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# From Waste to Resource

Shifting paradigms for smarter wastewater interventions in Latin America and the Caribbean

## Background Paper IV:

### Policy, Regulatory, and Institutional Incentives for the development of resource recovery projects in wastewater

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Please cite the work as follows: "World Bank, 2019. From Waste to Resource: Shifting paradigms for smarter wastewater interventions in Latin America and the Caribbean. Background Paper IV: Policy, Regulatory, and Institutional Incentives for the development of resource recovery projects in wastewater" World Bank, Washington, DC.

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Cover and report design: Alejandro Scaff Herrera.

# Background Paper IV: Policy, Regulatory, and Institutional Incentives for the development of resource recovery projects in wastewater

## 1. Introduction

Energy, clean water, fertilizers, and nutrients can be extracted from wastewater and contribute to the achievement of the Sustainable Development Goals (SDGs). Wastewater can be treated up to different qualities to satisfy demand from different sectors, including industry and agriculture. It can be processed in ways that support the environment and can even be reused as drinking water. The World Bank is working with partners around the world to ensure that wastewater's inherent value is recognized.

Wastewater treatment for reuse is one solution to the world's water scarcity problem, freeing scarce freshwater resources for other uses or preservation. In addition, by-products of wastewater treatment can become valuable for agriculture and energy generation, increasing the environmental and financial sustainability of wastewater treatment plants. Improved wastewater management offers a double value proposition if, in addition to the environmental and health benefits of wastewater treatment, financial returns can partially or fully cover operation and maintenance costs. Resource recovery from wastewater facilities—in the form of energy, reusable water, biosolids, and other resources, such as nutrients—yields economic and financial benefits that contribute to the sustainability of water supply and sanitation systems and the water utilities operating them. Resource recovery and reuse can transform sanitation from a costly service to one that is self-sustaining and adds value to the economy.

This background paper is one of several supporting materials for the report "From Waste to Resource: Shifting Paradigms for Smarter Wastewater Interventions in Latin America and the Caribbean", a product of the World Banks' Global Water Practice Initiative Wastewater: From Waste to Resource.

## 2. Policy Incentives

The key drivers for wastewater reuse and resource recovery (R&RR) provide compelling reasons to invest in and develop such facilities. Yet such investments often do not take place, because of policy, institutional, regulatory, and financial barriers.

Policy statements, at the national or even regional or local level, are the first and crucial step for any government to start developing a wastewater R&RR sector. Many R&RR initiatives happen ad hoc rather than systematically at the regional or national level, because specific local conditions trigger them. Policy statements allow governments to formally announce their intention for and commitment to the sector and to provide the initial landscape for the sector to be developed. This section discusses how policy can provide incentives for the development of wastewater R&RR.

### 2.1 Clear Policy Objectives

One of the key factors that can encourage the development of wastewater R&RR is having clear national policy objectives. A national policy statement shows the government's commitment to the development of wastewater management that includes R&RR. This commitment provides the following incentives to stakeholders:

- Relevant public sector departments (ministries, line agencies, and public utilities) can consider and develop the necessary implementing instruments.

- Different levels of governments can develop local wastewater management and investment plans that include R&RR.
- Private firms face a more stable environment for investing in wastewater R&RR technologies and facilities. For academic institutions and think tanks, a national policy statement provides incentives to conduct more research into all aspects of wastewater R&RR.
- Government commitment, especially if accompanied by awareness raising and educational campaigns, can lead to more community acceptance of the concept.
- Donor and development partners are more likely to provide technical and financial assistance to the national and/or local government to implement the policy.

In order to be effective, national-level policy needs to be specific about what problem the policy is designed to address. It should include a clear reason for R&RR that can be embedded in the legal, institutional, and regulatory framework. Providing a clear reason for the policy increases the chances of its implementation and reduces the potential application of "isomorphic mimicry"— defined as "the tendency of governments to mimic other governments' successes, replicating processes, systems, and even products of the 'best practice' examples" (Andrews and others 2017). Isomorphic mimicry is a risk if the wastewater R&RR concept is introduced by an external agent. It is important that there be internal motivations for developing wastewater R&RR policy development. Table 1 provides examples of how national-level policy can be defined to address specific issues. Box 1 provides an example of how national-level policy can influence the development of wastewater reuse.

**Table 1** National-level wastewater policy designed to address specific problems

| Driver/problem | National-level policy objective |
|---|---|
| Water scarcity/ security | Develop wastewater reuse and increase use of recycled water as an alternative water source |
| Environmental degradation | Improve wastewater treatment and disposal<br>Increase use of alternative sources of water |
| Food security | Increase use of wastewater for agriculture |
| Public health and economic development | Improve wastewater and sanitation facilities<br>Develop and create market for resource recovery from wastewater |

*Source:* ECA 2019.

**Box 1 Jordan's water substitution and reuse policy**

The government of Jordan recognized that water scarcity is a major issue in the country and that there is a need to find alternative sources of water. The Water Substitution and Reuse Policy, issued in 2016, clearly states the government's intention and commitment to the development of wastewater reuse. The national policy document states that the objectives of the policy are to:

- Manage scarce water resources efficiently, maximize the benefits and returns, and propose actions required for implementation;
- Enhance economic efficiency;
- Ensure sustainability and preserve fresh water;
- Protect the environment and nature.

*Source:* Ministry of Water and Irrigation 2016.

National-level policy is sometimes driven by, or made consistent with, international or regional commitments. For example, European Union (EU) member countries are required to implement the EU directives on wastewater, which include wastewater reuse. The SDGs provide an incentive for developing countries to include wastewater R&RR in their national policies on wastewater management and development.

Policy objectives can also be set in regional or local policies, depending on the country's government structure. Regional and local policy objectives should be clear and followed by implementation plans or instruments. Box 2 shows an example from the State of California.

**Box 2 California's policy objective and actions needed implement it**

California's objective regarding water use efficiency is:

- Use water more efficiently with significantly greater water conservation, recycling and reuse to help meet future water demands and adapt to climate change.

An indication of the related actions illustrates the range of mechanisms:

- DWR will work cooperatively with the California Urban Water Conservation Council to establish a task force that will identify best management practives to assist commercial, industrial and institutional sector in meeting the water conservation goal.
- Effective January 2009, all terms of water management loans and grants to urban water supplier administered by SWR, the State Boards and California Bay Delta Authority is conditioned on the implementation of the demand management measures described in Urban Water Management Plans.
- State government should authorize and fund new incentives-based programs to promote the widespread and mainstream adoption of substantial and aggressive water conservation, recycling and reuse, and related water use and reuse monitoring programs, by urban and agricultural water systems and their users.

*Source:* State of California 2009.

## 2.2. Political Leadership

Strong political leadership can help develop and implement wastewater R&RR, especially if the legal, institutional, and regulatory framework supports it. Box 3 shows how strong leadership from the governor supported wastewater reuse in the State of Florida.

**Box 3 Using an executive order to reform the water sector reform in Florida**

In January 2019, the governor of Florida issued Executive Order 19-12, to ensure environmental and water resource protection in the State of Florida. The executive order demonstrated the governor's commitment to the sector and formally required his administration to implement it.

