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Water Security Financing Framework for Latin America and the Caribbean

Mónica A. Altamirano
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Water Security Financing Framework for Latin America and the Caribbean

Mónica A. Altamirano
Silvia L. Saravia Matus

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Abstract

The Water Security Financing Framework for Latin America and the Caribbean responds to one of the region's most urgent challenges: closing the gaps that still exist in water access and sustainability in a context of climate change, rapid urbanization and limited financial resources. Despite progress in access to water and basic sanitation, the region faces structural shortcomings that jeopardize the universalization of the human right to safe drinking water and sanitation, sustainability, equity and resilience. This framework emphasizes that the problem lies not only in the shortage of financial resources, but in the limited institutional capacity to convert needs into well-structured and bankable projects.

To address that, this document introduces the Water Security Financing Framework (WSFF): an adaptable methodology based on principles of new institutional economics and systemic thinking aligned with the British "five case model" (strategic, economic, commercial, financial and management) for justifying and prioritizing public investments. The Water Security Financing Framework offers a step-by-step process that enables governments, operators, the private sector and civil society to jointly construct robust investment cases, design effective contractual arrangements and strengthen governance, funding and financing arrangements. It thus seeks to close two critical gaps: between political decision-makers and technical experts, and between investment needs and existing financial mechanisms.

The document is structured as follows: after an introductory chapter that provides the context and rationale for consolidating this financing framework for water security, chapter I analyses the region's challenges and implementation gaps in achieving water security. Chapter II presents an analysis of transformations in the global and regional financial architecture. Chapter III examines emerging financing mechanisms: green and blue bonds, blended finance, carbon and water credits, and philanthropic capital. Chapter IV examines in depth the strategies used to channel climate funds at the local level, with examples from South Africa and the Indian city of Surat. Chapter V describes the Water Security Financing Framework in detail, with example cases from the region. Finally, chapter VI concludes with recommendations for policy reforms, institutional strengthening and investment priorities.

To summarize, the regional Water Security Financing Framework offers a common-language, practical road map for mobilizing public, private and philanthropic capital to catalyse and enable transformative investments in water security for Latin America and the Caribbean.

Introduction

Water security is one of this century's greatest challenges. In Latin America and the Caribbean, the impacts of climate change —prolonged droughts, extreme flooding and deteriorating water quality— are compounded by accelerated urbanization, environmental degradation and institutional weaknesses in resource management. Those factors threaten environmental sustainability, public health and the productivity of the region's economies.

Despite the region's significant progress in providing access to basic water and sanitation services, structural gaps still exist, which have a particularly severe impact on rural and other historically marginalized communities (Economic Commission for Latin America and the Caribbean [ECLAC], 2024). Those shortfalls in achieving universal access prevent enjoyment of the human right to safe drinking water and sanitation and amplify social and economic vulnerabilities to climate change.

In that context of climate change, it is increasingly urgent for the Latin American and Caribbean region to invest in water security, and the gap in access to financing is unquestionably an urgent problem that requires a solution.

A. Need for a pragmatic approach to close gaps

The debate on water financing involves not only the volume of financial resources available, but also the national and local institutional capacities to convert analyses of needs into proposals for viable and sustainable investment projects and programmes. In that regard, for the development of a portfolio of high-impact and financially viable investments, two fundamental gaps must be addressed: (i) between political decision-makers and technical experts, and (ii) between investment needs and existing financial mechanisms. Because of those two gaps, projects do not achieve financial sustainability or lack the institutional structure required for their successful implementation and the sustainable provision of services over time.

The Water Security Financing Framework for Latin America and the Caribbean is intended to provide an accessible methodological foundation and practical examples —from both the region itself and elsewhere in the world— to overcome those limitations. It proposes a pragmatic approach that will

enable technical experts to influence more effectively the investment prioritization process and the criteria adopted by political decision-makers, and to develop the capacities needed to structure water security investment programmes and projects with more robust investment cases, including the five most important aspects —strategic, economic, commercial, financial and management— in order to accelerate the implementation of high-impact projects.

