universal access to water services. Leaving no one behind is a key objective for utilities without which the SDGs cannot be achieved.



*Optimizing resources:* combining urban and rural services under one mandate allows for shared infrastructure, reduced redundancies, and enhanced cost-efficiency.



*Resilience and scalability:* integration strengthens service delivery systems, reduces operational risks, and facilitates cross-subsidization, ensuring financial sustainability without compromising affordability.

A strong legislative environment can enable policy and legal reforms, such as the expansion of utility mandates to encompass rural and peri-urban areas, supported by updated regulations and service delivery standards. In particular, the mandate of utilities should be to reach all households – regardless of whether they

have legal status or approval. This will also require clear procedures for applying subsidies in poor communities, which must include reimbursement from public funds for the utilities.

The integration of urban and rural services is a ripe opportunity for improving efficiency and resource utilization. For example, Benin is creating a unified framework for urban and rural services through a merger between the urban utility SONEB and the Beninese National Agency for Drinking Water in Rural Areas. ANAEPMR. Desired outcomes are expanded access, reduced system breakdowns, improved reliability and better financial sustainability. Unification also supports tariff equity and transparency between urban and rural regions, improving the WASH financial landscape for utilities and consumers alike.

Beyond operational advantages, there is a clear equity argument to be made for extending the scope of utilities to operate in traditionally underserved or unserved areas. While the first foundational step towards universal services is enshrining the right to water and sanitation, this political move must be backed by resources and reform in other areas to enable a smooth transition. As described by USAID's enabling environment analysis, "unclear legal status can hinder service provision in LIAs, as utilities may not be authorized or incentivized to operate in these locations" (Drabble et al. 2021; Mallory et al. 2022). Their recommendation is to make

### Colombia's Agua al Barrio (*Water for the Neighbourhood*)

Colombia's water and sanitation regulator, Comisión de Regulación de Agua Potable y Saneamiento Básico (Regulatory Commission for Potable Water and Basic Sanitation, or CRA), is a special administrative unit of the Ministry of Housing, Cities and Territory. CRA is leaning into the theory that a differentiated strategy can offer a utility huge potential to improve and extend their services. CRA's Expert Commissioner acknowledges that while Colombia has made impressive strides toward water and sanitation coverage levels, the "most significant urban service gaps are in informal settlements, poor municipalities, and remote areas." The flexibility that CRA is offering to utilities defers to their technical expertise on how best to serve those areas, while maintaining their role in oversight to ensure compliance in implementation practices.

CRA also emphasizes the essential role of municipalities in urban planning, allocating funds, and supporting inclusion of informal areas into legislative reforms.

CRA itself has had to evolve in order to address urban sanitation gaps, by reforming public policy to expand their mandate beyond sewered sanitation. In 2019, the central government launched 'Agua al Barrio,' or 'Water for the Neighbourhood' which requires utilities to address sanitation simultaneously with extended water services. CRA sees its role as helping to provide incentives and reduce risk for utilities, making it economically feasible to operate in underserved peri-urban areas. Agua al Barrio "prioritizes everyone's human right to sanitation, provides 'safe management' throughout the entire sanitation service chain, recognises that sanitation contributes to a prosperous urban economy, and commits to a partnership approach to providing inclusive water and sanitation services across the cities."

Source: IWA 2021

explicit changes in key legal documents that recognize the right to water and sanitation of specific populations, such as defining city boundaries in a way that includes informal settlements in the service mandate.

In order to reach unserved and underserved areas, the mandate of utilities must be extended to marginalized populations within peri-urban and rural contexts. Utilities need flexibility, resources and skills to meet the changing needs of fast-growing populations. Flexible mandates can reflect local demographic, economic and geographic realities and ensure effective service delivery.

From efficiency to equity, many positive outcomes can result from extension and consolidation of utility mandates. The isolated examples are encouraging, though the real benefit lies in scalability. One of the most effective ways to encourage uptake of these reforms is by sharing in partnerships and regional networks, which is explored below.