The executive order includes two specific points on the development of wastewater reuse:

- Engage local governments, industry, universities, and water management districts to identify and research all viable alternative water supply sources and provide an assessment of funding needs critical to supporting Florida's growing economy.
- Engage local governments, industry, citizens, and other stakeholders through a targeted education and outreach campaign that will focus on the importance of conservation and reuse efforts and encourage Floridians to implement essential conservation and reuse efforts in their homes, businesses, and communities throughout Florida.

*Source:* DeSantis 2019.

Strong political leadership on wastewater R&RR requires political decision makers to have adequate understanding of the issues. Raising the level of debate about wastewater R&RR at the national level is likely to help increase the commitment of key decision makers. They can then use their power and authority to forge a national policy commitment, which can be translated into the implementation instruments discussed below.

### 2.3. Public Awareness and Engagement with Public and Civil Society

For R&RR policies to be effective, the general public needs to accept the idea of R&RR from wastewater. Public outreach and education through awareness-raising activities that overcome public concerns regarding the safety and quality of treated wastewater are ideally a precursor to and necessarily a complement to introducing wastewater R&RR as part of a country's long-term integrated and sustainable water management policy.

Awareness-raising activities can take many different forms, including the following:

- ***Policy review and stakeholder consultation:*** In some countries, such as the United Kingdom, stakeholders are consulted on their views before a policy statement is translated into a legally binding instrument. This process introduces the government's intentions and commitments and educates stakeholders on why the policy is necessary. It also provides opportunities to debate and discuss the policy.
- ***Education campaign:*** In countries where wastewater R&RR is new, an educational campaign may be more appropriate. It could include seminars, workshops, and community group discussions where the benefits of wastewater R&RR are explained and stakeholders are given opportunities to ask questions. Box 4 provides an example of an educational campaign driven by industry for acceptance of the use of biosolids in agriculture in the United Kingdom.

**Box 4 The United Kingdom's biosolids assurance scheme**

The Biosolids Assurance Scheme (BAS) is an industry-led certification system and initiative with the primary objective of promoting "the acceptance of recycling biosolids to agriculture land through a process of risk assessment, operational control, third party audit, and stakeholder reassurance." It brings together relevant regulation and best practices in a single transparent standard that all members of the BAS have to comply with. A third-party audit provides an objective assessment of members' compliance and provides consumers with the confidence that all standards are met and agriculture products are safe.

The BAS includes an information dissemination component. Educational materials are available online, and an intensive stakeholder engagement process is being implemented through which consumers can provide input into the development of the standard used by the BAS.

*Source:* ECA, 2019

- ***Working with local and/or religious leaders:*** Where public acceptance is closely related to religious beliefs or cultural background, it can be easier to achieve if a local and/or religious leader supports wastewater R&RR
- ***Pilot projects:*** Public acceptance can be achieved by demonstrating the advantages of wastewater reuse while assuring stakeholders of the safety and quality of the treated water through pilot projects. Box 6 describes how Jordan is promoting water reuse.

**Box 6 Promoting water reuse in irrigation in Jordan through a demonstration pilot program**

Water management has been one of the most critical sustainability issues in Jordan. Its importance is reflected in Jordan's water strategy (2009), which states that "wastewater is not managed as waste but is collected, treated, managed, and used in an efficient and optimized manner."

The Water Authority of Jordan, which is responsible for managing the country's wastewater systems, has been contracting with farmers to provide recycled water for agricultural irrigation. A demonstration pilot project for reusing treated wastewater in irrigation was first established in Wadi Mousa. The wastewater treatment plant consists of preliminary treatment, activated sludge, polishing ponds, and disinfection with reclaimed water distributed through an irrigation water pump station and water distribution system. The pilot project has been operated by the Sad Al-Ahmar Association, representing the local community, operated with the support of the Hashemite Fund for the Development of Jordan Badia (HFDB). The project showed that reclaimed wastewater reuse can be safely implemented to provide local communities with stable income. It also demonstrated the advantages of wastewater reuse for landscape irrigation and industrial applications in Amman and Aqaba, where reclaimed water used for cooling purposes in industries and landscaping areas saved a significant amount of fresh water which could be directed to domestic and commercial uses.

*Source:* US EPA 2012.

- ***Ad hoc/project-based stakeholder engagement process***: Engaging key stakeholders from the beginning of the project process can increase acceptance and hence the success of the project (box 7).

**Box 7 Engaging stakeholders in wastewater management in Japan**

In order to prevent contamination of rivers, Japan treats mining wastewater under strict regulatory requirements and then discharges it into the Shirai River, which flows into the Toyohira River. Water from this river is subsequently for Sapporo city's water supply, highlighting the need to ensure the integrity and reliability of wastewater treatment plants.

JX Nippon Mining & Metals installed two effluent treatment plants, designed and constructed in close collaboration with the Hokkaido government's Industrial Safety and Inspection Department and Sapporo City. The mining company regularly monitors wastewater discharge in accordance with regulations. It also adheres to voluntary standards to ensure safe water for downstream users.

During project implementation, the design and operation of the treatment facilities were explained to various stakeholders, including local community representatives, members of academia, and government officers. As part of its commitment to stakeholder involvement, JX Nippon Mining & Metals issues performance and monitoring results to all stakeholders and provides briefing sessions to discuss results with local residents.

*Source:* ECA, 2019

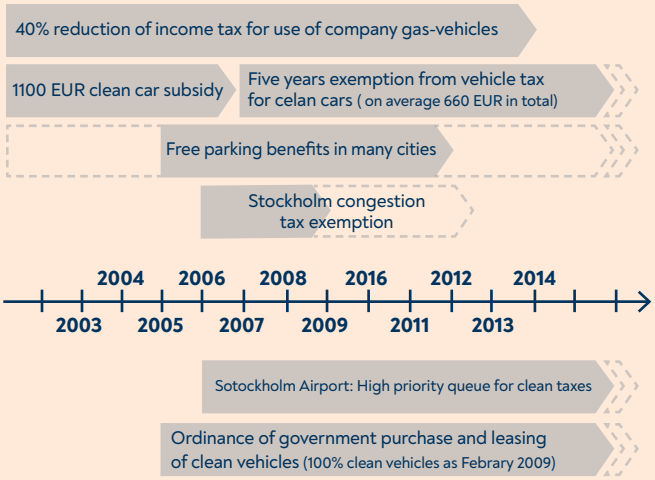
### 2.4. Policy Incentives

Public awareness is important, but implementing policies may require that incentives be provided. They can be designed as part of financial and/or regulatory measures. One option is tax exemptions, as illustrated by in box 8.

**Box 8 Creating incentives to use biogas in vehicles in Sweden**

Biogas has been produced in Swedish sewage treatment plants since the 1940s, initially to reduce sludge volumes. The government of Sweden wanted to encourage the use of biogas as a vehicle fuel. To do so, it adopted a series of policy initiatives to creates incentives for the use of gas-fueled vehicles. Figure B8.1 summarizes the reforms. By 2010 approximately 44 percent of the biogas produced had been upgraded and was used as vehicle fuel, placing Sweden at the forefront of biogas use in the transport sector.

**Figure B8.1** Timelines of reforms to incentivize use of biogas in vehicles in Sweden




*Source:* Swedish Energy Agency 2011; Ekman 2012

## 3. Regulatory Framework and Incentives

A national regulatory framework can provide incentives for wastewater R&RR if it is designed to support the implementation of R&RR policy and is supported by an institutional structure that can monitor and enforce the regulations. Regulatory frameworks can also create disincentives for wastewater R&RR, especially if the regulatory framework is copied from other settings and not adapted to national and/or local conditions.