While there has been a significant reduction in global development cooperation funds, the international private and financial sector has a growing interest in impact investments with social, environmental and climate objectives. Within the international financial architecture, climate and green finance are emerging as key tools for closing those financing gaps and for catalysing sustainable and resilient investments in water infrastructure. Within the framework of the 2030 Agenda for Sustainable Development, Sustainable Development Goal 6 (Clean water and sanitation) represents a strategic entry point that is interconnected with targets in the areas of health, energy, food security and climate resilience.

The Water Security Financing Framework (WSFF) was adopted following a thorough review of the existing literature on water security funding and the approaches developed by various institutions. Although numerous studies that document good practices and success stories exist (World Water Council, 2022; WaterAid & Blended Finance Taskforce, 2020; World Bank Group, 2020; Organisation for Economic Co-operation and Development [OECD], 2022; Khemka et al., 2023), together with analyses of enabling environments for water security investments (Castro and Delmon, 2018; Jiménez et al., 2019; World Bank, 2022; OECD, 2024)OECD, 2024), climate change adaptation (Stenek et al., 2013; Altamirano, 2021) and public infrastructure in general (Economist Intelligence Unit, 2019), none of them offer a step-by-step process that is specifically adapted to water security projects and that can also provide non-specialists in investment and project structuring with guidance. The present document makes reference to those other resources, which can be used to further develop specific aspects, but the WSFF provides the necessary comprehensive framework, adapted to the Latin American and Caribbean context.

The WSFF combines contributions from new institutional economics, transaction cost economics, infrastructure economics and engineering design theory (Altamirano, 2010) and incorporates concepts from engineering asset management and the financing and provision of public infrastructure networks. Its structure is also in line with the "five case model" approach used by the United Kingdom Treasury to evaluate public investments, which reinforces its methodological rigour. That model has been applied in eight countries on different continents, in projects of different types and scales. Within the framework of the Nature Insurance Value: Assessment and Demonstration (NAIAD) project of the European Horizon 2020 programme (2016–2020), specific guidelines were developed for projects based on nature-based solutions, which were subsequently published in the *Handbook for the Implementation of Nature-based Solutions for Water Security* (Altamirano et al., 2021).

To summarize, the Water Security Financing Framework is a proven and adaptable methodological approach that provides a detailed process for structuring the implementation and financing of water security projects for the benefit of Latin American and Caribbean stakeholders.

B. Objectives and content

The financing framework's central purpose is to support national and local government authorities, utility operators, the private sector and civil society in constructing portfolios of transformative water security investments in Latin America and the Caribbean. Instead of merely mobilizing additional resources, the goal is to strengthen the capacity of national and local actors to create viable and sustainable projects that consider implementation, financing and governance issues from the outset and that are framed within a shared strategic vision, thus increasing the real capacity for regional execution.

The specific objectives address the strengthening of national and local institutional capacities to enable:

- The development of robust investment cases, aligning financial viability with the Sustainable Development Goals (SDGs) and climate resilience in order to access climate, green and impact finance.
- The design of clear, performance-based implementation arrangements and contracts that generate confidence and reduce investor risk.
- The adoption of a systemic, mission-driven approach in investment design, interconnecting strategic objectives, funding models and action plans from the outset and thereby promoting financial sustainability and long-term service delivery.
- The promotion of multisectoral collaboration, taking advantage of collective intelligence and synergies between the public, private and third sectors.