## Using funding effectively

The most significant barrier to real change and accelerated progress towards universality of lasting WASH services is finance. The world is asking low- and middle-income countries to surpass previously achieved levels of service in water and sanitation, and to do so in a climate-resilient way, without accounting for the resources required. The current funding gaps – a 2024 World Bank report estimates that, globally, countries need to nearly triple their spending towards WASH (Joseph et al. 2024) – cannot be filled through user tariffs.

A UN-Water analysis (GLAAS 2021) showed that, globally, 61 per cent of funding came from households. However, given general pressures to keep tariffs affordable, heavy reliance on this source makes cost recovery extremely difficult. Over half of 96 responding countries surveyed for the 2019 GLAAS report indicated that household tariffs are insufficient to cover basic operations expenditure.

The sector needs to mobilize higher public funding allocations and acknowledge the role of transfers and private sector finance, so that utilities can reach the point of operating cost recovery. The measures to attract additional funds to utilities revolve mainly around one area: reducing the risk profile of their operations. This is true for attracting public or private funds, grants or loans (even highly concessional ones). Giving or lending to water sector utilities needs to be possible and perceived as medium risk, with investors becoming more comfortable with the specific complexity in sector arrangements and long-term payoffs.

Three main areas are critical for risk mitigation for investments: asset management, tariff reforms, and eliminating corruption while gaining efficiencies.

Reducing risk means that tariffs need to cover at least minor maintenance while other inter-governmental transfers cover major maintenance and expansion of the network. This is to ensure a basic level of sustainability of investments. Tariffs need to be revised annually, at a minimum, to include inflation rates. Tariff reform is a complex and time-consuming mechanism that can only be taken progressively alongside service improvements. Frontloading investments through performance-based mechanisms has been successful in many countries (SWA 2020). Revising tariffs can then be closely linked with incentives for the reduction of non-revenue water.

Financial challenges do not only affect low- and middle-income countries. Research by McKinsey and Partners shows the US water utility sector faced an estimated USD 110 billion funding gap in 2024 (nearly 60 per cent of utilities' overall spending), and that this gap could increase to USD 194 billion by 2030 (Barth 2025).

The gap is partly created by the need for utilities to manage complex climate challenges, notably water stress and flooding, hazards that are expected to increase in the United States and globally. McKinsey says that actions that can be taken to mitigate these problems could reduce the gap by 25-45 per cent. These include optimizing existing funding sources, developing long-term resilience planning, and making operational efficiencies.

The McKinsey report states: "Although water utilities did not create these challenges, they must not fail to provide solutions as well as drinking water and wastewater services. If they do, the consequences for communities could be catastrophic."

One of the most important roles for government to play in creating the right conditions for utilities to succeed is around tariffs. As mentioned by the Water Integrity Network, "governments should establish a transparent framework and methodology for tariff setting and review" (WIN 2024). WIN also notes that tariffs are at particular risk of interference by politicians, making clarity and transparency even more important. This can combat corruption in the sector, while also critical for establishing financial viability among utilities and moving towards universal services. This should all be done in consultation with water users and with meaningful representation of marginalized groups. A similar process should be followed for subsidy policies to help ensure that the support reaches populations for whom it is intended. Beyond a visible process which can lend legitimacy to the mechanism, subsidies require review and evaluation on a regular basis to avoid capture by elites (WIN 2024).

The Water Integrity Network report also suggests addressing non-revenue water from the angle of integrity, rather than as a solely technical issue (WIN 2024). This can accelerate reduction of non-revenue water and make services more accountable to resource expenditure.

Estimates by the Water Integrity Network and the Inter-American Development Bank suggest that up to 26 per cent of the finances invested in the water sector are lost due to failures of integrity such as corruption and mismanagement (Adam et al 2020). The complexity of institutional arrangements and high capital investment costs leave the water and sanitation sector especially vulnerable to these risks (WIN 2024). Capital maintenance funding is at a particularly acute risk and without it, infrastructure eventually has to be replaced at a huge, wasted cost. To effectively address capital maintenance, there is a need to strengthen governance and the financial management regimes at multiple levels of government.