Regulation for wastewater management, reuse, or resource recovery is in its early stages of development; it is driven by the regulatory framework in the public health, environment, and water and sanitation sectors. No regulatory frameworks have been specifically designed to provide incentives for investment in wastewater R&RR.

### 3.1. Technical Regulation

Most technical regulation and standards for wastewater focus on treatment and disposal into the environment; they are not specifically designed for R&RR. As more countries consider wastewater R&RR, there is a need to ensure that technical standards and regulations protect human health and the environment.

A wide range of technical regulation aspects needs to be considered:

- ***Environmental regulation.*** Environmental regulation usually governs the quality of wastewater and the quality of any solids released back into the environment.
- ***Public health regulation.*** In many countries, drinking water quality standards and regulation are the responsibility of the ministry or department responsible for public health. The regulation of sanitation and waste may also be under the umbrella of public health regulation.
- ***Agriculture regulation.*** Agriculture regulation governs the quality of sludge produced by wastewater treatment processes that are used for agriculture purposes. Spain has a national standard for wastewater reuse in agriculture that could be tailored to different countries' needs. The United Kingdom's code of practice for sewage sludge in agriculture, which provides practical guidelines for the safe use of sewage sludge in agriculture, could also serve as a model. Table 2 shows the safe sewage matrix used in Scotland as part of the application of the code of practice.
- ***Biomethane/biogas regulation.*** Biomethane/biogas regulation governs the quality of biomethane/biogas produced from wastewater treatment processes.

**Table 2** Matrix for safely using sewage in agriculture in Scotland

| Crop Group | Untreated sludges | Conventionally treated sludges | Enhanced treated sludges |
|---|---|---|---|
| Fruit | ✗ | ✗ | ✓ (10 month harvest interval applies) |
| Salads | ✗ | ✗ (30 month harvest interval applies) | ✓ |
| Vegetables | ✗ | ✗ (12 month harvest interval applies) | ✓ |
| Horticulture | ✗ | ✗ | ✓ |
| Combinable & Animal feed crops | ✗ | ✓ | ✓ |
| Grass & Forage | | | |
| •Grazed | ✗ | (Deep injected or ploughed down only) ✗ (3 week no grazing and harvest interval applies) | ✓ (3 week no grazing and harvest interval applies) |
| •Harvested | ✗ | (No grazing in season of application) ✓ | ✓ |

*Note:* ✓ All aplications must comply with the Sludge (Use in Agriculture) Regulations and DETR Code of Practice for Agricultural Use of Sewage Sludge (to be revised during 2001).

✗ Applications not allowed (except where stated conditions apply).

*Source:* Safe Sludge Matrix 2001.

Technical regulation and standards applied to wastewater R&RR can be very specific. In many cases, technology has superseded regulation, and standards are written after the technology is implemented. In Durban, South Africa, for example, standards for recycled water were based on the paper industry, which was using the recycled water in Durban; these standards were then adopted as national standards (World Bank 2018a). However, this is changing, as international organisations such as the World Health Organization (WHO) have issued some technical guidelines on the use of wastewater for agriculture (WHO 2006) and potable reuse (WHO 2017). International standards are a good starting point for national standards. However, developing countries tend to copy technical standards from developed countries that are unsuitable for national/local conditions. As a result, some technologies that are too expensive—and, in most cases—unnecessary have been implemented (World Bank, 2019).

Table 3 summarizes the challenges of setting wastewater reuse standards and provides some recommendations.

**Table 3** Challenges and solutions for development of wastewater reuse standards

| Challenge | Recommendation |
|---|---|
| Guidelines, frequently copied from developed countries, are directly adopted as national standards. | Every country should adapt the guidelines based on local conditions and derive corresponding national standards. |
| Guideline values are treated as absolute rather than target values. | Guideline values should be treated as target values, to be attained over the short, medium or long term, depending on the country's technological, institutional, and financial conditions. |
| Treatment plants that do not comply with global standards do not obtain licensing or financing. | Environmental agencies should license and banks should fund control measures that allow for stepwise improvement in water quality, even though standards are not immediately achieved. |
| No affordable technology leads to compliance with standards. | Control technologies should reflect countries' financial conditions. The use of appropriate technology should always be pursued. |

| | |
|---|---|
| Standards are not enforced. | Standards should be enforceable and enforced. Standard values should be achievable and allow for enforcement, based on existing and affordable control measures. Environmental agencies should be institutionally well developed in order to enforce standards. |
| Discharge standards are not compatible with water quality standards. | The objective of pollution control is the preservation of the quality of water bodies. Discharge standards should be based on practical and justifiable reasons, assuming a certain dilution or assimilation capacity of the water bodies. |
| Number of monitoring parameters is not optimal (too many or too few). | The list of parameters should reflect the desired protection of the intended water uses and local laboratory and financial capacities, without excess or limitation. |
| No institutional development supports or regulates the implementation of standards. | Efficient implementation of standards requires adequate infrastructure and institutional capacity to license, guide, and control polluting activities and enforce standards. |
| Reduction of health or environmental risks associated with compliance with standards is not immediately perceived by decision makers or the population. | Decision makers and the population at large should be well informed about the benefits and costs associated with the maintenance of good water quality, as specified by the standards. |

*Source:* Lautze 2014.

Technical regulation and standards can be applied in different ways; they need not always be set in formal regulation or law. Box 9 shows an example of a certification process used in Sweden to ensure the safe use of wastewater in agriculture.

**Box 9 Implementing a voluntary system for certifying the quality of sewage sludge for use in agriculture in Sweden**

REVAQ is a voluntary certification system aimed at regulating the quality of sewage sludge for use in agriculture. Certification requires plants to continuously improve the quality of influent wastewater in order to control the resulting sewage sludge. The sludge must then be made hygienic by one of a number of defined methods to prevent the distribution of pathogens and viruses to farmland.

The system was developed in 2002 by Swedish Water (a national water organization) the Federation of Swedish Farmers (LRF), Lantmännen (an economic association operated as a producers cooperative), and a number of food retailers and distributors. It is now owned and administered solely by Swedish Water.

*Source:* I'Ons and others n.d.

### 3.2. Economic Regulation

Economic regulation can be defined as the "setting, monitoring, enforcing and changing of the allowed tariffs and service standards for utilities" (Groom and others 2006). This definition has sometimes been broadened to encompass social or developmental goals of access and equity. Economic regulation cannot be achieved in isolation from technical regulation, as regulations on these matters contribute significantly to a service provider's costs. Economic regulation can be broken down into three categories: cost of service or tariff regulation, service quality regulation, and competition regulation.

#### 3.2.1. Cost of service or tariff regulation

Cost of service or tariff regulation consists of setting tariff levels and tariff structure so that a) the average tariff delivers reasonable costs (the

so-called 'required revenue') and b) economic efficiency is encouraged so that the tariff structure reflects the marginal costs that different consumers impose on the utility.

Wastewater R&RR adds to the complexity of determining the tariffs for wastewater collection and disposal, because the required revenue calculation needs to take account of revenues generated from R&RR assets. Box 10 shows how England and Wales separate wastewater R&RR from water supply costs.