Following this introduction, the document is organized to provide a financing framework that combines analysis, methodological proposals and practical applications:

- Chapter I, "The challenge: Implementation gaps and call for action", describes the constraints that have prevented the mobilization of water security investments.
- Chapter II, "Evolution of the financial architecture for water security", analyses recent changes in the global and regional financial architecture, including trends in climate finance, environmental, social and governance (ESG) issues and an overview of public, private and philanthropic sources in Latin America and the Caribbean.
- Chapter III, "Innovations and emerging financing mechanisms", examines such instruments as blended finance, green, blue and sustainable bonds, carbon and water credits and philanthropic capital.
- Chapter IV discusses strategies for channelling climate funds to local governments, with examples from South Africa and the Indian city of Surat.
- Chapter V sets out the Water Security Financing Framework (WSFF), its methodological foundations, the five business cases and the necessary implementation and governance arrangements. It also includes examples from Latin America —the experiences of La Farfana, Aquapolo and Tenorio— that illustrate how the framework has been applied in real-world projects.
- Finally, chapter VI, "Final conclusions and recommendations", summarizes the lessons learned and proposes actions to accelerate transformative investments in the region, maximizing the catalytic use of public funds and mobilizing private and philanthropic capital.

In addition to conceptual frameworks, it offers operational tools and practical formats to enable proponents to move from their basic idea towards a structured investment proposal, which potential funders can then begin to evaluate. The methodology assists in mapping key actors and institutions, identifying financing options and potential funding sources based on the hierarchy of services, and defining contracting and risk allocation strategies.

The WSFF represents a unique contribution to its field in Latin America and the Caribbean, as it enables the adaptation, demonstration and development of investment needs through robust projects that promote water security. More than a technical manual, the WSFF provides a common language and a practical road map for a range of stakeholders to work together in structuring transformative projects and to build the trust and contractual strength needed for funding to flow.

I. The challenge: implementation gaps and call for action

This chapter examines the main challenges that limit the ability of Latin America and the Caribbean to make progress towards water security. Based on a diagnosis of the regional impacts of climate change, infrastructure shortcomings, inequalities in access and financial constraints, it identifies the investment needs and institutional tensions that have slowed progress. The chapter also analyses the ideological and structural debates surrounding service financing and delivery, and it issues a pragmatic call to action based on three key lessons: (i) avoiding the construction of "white elephants", (ii) tailoring solutions to the local institutional context, and (iii) acknowledging the reality of limited resources. Finally, it identifies the two fundamental gaps and leverage points that must be overcome in order to transform commitments into sustainable projects and pave the way for understanding the global financial architecture discussed in the next chapter.

A. Implementation gaps in water security

The Latin American and Caribbean region's water security is facing a critical situation. Despite the progress made with the coverage of drinking water and sanitation services, substantial gaps still exist in access, quality and sustainability, and these are more evident in rural and peri-urban communities and among historically marginalized groups. Not only do those limitations affect enjoyment of the human right to water and sanitation, they also weaken the region's capacity to adapt to climate change and other external shocks (Saravia Matus et al., 2020).

Climate change has exacerbated those risks. Prolonged droughts, extreme flooding and deteriorating water quality affect agriculture, energy generation and the provisioning of urban areas. Since 2000, droughts have affected 53 million people, generating economic losses of US$ 22 billion. The 2022–2023 drought in Argentina reduced GDP by 3%, with impacts on agriculture, hydroelectricity and

urban provisioning (Rosario Stock Exchange, 2023). At the same time, floods and storms accounted for 80% of climate disasters between 1990 and 2023, affecting 116 million people and causing 77% of the region's economic losses (ECLAC, 2024).

Retreating glaciers further exacerbate the situation. Estimated annual glacier mass loss stands at 22.9 Gt (Dussaillant et al., 2019). Glaciers such as Ventorrillo in Mexico, Chacaltaya in Bolivia and Humboldt in Venezuela have disappeared, affecting urban water supplies, ecosystems and hydropower generation (Intergovernmental Panel on Climate Change [IPCC], 2023; World Meteorological Organization [WMO], 2023). Depending on how dependent they are on glaciers, various cities could face supply reductions ranging from 14% to 70% (Sánchez Peña et al., 2022).

In addition, the water infrastructure suffers from structural deficiencies: network water losses can be as high as 40% or 60% due to leaks and inefficient distribution systems, and only 45% of wastewater is safely treated, which leads to widespread contamination in two thirds of the region's rivers (ECLAC, 2024).