A 2024 report by the World Bank suggests that the water sector, globally, has an average budget execution rate of just 72 per cent (Joseph et al 2024). There are factors beyond corruption that contribute to this

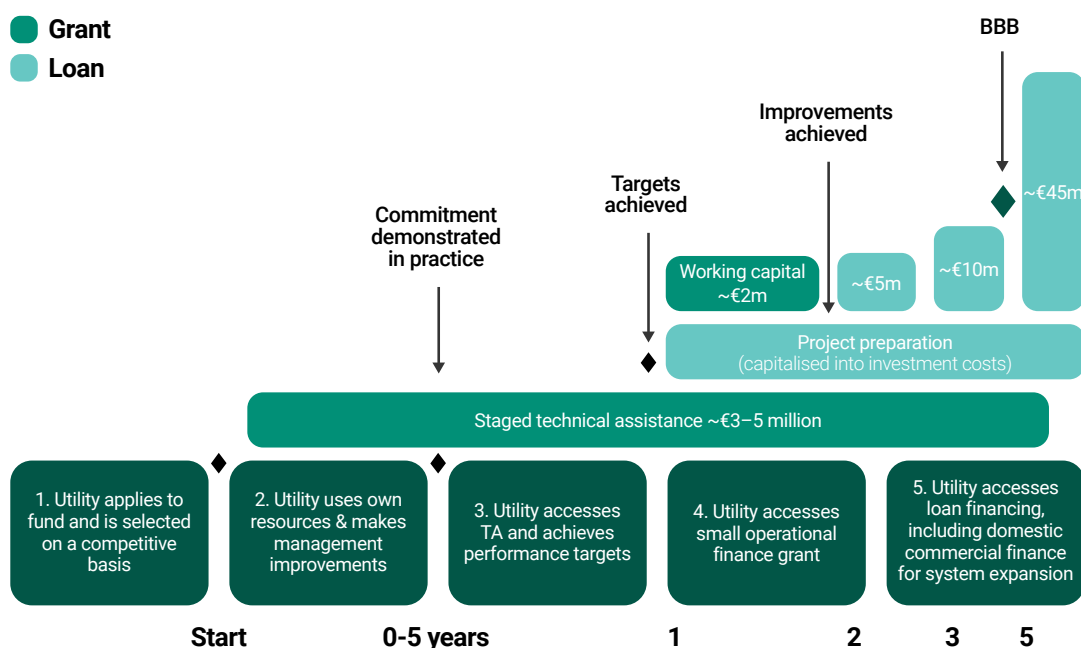
statistic, but ultimately, all of them support a case for improved transparency and financial management of water and sanitation budgets.

Other efficiencies can be gained by improving the financial governance of wastewater services. One of the first measures is to permit water utilities to combine wastewater bills with water bills. Another is to ringfence specific taxes for sanitation services. Environmental taxes can raise additional revenues and boost fiscal space, meeting in part the need to invest in infrastructure and measures to achieve the SDGs or increase resilience to climate change impacts (UNESCAP 2017). Cambodia for example is currently preparing for sanitation tariff reforms for urban areas, with the intention to roll out a sanitation tariff collected by water operators through combined water and sanitation bills in several cities and towns.

### Funding opportunity for performance improvements: Urban Water Catalyst Initiative

WaterWorX, KfW and GIZ developed the Urban Water Catalyst Initiative which is a financing mechanism for urban water utilities that have demonstrated willingness to improve their operations. Participating service providers will benefit from tailored technical assistance combined with demand-driven, short-term operational investments to improve the efficiency of their assets and business processes. The aim of these interventions is to enhance the creditworthiness of utilities, and thus to prepare them for loan-financed infrastructure investments, especially from domestic financiers.

The programme aims to improve the performance of 39 urban water utilities in 15 low- and lower-middle income countries by 2030, and ultimately to provide 10 million people with improved water services. Finance for small investments will be made available early in the process to support performance improvements.



Sources: VEI 2022, GIZ/KfW 2021

### Kenya's Innovative Finance Facility for Water

Kenya's Innovative Finance Facility for Water (KIFFWA) is structured as a typical investment fund with a Foundation (located in the Netherlands) and a Fund Management Company (based in Kenya). The vision is to be the preferred investment partner for scalable water-sector initiatives that promote climate resilience.