**Box 10 Separating revenues from bioresource to ensure fair wastewater tariffs in England and Wales**

"Water 2020: Our Regulatory Approach for Water and Wastewater Companies in England and Wales," adopted in 2016, is the current regulatory framework for water and wastewater services of the United Kingdom's Water Services Regulation Authority (OFWAT). It acknowledges the need to encourage the use of alternative water resources (including recycled water from wastewater) and the recovery of resources from wastewater, which it plans to implement by creating a market for bioresources (resources recovered from wastewater treatment and processes).

One way to promote the creation of bioresources while protecting water and wastewater customers from tariff increases necessitated by the additional infrastructure investments to accommodate bioresource development is for the regulatory framework to requires companies to separate accounting for bioresource assets from any other water and wastewater assets. The regulatory tool used to monitor water and wastewater prices is called the price review. It assesses waste and wastewater companies bioresource costs separately from water and wastewater services costs, in order to clearly separate which costs can be recovered from water and wastewater tariffs and which costs are to be recovered from bioresource revenues. The mechanism ensures that water and wastewater customers pay fair tariffs.

*Source:* Ofwat 2017.

Policy makers also need to think about how to price recycled water. Countries have done so in various ways. In Australia, for example, the tariff for recycled water is charged separately from fresh water supply and priced at a lower level to encourage use (box 11). In Windhoek, Namibia, recycled water is treated as a bulk water source by the water company and as an operating cost. The final customer water tariff includes the recycled water price.

**Box 11 Setting the tariff for recycled water in New South Wales**

To respond to droughts and water scarcity, water utilities in New South Wales are required to invest in water recycling infrastructure. For areas served by recycled water, differential charges are applied to customers, with Charges for this water set below potable water charges. Water utilities separately calculate the cost of service for recycled water. If the resulting tariffs are higher than potable water tariffs, a portion of the recycled water costs can be recovered from the broader customer base.

The recycled water program includes a mandatory scheme, in which customers are mandated to meet a portion of their water needs from recycled water, and a voluntary scheme, in which customers can choose to connect to and use recycled water. The recycled water charges for the mandatory scheme are regulated and are not allowed to be above potable water charges. The recycled water charges for the voluntary scheme are negotiated between the water utility and the customer, allowing some form of cross-subsidization between the scheme to ensure cost recovery for the water utility.

*Source:* IPART 2006.

### 3.2.2 Service quality regulation

Service quality regulation is intended to ensure that service providers maintain the promised level of service quality. It does so by setting and monitoring service performance standards and key performance indicators (KPIs). These

standards and KPIs can be technical, financial, or operational.

Service quality regulation tends to apply to water supply and sanitation services. However, it can be extended to R&RR. If treated wastewater is reused, it should be required to meet quality standards relevant to its intended reuse. If resources are recovered through wastewater treatment, the service standard should depend on what the product is. If, for example, wastewater treatment processes are used to produce biogas that will be used to generate electricity, the electricity standards on voltage and frequency stability may need to be applied to the generation component of the process. If biosolids are produced for use by the fertilizer industry, some agricultural standards may need to be applied.

### 3.2.3 Competition regulation

Competition regulation is intended to ensure effective competition for and in the market. Requiring firms to compete for R&RR opportunities is competition for the market; competition in the market applies to the need for recovered products to compete in existing markets (for fertilizer, for example). Competition regulation may be needed to ensure that recovered resources compete fairly with similar products and that water/wastewater companies, whose assets are funded through regulation and could cross-subsidize their recovered products, compete fairly with firms whose assets are not subsidized.

Markets for recovered product may not yet exist but can be developed. For example, the United Kingdom's Environment Agency is developing a sewage sludge strategy that will include incentives to create a market for bio-resources. Creating a competitive market for sludge requires adoption of a regulatory framework that provides potential investors and market participants with a clear and stable operating environment.

Experience from on-site sanitation projects is instructive. Pilot projects tested and documented by the Toilet Board Coalition have shown that there is potential for creating markets for resources recovered from sanitation products. The study described in box 12 focused on small to medium-size enterprises selling products to larger enterprises. It did not cover potential competition from other sectors, which could impede the development or scale-up of these small to medium-size enterprises. If small businesses are to compete with larger enterprises, such as large fertilizer producers, a good regulatory framework needs to be in place that will support and encourage small businesses to continue to recover resources from sanitation waste.

**Box 12 Business potential for resources recovered from sanitation waste in Kenya**

Sanergy, in Kenya, produces organic compost for small farmers that is produced from sanitation waste mixed with other organic waste. Although the product has been proven to produce higher yields, Sanergy has not been be able to scale up its production to be profitable in the long run. One of the difficulties in scaling up production is the lack of demand, as a result of community reluctance to use compost produced from human waste. Another problem is the lack of technical standards for organic waste. According to financial analysis by Sanergy, if government policy (including public educational campaign) and the regulatory framework are improved, its business model can be profitable.

Another Kenyan company, Sanivation, produces fuel briquettes from sanitation waste. Households can use the briquettes for cooking and heating, replacing coal. According to the study by the Toilet Board Coalition, revenues from selling briquettes to household can cover waste-processing costs and potentially lower the cost of providing municipal sanitation services. The company plans to scale up the business model and test it at the city level. Sanivation's financial analysis suggests that it has the potential to be profitable if it operates at the city level. Regulatory and policy incentives may be necessary to help develop the market.

*Source:* Toilet Board Coalition 2017.

## 4. Institutional Arrangements to Create Incentives

Successful implementation of wastewater R&RR development and investment may require changes to institutional arrangements. This section describes the requirements for stakeholder engagement and coordination across different tiers of government and different economic and social sectors.

### 4.1. Mechanisms for Coordinating across Levels of Government

Ultimate responsibility for policy development in the wastewater sector typically lies with national or state-level government, but important functions—such as planning, investment, and implementation—are often delegated to local government or municipalities. Where responsibility is shared, it is important to establish and use a mechanism to coordinate the actions of different levels of governments.

This section describes some of these arrangements. (River basin organizations [RBOs] are particularly important. They are discussed separately, in section 4.2.7) An important lesson is that standards and regulation should be tailored both to the national/local context and to the intended use for the reuse and resources recovered from wastewater.

#### 4.1.1. Water/wastewater commissions

A water/wastewater commission is an institution formed by a legal framework. It has a clear mandate and functions. Ideally, it should include members from all levels of government that are responsible for water and wastewater, but it is essentially a national institution. (RBOs often fulfil the same sort of functions as water commissions—and may be part of a water commission—but by definition they are entities with responsibility for specific geographic regions. River basins typically cut across administrative boundaries and thus have an important role to play in coordinating among local government structures.)

In many countries, national water commissions have responsibility for both water and wastewater—and more generally for implementing the principles of integrated water resource management. However, some commissions have been set up specifically to promote reuse of treated wastewater (box 13).

**Box 13 Bolivia's Joint Commission for the Reuse of Water for Irrigation**

Bolivia's Joint Commission for the Reuse of Water for Irrigation was established to enable information exchange, coordination, and intersectoral consultations on various issues, including the need to achieve effective management of wastewater treatment plants and sustainable wastewater reuse for agricultural purposes. Members of the commission include the vice-ministers of water resources and irrigation, drinking water, and basic sanitation; the directors of the National Irrigation Service and the National Service for the Sustainability of Basic Sanitation Services (SENASBA); and representatives of Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ) programs and other international development bodies.