Those challenges, combined with rapid urbanization —80% of the region's inhabitants live in cities— put pressure on already fragile systems. Cities such as Mexico City, São Paulo and Lima face severe water stress and overexploitation of aquifers, while inadequate sanitation systems in informal settlements reinforce exclusion.

1. Investment needs and financial constraints

The dimensions of the implementation gap become evident when investment needs are examined. It has been estimated that the region needs to invest 1.38% of its GDP annually for 10 years to achieve universal access to drinking water and sanitation, which implies an eightfold increase in the current level of investment (Saravia Matus et al., 2023). At present, public spending in the sector totals US$ 14.9 billion, equivalent to 0.3% of regional GDP.

A similar pattern can be seen in the global situation: the world's annual water spending amounts to US$ 164.6 billion, of which 85.5% comes from public budgets, 6.9% from official development assistance and less than 2% from the private sector (Joseph et al., 2024). Most of that money is allocated to capital investment (63%) and not to operation and maintenance (37%). That breakdown explains why so much of the built infrastructure fails to be sustainable over time.

The problem is not only the insufficient funding amounts, but also the low absorption capacity. According to a World Bank study, budget execution rates in the global water sector between 2009 and 2020 were only 72%, which means that 28% of the allocated funds were not spent (Joseph et al., 2024). Those low execution rates reveal systemic constraints in the sector's absorption capacity, which are linked to institutional, governance, project management and political economy factors. Simply increasing the execution rate would allow some progress to be made in closing the water sector's funding gap without the need for greater financial outlays.

2. Redefining the debate

Despite the clear evidence of the need and economic case for investments in water security, funding for resilient infrastructure has been slow to advance. This is largely due to inadequate planning practices, failures of governance and ideological debates about private sector participation.

In many countries, polarization has fuelled political inertia, delaying necessary institutional reforms. Some poorly designed experiences of the past, which led to the total privatization of water services, have left negative perceptions and myths that hinder the possibility of establishing models for regulated and balanced collaboration between the public and private sectors. Such reforms are essential to create mutually beneficial arrangements that enable money to flow into the sector and resilient water infrastructure to be developed.

Indeed, many Latin America and Caribbean cities already have de facto privatization through informal markets: bottled water, tanker trucks and private wells, at prices well above the official rates. As a result, poorer populations pay more for a less reliable service. Social disparities aggravate the picture: the poorest quintile of the population has 25% less access to safely managed drinking water than the richest, and they can pay up to twice as much for unreliable informal services. In the region, there are still 431 million people without safely managed sanitation (ECLAC, 2024).

Studies by organizations such as Water.org have shown that low-income communities are willing to pay for reliable water and sanitation services, provided that adequate financial mechanisms and access options are in place (Water.org, 2015, 2021; Iwel and Aguaconsult, 2021; Pories et al., 2019). The failure to recognize that demand perpetuates exclusion and poor service provision.

Other myths, such as rigid adherence to centralized piping systems, can also hinder progress. While universal access is a human right, exclusively pursuing idealized models can delay pragmatic and contextually appropriate solutions that enable gradual progress to be made. Each year that the construction and delivery of water infrastructure is delayed increases social and environmental costs and widens gaps in equity. Paradoxically, the cost of inaction is usually higher than the potential fee increases associated with models for regulated private participation.

Overcoming this polarization demands a pragmatic approach: what matters is not who provides the service, but how to ensure its financial, social and environmental sustainability.

The arguments set out in this section agree with the views of Mariana Mazzucato (Mazzucato, 2016, 2017, 2025) on the need to leave behind ideological dogma and sterile debates about the role of the State and the private sector. As she argues, the key issue is not who provides the service, but how intelligent institutional and financial arrangements are designed so that strategic investments can be made in critical public goods such as water security.