KIFFWA offers early-stage, risk-tolerant, catalytic and patient capital to innovation-driven projects and high-growth companies in the water sector. Alongside this investment, it provides extensive technical, financial and legal expertise from the point of onboarding to the point of exit. This assistance encompasses concept development, business model improvement, legal structuring and transaction support during negotiations with other investors.

Source: <https://kiffwa.com/>

Larger utilities usually have access to commercial or concessional finance. The use of credit enhancements in the form of risk-sharing mechanisms and technical assistance packages is one useful approach. However, it must be noted that for tapping into some options a set of basic conditions need to be in place<sup>1</sup>.

Innovative and emerging sources of funding, such as climate finance, can play a part. However, these will remain confined to a niche role, unless complexities are reduced sufficiently for this source to become more accessible to municipalities and utilities that urgently need it. (Fonseca 2024). Climate funding needs to be

reframed as water and sanitation funding, recognizing that for many under-resourced global communities, the most immediate impacts of climate change are felt through gaps in these essential services.

### Innovative partnerships

Utilities cannot solve the multiple challenges that they face alone. They need partnerships that support their role as essential public services, partnerships that support learning and knowledge sharing within their areas of operation and partnerships that strengthen skills and support efforts to maximize efficiencies and resources.

### South-South partnership between Guatemala and Chile

The Water Operators' Partnership between Asociación de Desarrollo Comunitario Rural (Rural Community Development Association, Guatemala, or ADECOR) and the Federación Nacional de Cooperativas de Servicios Sanitarios de Chile (National Federation of Cooperative Water and Sanitation Services, Chile, or FESAN) is an example of South-South cooperation which offers valuable recommendations. First, service design must be grounded in community knowledge, particularly from marginalized and isolated communities. Both participating organizations identified three crucial factors for the success of future WOPs: full commitment and active engagement from every partner, financially stable interventions, and ongoing capacity building and training. While this training produced significant learning on the part of ADECOR in terms of tangible knowledge regarding rural water management, the WOP proved to be a valuable opportunity for the mentoring organization, as well. FESAN noted the importance of demonstrating their own success and encouraging the replication of this progress in Guatemala.

Importantly, both entities recognized one limitation of the WOP as the lack of monitoring mechanisms to assess the long-term impact of their interventions in the absence of funding to support evaluation, feedback and continued improvement. Both operators cited the need for additional dissemination of these partnerships in Latin America and the Caribbean, particularly in rural water services. "This will facilitate greater visibility and, consequently, enable the acquisition of additional resources to reinforce and scale up these WOPs."

Source: Barrero Cimbi (2024)

<sup>1</sup> For details on a systems approach to attract more finance, see Pories et al. 2019.

Partnerships can be inspiring and bring energy and new approaches, but they can be difficult to sustain at a high quality and with adequate funding. They should be seen as an investment of time and energy that can raise standards across the sector. Creating and supporting national and local platforms for knowledge sharing and learning, both face to face and online, is a cost-effective means of building adaptive capacity and improving outcomes. A focused and long-term attention to keeping knowledge-sharing and learning platforms alive is required.

One key area for specific partnership is in the development of cities and other population centres. Utilities currently have to pick up the pieces from unplanned development and deal with the extra demand for water services and the human waste that, if left uncontained and untreated, is a threat to public health. As discussed earlier, partnerships with city planning services and other essential services are crucial. As a key component of public health, water and sanitation utilities also need formal partnerships with health services to identify and address risks.

Water operators must consider additional cross-sector partnerships to support them in facing the effects of climate change. As the risk of water scarcity increases, so too will competition between different water-intensive sectors (for example, mining or agriculture). Although these demand drivers from productive uses of water are not typically managed by drinking water suppliers, relationships between these stakeholders will need to be explored to help manage tensions between demand and diminishing supply (Solís 2023). Within the water and sanitation sector, new and different partnerships will be required to manage the risks associated with climate change, such as building resilience and redundancy into assets and integrating nature-based solutions. Intentional collaboration with climate policy and programming stakeholders, both in public and private sector, will help utilities mainstream climate considerations, access climate finance and weave climate change into their communications – supporting stronger engagement from a wider audience. The climate crisis, when understood and communicated through a water and sanitation lens, can enable more awareness of the role utilities play in climate action – both in their contributions to the climate impacts and as a source of solutions in terms of mitigation and adaptation.