*Source:* ECA, 2019

There are clear advantages to including representatives of water commissions from local as well as national government, but coordination can also be achieved by having the national level work effectively with subnational structures. An example is Mexico's framework agreement involving state, federal, and municipal levels for the implementation of pilot projects promoting wastewater reuse in agriculture. The agreement was signed by the Hidalgo State Water and Sanitation Commission and the Environmental Infrastructure Trust Fund in Mexico, with the participation of the national water commission (box 14).

**Box 14 Involving federal, state, and local governments in wastewater reuse in Mexico**

In 2008 the Hidalgo State Water and Sanitation Commission, the Environmental Infrastructure Trust Fund (FIAVHI), and Mexico's national water commission (CONAGUA) signed a framework agreement to establish 10 wastewater treatment plant pilot projects for agriculture reuse. The agreement represented an important step in exploring wastewater reuse alternatives. These projects played an important role in preparing local communities to reuse treated wastewater in agriculture.

One of the treatment plants—San José Acoculco within the Atotonilco de Tula Municipality—was implemented in collaboration with an agricultural farmers organization, Ejido Progreso. The project, completed in 2011, was to treat 500,000 liters every day and irrigate 20 hectares. Development of this treatment plant involved CONAGUA; the State of Hildago; agricultural users of the untreated wastewater; and municipalities in the management, operation, and maintenance of wastewater reuse. This pilot project is an example of how federal, state, and local governments can be involved in wastewater treatment and reuse.

One important achievement of these pilot projects was the development and constitution of the Comite de Gestión de Competencias para Riegos Agrícolas Tecnificados con Aguas Residuales Tratadas (Council for the Certification of Irrigation with Treated Water in Mexico), made up of individuals, companies, and organizations promoting certification of capacity construction and competences to ensure appropriate management of treated wastewater for agricultural irrigation.

*Source:* UNU-FLORES 2016.

### 4.1.2 Contractual arrangements

A formal agreement among different levels of governments that clearly sets out the roles and responsibilities of each party to the agreement can be used to improve coordination. Contracts can also include KPIs and/or other monitoring mechanisms if appropriate.

This type of arrangement resembles the Delegated Management Framework in Mozambique, where responsibilities for providing water were transferred from the central government to an asset-holding company that delegated operations to a private entity. The framework could be applied to wastewater reuse in countries in Latin America and the Caribbean (LAC) by delegating some responsibilities to public entities or lower levels of government, in order to simplify service provision and provide contractual incentives for operators.

### 4.1.3 Establishment of clear roles, responsibilities, and accountability mechanisms

The legal and regulatory frameworks related to water and wastewater should include a well-specified allocation of roles and responsibilities for the different levels of governments and clear accountability mechanisms that encourage coordination and monitoring of the sector's performance. Where these elements are missing, effective coordination is much more difficult to achieve.

The National Water Initiative (NWI) in Australia did a good job of specifying the national regulatory role in a federal system where states have most water sector responsibilities. NWI guides the pricing of water and recycled water in Australia, as developed jointly by the Australian government and state and territory governments to help states implement water pricing in a consistent way. Although state governments set bulk water prices and local councils and water authorities distribute water, all states have to follow the principles and guidelines set by the NWI (Box 15).

**Box 15 National pricing principles for recycled water in Australia**

The National Water Initiative (NWI) encapsulates a shared commitment by all state governments to increase efficiency of water use. The NWI issued the pricing principles for water supply as well as recycled water, which are to be used by all state governments in Australia.

Pricing principles for recycled water include:

- **Flexible regulation:** light and flexible regulations are usually more cost-efficient;
- **Cost-allocation:** based on beneficiary pays approach, with the specific cost share across beneficiaries;
- **Water usage charge:** such as a volumetric charge;
- **Substitutes:** the price of freshwater or raw water is used to set the upper bound of the price band for recycled water;
- **Differential pricing:** the pricing structure reflects the difference in the quality and reliability of supply;
- **Integrated water resource planning:** pricing reflects the role of recycled water as part of an integrated water resource planning system;
- **Cost recovery:** price recovers the full direct costs;
- **Transparency:** price are transparent, understandable to users and publicly available;
- **Gradual approach:** the pricing structure is to be gradually adopted to allow consumer education and provide time for communities to adapt.

*Source:* NRMMC, 2010

### 4.1.4 Transition from the national to the local level

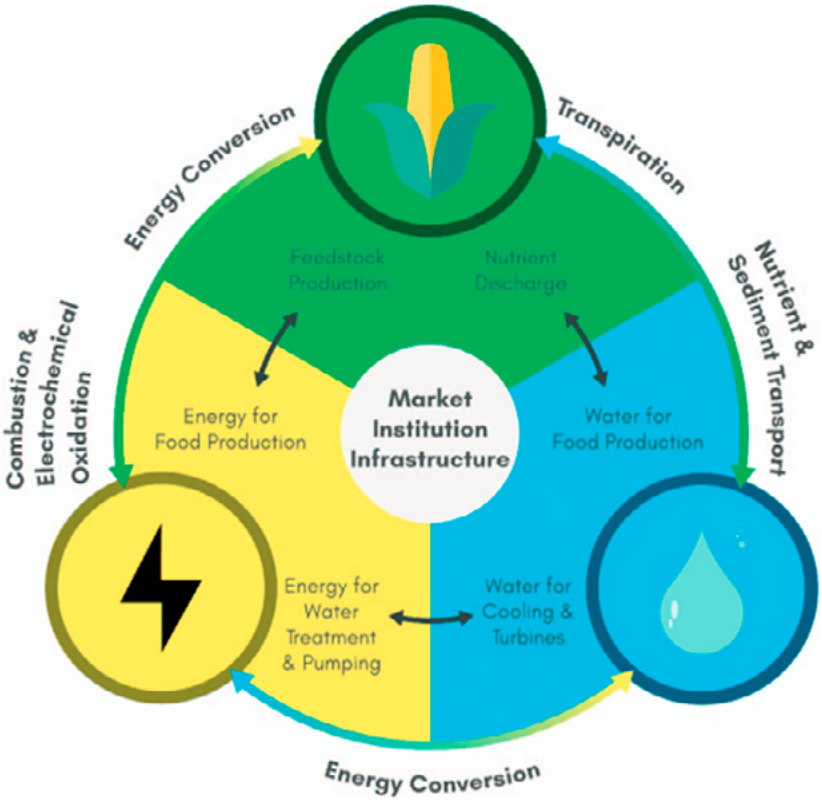
Policy statements are sometimes accompanied by policy targets. For example, India's National Urban Sanitation Policy requires all cities to reuse at least 20 percent of their wastewater. This national policy can be adapted to local conditions and specific targets set for particular cities. The City of Delhi has an objective of treating and reusing 50 percent of total sewage by 2022 and 80 percent by 2027.

## 4.2. Cross-Sectoral Coordination

Wastewater projects involve stakeholders at various levels of government and sectors. Particularly when R&RR is included, stakeholders from various economic sectors need to be accommodated. They include public and private sector stakeholders from the water and sanitation, environment, energy, agriculture, food, and health sectors.

The role of wastewater as a potential source of agricultural production is gaining growing attention, thanks to its high nutrient content. Wastewater can significantly contribute to food security and improve livelihoods if adequately treated and safely reused. Many wastewater treatment plants have started converting the biogas generated from wastewater and sludge into heat or electricity, allowing water and sanitation companies to become energy-neutral, as the same amount of energy consumed in the treatment process is recovered from wastewater. Figure 1 shows the interlinkages across sectors.

**Figure 1** Energy-Water-Food Cross-sectoral linkages




*Source:* Cai and others 2018.

Coordination among these stakeholders is needed to ensure that the right incentives are created for wastewater R&RR. RBOs are one institutional arrangement that can improve coordination across sectors. Other ways to improve coordination, which can be used independently of or in conjunction with RBOs, are discussed below.

### 4.2.1. Alignment of legislation and regulatory frameworks across sectors

Legal structures that limit or even prohibit the reuse of reclaimed water often reinforce public resistance and low acceptance of treated wastewater products, erecting barriers to resource recovery. These problems are particularly common where consumers are concerned about the safety of treated wastewater and in areas without strong wastewater practices. Supportive policy, regulatory, and legislative frameworks in all relevant sectors, including wastewater, agriculture, energy, and health, should be in place to ensure a consistent enabling environment for wastewater investment and reuse.

Jordan regulates treated municipal wastewater reuse through water reuse standards that allow the use of reclaimed water for other purposes, such as cooling and fire-fighting, on a case-by-case basis. Water reuse is also planned concurrently with wastewater treatment facilities, to ensure coordination across sectors. In contrast, Mexico's regulatory framework for biogas, for example, focuses on the waste and gas produced by agriculture; it does not consider the use of biogas from wastewater treatment as energy source (ECA, 2019)

### 4.2.2. Contractual agreements among different sectors' stakeholders

Stakeholders from different sectors involved in the management of wastewater R&RR can sign a contractual agreement to formalize their relationship and clarify their roles and responsibilities. In San Luis Potosí, Mexico, a national agreement was signed by the national water commission (CONAGUA), the Federal Electricity Commission (CFE), and the state government for the sale of treated wastewater to a thermal power plant for cooling purposes (World Bank 2018b). The CFE has an interest in finding alternative options for water cooling, particularly if they are less expensive than fresh water sources, which contributes to creating an enabling environment for wastewater reuse. The contractual agreements with the industrial user guarantees demand for treated wastewater, which ensures constant revenue streams.

A similar arrangement was used in Nagpur, India, where the Nagpur Municipal Corporation (NMC) signed a build-operate-transfer (BOT) contract with the Maharashtra Generation Company Limited (MahaGenCo) (Hastak 2015). MahaGenco is responsible for building and operating the wastewater treatment plant as part of its expansion program. Treated wastewater is used for cooling purposes at the power plant.

These experiences show how intersectoral coordination challenges can be addressed if specific conditions are met. Agreements like these could be adopted in other countries in LAC. They could be replicated in countries where water is scare and wastewater treatment plants are not very far from power plants, encouraging wastewater reuse in power generation.

### 4.2.3. Collaboration in the development of multisector master plans

An important factor that can impede coordination between wastewater utilities and energy companies is the discrepancy in planning horizons between the two sectors. Power sector planning typically has a 30- to 40-year planning frame. Such long horizons are not common in the wastewater sector, unless specific drivers, such as water scarcity, motivate governments to extend them. RBOs or municipalities set the boundaries for the planning of water and wastewater utilities. In contrast, energy planning involves the national grid. These discrepancies constrain implementation of multisectoral and multistakeholder processes.

Addressing them requires the signing of institutional agreements by wastewater and other sectors before the completion of individual masterplans, in order to ensure that wastewater reuse is included in long-term overall planning. These arrangements could address synergies and trade-offs across sectors to achieve policy coherence, allowing political and market forces, such as profit-seeking, to exploit the full potential of cross-sectoral linkages.

Several countries are adopting integrated approaches to wastewater recycling. One of them is India (box 15).

**Box 15 Reusing municipal wastewater for thermal power generation in Nagpur, India**

Fresh water is a scarce resource in Nagpur, where thermal power plants operated by the Maharashtra Generation Company Limited use large volumes of water to produce electricity. After identifying the potential for improving the water supply and distribution sector, the Nagpur Municipal Corporation began a comprehensive water efficiency program in 2005, incorporating key findings into a water sector energy efficiency master plan. Based on this master plan, wastewater projects were developed that include wastewater reuse for power generation plants.

*Source:* ICLEI 2010

Saudi Arabia has also been developing multisector master plans. The Arriyadh Development Authority, which is responsible for the socioeconomic, cultural, and environmental development of Riyadh, is investigating integrating cross-sectoral reuse options into metropolitan plans (box 16).

**Box 16 Saudi Arabia's master plan study for integrated wastewater recycling**

Riyadh, the capital of Saudi Arabia, is located in one of the world's most water scarce regions. Treated sewage effluent has recently became a significant alternative source of water and is increasingly reused for agricultural and industrial purposes.

The Arriyadh Development Authority launched a master plan study for water recycling to assess the potential for wastewater R&RR in the region by investigating the most feasible and integrated reuse options across different sectors. Options included the following:

- Agricultural reuse. As the agricultural sector consumes 80 percent of the water in Saudi Arabia, there is considerable potential for wastewater reuse in agricultural production.
- Industrial reuse. Several industrial enterprises were identified that could reuse wastewater for cooling and other industrial processes.
- Landscape irrigation. Landscape irrigation is assumed to be the most acceptable reuse option. It has a significant potential for parks and golf courses.
- Groundwater recharge. The feasibility of using wastewater to recharge groundwater depends on geological and hydrogeological conditions. It is likely to involve the strictest requirements, in order to avoid contaminating groundwater aquifers.
- Recreational/environmental reuse. The Wadi Hanifah Basin in Riyadh is Riyadh's most important source of drainage. It includes various recreational areas. Some 180,000 cubic meters of treated sewage effluent must be discharged into the Wad every day to maintain its ecological balance. Health concerns need to be considered to avoid contamination from toxic compounds in wastewater.
- Less conventional reuse. Other measures might include grey options, such as toilet flushing, which may require heavy investment to create a parallel grey water network.

*Source:* Deeken and Al-Dukair 2009.

Steering committees and working committees Multisectoral committees can be formed, with members from different sectors. Under this less formal institutional arrangement, the formation of the committees is not required by law. Committees can be created to advance one or more specific projects, or they can be permanent/long-term institutions formed to achieve certain objectives in line with policy objectives or targets in the sector. An example of a committee formed to design and implement a particular project is the New Water Project Steering Committee in South Australia (box 17).

**Box 17 Using a project-based committee to implement a wastewater use project in Australia**

The South Australian Murray-Darling Basin Natural Resources Management Board was established with the aim of promoting wastewater reuse for agricultural purposes within the region. To achieve this objective, in 2005 a project was commissioned to investigate opportunities for wastewater reuse in the basin. The project, New Water, seeks to match industrial and domestic wastewater supply needs with beneficial reuse programs and maximize the beneficial reuse of wastewater.

A steering committee consisting of representatives from regional development boards, industry, local government, the Environment Protection Authority, and industry representatives was created to oversee the project. It ensures that the needs and interests of stakeholder are represented.

The role of the steering committee is to:

- provide support and commitment to the direction and outcomes of the project
- manage stakeholder input and feedback
- ensure that the project scope and outcomes align with the requirements of stakeholder groups
- determine if emergent issues are within the scope of the project
- provide feedback on documentation and issues arising from the project
- address any issue that has major implications for the project.