One of the most significant outcomes of effective partnerships is the ability to freely share knowledge and experiences. This can mean learning more about

innovations within a utility or identifying leverage points in the overall system. Connections can be within the same region and between utilities with similar resources and technology or they can be designed explicitly to learn from utilities at a more advanced stage of development. However, healthy partnerships should always be on a basis of equality in which both parties are learning.

Water Operators' Partnerships (WOPs) help bridge the gap between those who need guidance and those who can provide it. WOPs use mentorship to strengthen the capacities and performance of water and sanitation operators (GWOPA/UN-Habitat, 2020). These peer-to-peer mentorship relationships can be global, triangular and – importantly – South-South. The United Nations has been promoting these solidarity-based partnerships between utilities and established the Global Water Operators' Partnerships Alliance (GWOPA) at UN-Habitat in 2009 to connect WOP practitioners and professionalize and scale up these partnerships worldwide through a global network. Collaboration between water operators worldwide is at the core of its methodology and implementation strategy, with the ultimate goal of enhancing services and promoting access to water for the entire population, including vulnerable groups such as women, girls and underserved areas (United Nations 2023).

A different format for learning is the International Water Association's LeaP Programme for Young Water Professionals, which looks to assist the next generation of water leaders to inspire and influence others. Ongoing support is available through the Global Water Leaders Group – a network of CEOs in the water industry whose purpose is self-described as “existing to make the world of water work better.” This programme thus taps into the expertise of water leaders from across the world to share their ideas and experience and to help participants make a stronger case for water.

Complementing the development of sector professionals, Learning Alliances are a tool to start strengthening WASH systems with continuous learning and adaptation, facilitating collective action particularly in nascent utility settings. Learning Alliances facilitate the sharing of information and the use of data for critical analysis, with insights from multiple stakeholders, including civil society. They aim at scaling innovation in areas of common interest through active experimentation and multi-level platform that reflect the complexity of WASH systems, all while maintaining a shared vision for excellence.



## Conclusion

There are many pathways through which the enabling environment surrounding water and sanitation utilities can be improved. They are critically linked to one another, so if water and sanitation stakeholders can come together and promote collective action on multiple fronts, the entire sector will benefit.



Political leaders at all levels must urgently focus on communicating about the climate crisis in terms of water and sanitation, recognizing the critical role that utilities play in building resilience, reducing risk and mitigating impact.



There are diverse opportunities for water and sanitation utilities to embrace circular models, resulting in economical, operational and ecological benefits.



Flexibility and reform in regulation and service mandates can enable utilities to adapt service delivery models to integrate with other urban development and reach underserved populations with higher quality services in more cost-effective ways.



Systematic performance monitoring of utilities and grassroots mechanisms that amplify the voice of civil society can together create a more equitable, transparent and accountable sector.



Digital innovation may hold the answers to some technological and operational challenges faced by utilities but also presents new risks, which tools like the People-Centred Smart Cities guidelines can help to manage.



In order to diversify and increase funding sources, risk mitigation of investments is critical and can be accomplished through three areas of asset management, tariff reform and anti-corruption action.



Climate funding needs reform to improve accessibility, and meanwhile, what is available can be leveraged by utilities in mitigation, especially in sanitation and wastewater treatment practices.



Partnerships between utilities of varying size, structure and geography, as well as alliances between water and environment stakeholders across sectors, will be key to enabling success for utilities.

In general, political leadership that champions water and sanitation and is accompanied by legislative efforts (local and national) can provide the necessary direction and drive to unblock hurdles throughout the enabling environment. In turn, promoting flexible and inclusive reforms that allow utilities to fulfill their mandates in a climate-responsive and financially sound way.

It will take strong political leadership coupled with decisive and coordinated action from utilities of all models and sizes, from development stakeholders across sectors, and from those throughout the enabling environment surrounding water and sanitation operators to enable successful achievement of SDG 6.

These seven pathways are closely interconnected and require water and sanitation stakeholders to pursue collective action across all fronts. This effort must be anchored in political leadership that prioritises water and sanitation, supported by local and national legislative measures and reforms that enable utilities to fulfil their mandates. It should also bring together the coordinated contributions of utilities of all models and sizes, alongside those of development partners and other stakeholders that constitute the enabling environment necessary for water and sanitation operators to advance the successful realization of SDG 6.

Technical demonstration at meter workshop centre laboratory of Da Nang Water Supply Joint Stock Company (DAWACO) on non-revenue water and billing.  
Photo: Da Nang Water Supply Joint Stock Company



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Hands-on co-composting session as part of the Water Operators' Partnership between Società Metropolitana Acque Torino, Italy and Odisha Water Supply and Sewerage Board, India.  
Photo: Odisha Water Supply and Sewerage Board

## Annex: Methods and Data

A new source of data for this report is a 23-question survey conducted in March 2025, with 243 responses from 79 countries, called the Global Survey on Water and Sanitation Service Providers. The respondents were utility managers, executives, consultants and operators, of whom 153 responded on behalf of an individual utility, while the rest answered questions about their national context instead of a specific utility. They were asked about utility characteristics, including the structure, governance, service quality and financial performance. The questionnaire also included ranking and open response questions on how utility performance might be improved, including their

assessment of opportunity areas and climate risks to operations. Categorical and ranking responses are presented in bar or pie chart form, while open responses have been analysed thematically to derive themes and insights. Perplexity AI was used for translation and text mining.

Datasets referenced: UNIDO Indstat Revision 4, IBNET, GLAAS, JMP, International Water Association (IWA) Statistics and National Statistics Offices, regulatory authorities and membership organizations provided the counts of water and sanitation service providers used to calculate the indicators in this chapter.

### The Global Survey on Water and Sanitation Service Providers 2025

N=243; Languages: Arabic, English, French, Spanish

Questions:

1. Are you responding on behalf of a specific water and sanitation utility?
2. What is the name of the utility or other organization you represent.
3. What is your role at the utility or other organization you represent?
4. Are you replying on behalf of a GWOPA institutional member?
5. In which country is the utility or organization you represent operating?
6. What is the scope of services provided by the utility? (if other, please specify)
7. Who governs the activities of the utility (i.e. makes key high-level decisions and holds the utility accountable)? (if other please specify)
8. What is the organizational form of the utility (who operates)?
9. Is there a clear trend in the overall reach of services provided by the utility in the last 5 years?
10. For very low-income or slum dweller populations, is there a clear trend in the reach of services provided by the utility in the last 5 years?
11. What do you see as the main factor(s) in relation to the numbers of consumers reached with services?  
Suggested word count: 100
12. What is your perception of the overall level of the services provided by the utility (combining issues of accessibility, availability and quality)?
13. What do you see as the main factor(s) in relation to changes in the level of service for consumers?
14. Generally, is the utility recovering its costs (considering all sources of revenue including planned subsidies)?

15. To what extent do you currently cover these expenses from your tariff revenue?
  - a. Annual operating expenses
  - b. Planned capital maintenance expenditure
  - c. Interest on any loans taken to finance capital expenditure
16. What do you see as the most important action that could be taken to improve financial performance? Please rank the list of options below from most important to least important.
17. Is there another important action to take to improve financial performance missing from the list of options above?
18. To strengthen the utility, which areas would you like to see prioritized in 2025, i.e. where should the short-term focus be to have the most impact for improving services? Rank from most to least important.
19. In your perception is there a clear trend in the enabling environment in which the utility operates?
20. How would you rank the following opportunity areas (from most important to least important) with respect to the enabling environment in which the utility operates? Which ones need action in order to help the utility deliver on its mission and service delivery goals?
21. What other areas of opportunity would you identify as different from above?
22. How concerned are you about risks to the utility's operations due to a changing climate and water resource availability, specifically:
  - a. drought and reduced availability of surface water resources
  - b. competing upstream demands for water resources
  - c. declining groundwater levels
  - d. flooding, inundation and heavy rains
  - e. poor water quality and contamination of water resources
  - f. natural disasters and destruction of infrastructure
  - g. disease outbreak from unsafe water and sanitation
  - h. interruption of power, supply chains and transportation
23. Are there any other comments or suggestions you would like to highlight with respect to how the services provided by water and sanitation utilities can be improved?







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