The New Water Project concluded that 4,000 megaliters of wastewater are available a year from centralized domestic and industrial wastewater schemes and identified a list of priority wastewater reuse projects in the basin that could provide a sustainable and guaranteed water supply for irrigators.

*Source:* SA Murray-Darling Basin NRM Board 2006, 2007.

### 4.2.5. Alignment of multisector regulation

The regulatory framework governing wastewater R&RR must span different sectors and be adapted to local conditions. Both technical regulation (to ensure human and environmental health and safety) as well as economic regulation (to ensure market competition, performance of service providers, and cost-reflective tariffs) are needed.

In most cases/countries, technical and economic regulations for different sectors already exist. To create a regulatory environment that will encourage wastewater R&RR, all relevant regulations need to be aligned, based on a clear policy objective, which will drive the direction and focus of R&RR.

The Environment Agency in the United Kingdom developed a sewage sludge strategy that is intended to create incentives for wastewater R&RR (box 18). The strategy, which is still in its nascent stage, is one of the first national strategies for wastewater R&RR that attempts to align the legal and regulatory framework from different sectors.

**Box 18 Developing a sewage sludge strategy i n the United Kingdom**

The United Kingdom developed it sewage sludge strategy with three main objectives:

- Modernize and clarify the regulatory framework that relates to sewage sludge treatment, storage, and use.
- Address inconsistency with other waste sectors.
- Set in place investigations to evidence possible risks posed by modern sewage sludge practices.

The first objective is driven by the complex, and in some cases outdated, regulation related to sewage sludge treatment, storage, and use.

The strategy also aims to align wastewater practices with other waste sector practices, such as application of recovery, recycle, and reuse principles.

Stakeholder engagement processes are being developed to gain industry and stakeholder perspectives on what kind of enabling environment is needed to encourage and develop the sewage sludge market in the United Kingdom.

*Source:* ECA, 2019

The case of San Luis Potosí, Mexico shows that is possible to craft regulations and standards that are compatible with the implementation of multipurpose wastewater reuse projects (World Bank 2018b). To create incentives for wastewater R&RR, it is imperative that the regulatory frameworks of sectors relevant to wastewater R&RR be aligned. Such alignment requires clear policy direction from the national, or even local, government, to create the space for organizations (or individuals) to become leaders and champions for the sector and develop the necessary enabling environment.

### 4.2.6. Ad hoc and project-based stakeholder engagement

Effective stakeholder engagement can take place in an ad hoc manner. An example is the development of wastewater treatment plants for wastewater reuse for a mining company in the Arequipa Province in Peru (box 20).

**Box 20 Reusing wastewater for copper mining in Arequipa Province, Peru**

Expanding the Cerro Verde copper mining complex in Arequipa, Peru required access to additional water supplies. Providing them was a challenge in this arid environment, where growing population makes access to water a major challenge. Wastewater treatment capacity in the province is inadequate, and the Rio Chili watershed (the primary supply for the Cerro Verde operation) is increasingly contaminated from untreated residential and industrial sewage discharges. Treating this wastewater for reuse would provide a long-term source of water for mining operations and improve the quality of the river's water, enhancing agricultural products and reducing waterborne diseases.

Following discussions with regional and local governments, development agencies and civil leaders, Freeport-McMoRan, the firm responsible for Cerro Verde, agreed to fund the construction costs of new wastewater treatment plants in Arequipa. These facilities would allow wastewater to be reused, limiting the environmental and human health impacts of untreated water discharges into the Rio Chili. Consultations between Cerro Verde and the regional government of Arequipa, the national government, the local utility (SEDAPAR), and other local institutions provided the backdrop to Cerro Verde raising funds for the construction of the treatment plant.

A key success factor in this case was ongoing stakeholder engagement, including by the people directly affected by the environmental impacts of the mining operations and people in areas of indirect impact. The mining complex created a community relations program that brought together municipalities and social leaders to identify the major social problems in the affected areas and potential ways to address them.

*Source:* ICMM 2012.

### 4.2.7. River basin organizations

Since the 1992 Dublin Conference on Water and Sustainable Development, there has been a shift away from the top-down hierarchical model of water management toward the creation of basin-level institutions, which have a mandate to consult and involve water users. RBOs take a variety of forms, with different levels of technical expertise for the analysis, planning, and management of water resources. They typically share a commitment to involving stakeholders from different levels of governments as well as representatives from different sectors and local communities.
Spain provides a good example of how water reuse has been mainstreamed in basin planning (box 21).

**Box 21 Reusing water in Spain**

In the face of growing water scarcity, Spain has become a leader in reclaimed water. In the region of Murcia, for example, where agriculture has high socioeconomic importance, the General Sanitation and Wastewater Treatment Plan was oriented to providing reuse water for agricultural purposes. Under the plan, a number of high-end wastewater treatment plants were built, with water from the plants directed either to irrigation or to providing base flow to the Segura River, thereby helping maintain its good ecological status.

The Wastewater Treatment Agency created and managed a new tax—the "sanitation fee"—for the region. The funds are used to cover the operational and maintenance costs of wastewater treatment plants in the region and the refurbishment of old plants and the building of small plants in remote regions.

*Source*: Navarro 2018.

RBOs can perform a range of functions, including the following:

- policy development and planning
- implementation of wastewater R&RR projects
- regulation and monitoring of basin water quality
- execution of relevant research on the management and development of the river basin.

An example of an RBO with multiple functions is the Murray-Darling Basin Authority in Australia (box 22).

**Box 22 The Murray-Darling Basin Authority in Australia**

The Murray-Darling Basin Authority (MDBA) was established under the Water Act 2007 as an independent, expert-based statutory agency. Its roles and responsibilities include the following:

- preparing, implementing, and reviewing an integrated plan for the sustainable use of the Murray-Darling basin's water resources
- operating the River Murray system and efficiently delivering water to users
- coordinating Living Murray program activities on behalf of partner governments
- measuring, monitoring, and recording the quality and quantity of the basin's water resources
- supporting, encouraging, and conducting research and investigations about the basin's water resources
- disseminating information about the basin's water resources
- engaging and educating the Australian community about the basin's water resources.

In fulfilling its roles, the MDBA worked with state government agencies, utilities, industrial and/or community-based organization, and private sector actors.

The MDBA's governance structure allows for coordination and close interactions across different levels of government, as well as among stakeholders from different sectors. Roles are clearly allocated to the different stakeholders:

- The Commonwealth Water Minister ultimately makes decisions about the basin plan and the strategies proposed and developed by the MDBA, based on advice from the Ministerial Council.
- The MDBA is responsible for implementing and monitoring the basin plan approved by the water minister; planning and managing basin water resources in collaboration with partner governments and the community; and managing the River Murray system on behalf of joint governments.
- The Ministerial Council consist of minister-level representatives from each state. It is responsible for setting policies, making decisions about water allocation to each state, and providing funding for joint projects.
- The Basin Officials Committee includes officials from different state governments and sectors. It makes decisions in line with advice from the Ministerial Council.
- The basin community committees represents relevant communities' interests. They provide advice to the MDBA and the Ministerial Council on issues affecting communities.

*Source:* MDBA 2015.

At the heart of an RBO is the river basin approach to water resource management, which has a foundation in participatory approaches, in which stakeholders have a say in the planning and decision-making process for projects in the basin area. Their participation ensures that the interests of different stakeholders are considered and that an agreed upon balance of costs and benefits is achieved.

Stakeholder participation is key to gaining acceptance of the R&RR component of wastewater projects. Box 23 provides an example of an RBO that has enhanced stakeholder participation in river basin planning and development.

**Box 23 Enhancing stakeholder participation in the Lerma Chapala River Basin Council, in Mexico**

River basin councils (RBCs) in Mexico are a means of coordinating government institutions, water users, and social organizations with the objective of formulating and executing programs to improve regional water management and preserve river basin resources. The Lerma Chapala River Basin Council (LCRBC) is the first RBC in Mexican history and a forerunner of a new approach to enhanced water resource management integrating different stakeholders in the council. It serves as a forum within which stakeholders can meet with government officials to present complaints, search for solutions,

raise questions, and promote projects, including wastewater reuse activities.

A critical improvement to regional water management arrangements introduced with the LCRBC was the possibility for water users to interact with government representatives to discuss solutions and actions. Water users integrated a General Regional Assembly and work committees arranged by water use and state to select members to represent them on the LCRBC.

*Source:* Mestre 2001.

### *Facilitation of financing of basin projects through river basin organizations*

Economic analysis of wastewater projects should be conducted at the river basin or catchment level. RBOs can assist in finding ways to finance wastewater investments with multisectoral benefits from R&RR, as shown by the examples in box 24.

**Box 24 River basin financing mechanisms in France and Germany**

Each of France's six river basins is governed by a basin committee (known as a water parliament), which is made up of representatives from national, regional, and local governments; the industrial and agriculture sectors; and communities. The water parliaments to determine how financial resources are used to benefit stakeholders. They decide where wastewater treatment plants are located and what level of treatment is needed. They consider environmental benefits and balance them with the costs of investment needed to meet a particular standard agreed on by stakeholders. Once an investment is agreed on, the water parliament determines how to finance the investment, administers the collection and distribution of any revenues, and ensures that revenues are used to recover investments.

In Germany the Ruhrverband (a form of RBO) is a self-governing public body that manages water resources in the Ruhr Basin. It is made up of representatives from communities, district governments, and trade and industrial firms. The decision-making body of the Ruhrverband sets annual budget for wastewater infrastructure development as well as operations and maintenance, which are recovered through charges levied on users and polluters.

*Source:* Bartone 1997.

Transboundary river basin organizations
In many areas of the world, major rivers define national boundaries. Many RBOs are therefore transboundary institutions, increasing the need for consultation and stakeholder involvement. Transboundary basin organizations must be careful to treat each member state equally.

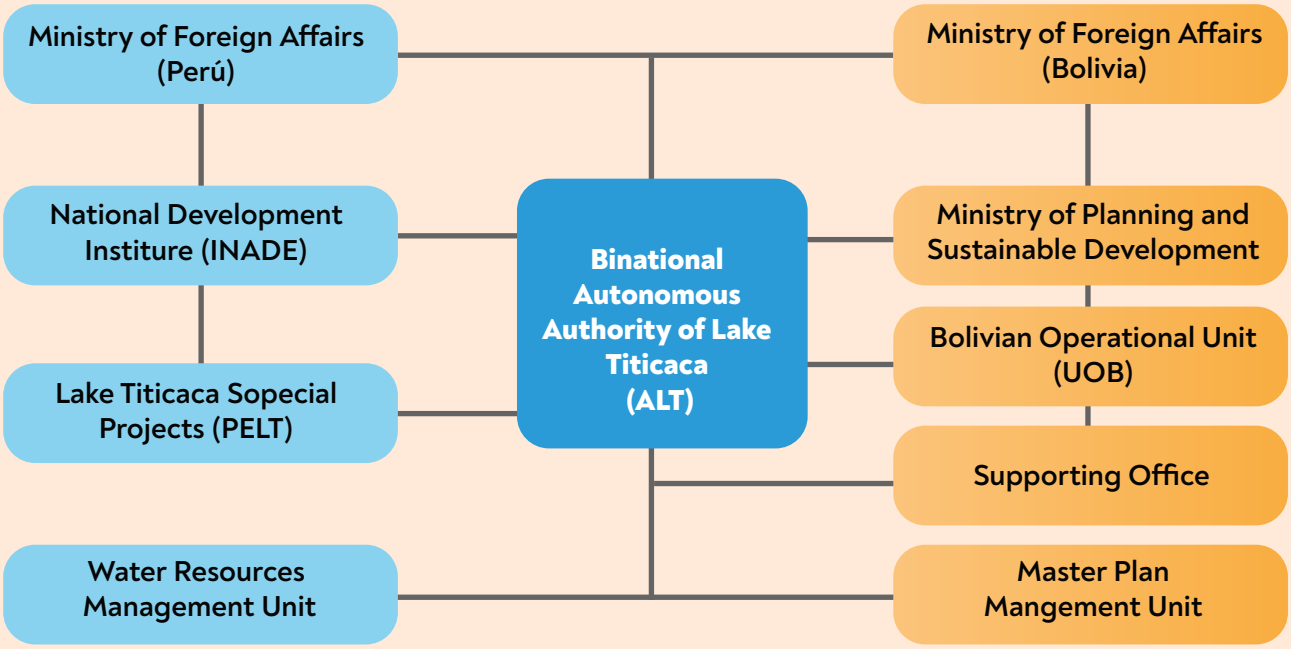
Transboundary RBOs can become a unifying force, creating incentives for member countries to aspire to the best-performing riparian neighbor. Boxes 25 and 26 describe two transboundary RBOs.

**Box 25 Resolving transboundary disputes in Lake Titicaca**

Discharge of untreated waste directly into Lake Titicaca has contaminated the water body. In response, in 1992, Bolivia and Peru established the Autonomous Binational Authority of Lake Titicaca (ALT) to implement and enforce the management and protection of the lake's water resource. Administrative entities of each country coordinate with the ministries of foreign affairs of both countries and with one another (figure B25.1).

ALT has advanced regulatory efforts within the basin. Bolivia and Peru also bound themselves to consider the lake as a shared body of water owned by both countries. Consequently, although the Desaguadero River flows from the lake into Bolivia, the countries have worked in a cooperative way to manage the watershed, minimizing upstream versus downstream issues.

**Figure B25.1 Institutional structure of the Autonomous Authority of Lake Titicaca**




*Source:* Newton n.d.

## Box 26 Promoting equitable and sustainable development of the watershed through the Orange-Senqu River Commission

The Orange-Senqu River Basin is a transboundary water resource shared by Botswana, Lesotho, Namibia, and South Africa managed by the Orange-Senqu River Commission (ORASECOM). This RBO seeks to promote equitable and sustainable development of the watershed by providing a forum for consultation and coordination by member states.

The RBO's organizational structure consists of a council, a secretariat, and task teams. Its key functions include the following:

- administrative, technical, and financial control (handled by the Secretariat)
- management, to support joint management of projects at the basin level
- coordination, to facilitate the participation of all stakeholders
- communication, to enable transparent dialogue among the commission, the scientific community, NGOs, and other stakeholders
- screening, to monitor the execution of decisions made by the commission and assess the possibility of new activities.

One of the challenges that remains to be addressed is the issue of wastewater management. Despite significant urban development within the river system, investment in wastewater treatment and reuse opportunities across the basin have been limited.

*Source:* ORASECOM 2018.

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