In line with its call for States to be active and mission-driven, the Water Security Financing Framework's approach proposes moving away from the paralysis created by polarization and towards models of regulated and balanced collaboration that mobilize public, private and philanthropic capital, applying the same determination with which governments find resources in other areas such as military security.

B. Pragmatic approach: leverage points

Water is a human right, but ensuring universal access requires more than political rhetoric. It needs a pragmatic and solution-based approach that takes account of financial constraints, institutional realities and the range of implementation models available.

The Water Security Financing Framework incorporates key lessons learned from the region and across the world:

Infrastructure is not an end in itself, but rather a means to ensure sustainable service provision. The region suffers from a "white elephant" problem: infrastructure that is built and quickly ceases to function, either because of a lack of maintenance or because the budget for the operating and personnel expenses required does not exist. In the water sector, many countries have built wastewater treatment plants (WWTPs) without planning for operating and maintenance costs over their useful life or the institutional arrangements needed to ensure their operation. The result is a high number of inoperative facilities.

A recent study by WaterAid (2020) of national WWTP inventories and their performance over time shows that inadequate maintenance is a recurring problem across the region. The case of Mexico is illustrative: in Chiapas, 182 of the 194 inventoried WWTPs were out of service; and in the State of Mexico, 3 of every 10 plants were reported with construction never completed, 1 in 10 was not operational, 4 in

10 were partially operational and only 1 in 10 was operating fairly effectively. Those figures underscore the urgency of moving from an approach that focuses on physical infrastructure to one oriented towards sustainable services.

The historical, cultural and institutional context must be taken into account. Copying solutions without adapting them to local realities leads to inefficiencies and, in some cases, major crises. One key historical example is provided by the so-called "Water War" in Cochabamba, Bolivia (1999–2000). The privatization of the water supply, as part of recommendations made by international financial institutions, was undertaken without considering the local population's customs and needs. The new concession-holder increased the rates by up to 200% in some cases and restricted traditional uses such as rainwater harvesting (Grupo Semillas, 2006). Those measures triggered massive protests that culminated with the cancellation of the contract and left a profound impact on the region, fuelling social resistance to private participation in the water sector (Grupo Semillas, 2006; Spronk, 2007).

The reality of limited financial resources demands creativity. A context of limited public resources demands acknowledgment of the fact that not all needs can be met simultaneously. Creativity is therefore essential to design mechanisms that can balance competing urgent demands on constrained budgets. This process requires realistic solutions and implementation road maps, in which practical trade-offs are unavoidable. This implies transparent prioritization, focusing on institutional and financial arrangements that maximize impact with the resources available instead of starting from unworkable universal principles.

Based on those lessons, the WSFF emphasizes that the main challenge is not only to mobilize more resources, but to transform them into viable, sustainable, high-impact projects. Progress towards effective solutions requires that two basic gaps be addressed:

The gap between political decision-makers and technical experts. Political cycles tend to favour visible short-term projects that lack comprehensive studies supporting their feasibility. In many cases, eager to complete visible infrastructure projects within their electoral cycles, politicians may tend to pursue projects that lack the complete studies required to support the full investment case and request implementation assistance from regional development banks and bilateral donors. Technical experts, although trained in hydrology, sanitation and engineering, often lack training in strategic asset management, infrastructure funding and institutional structuring. As a result, implementation and financial sustainability are often considered after the project has been designed, rather than being included from the start of the project.

The gap between investment needs and the existing financial mechanisms. Many mechanisms fail to align investment incentives with long-term service provision goals. In other cases, the available funding sources have requirements that many water security projects cannot meet, or their conditions are not favourable or in line with the needs. Closing that gap requires changes in project planning and preparation geared towards capitalizing on the potential of new instruments: climate finance mechanisms, impact investment vehicles and blended finance models. Most of these mechanisms are based on well-designed performance contracts, through which funding can be linked to measurable results.

Overcoming both of these fundamental gaps demands not only new financial instruments, but also a determined effort to strengthen local capacities to design robust, viable and sustainable projects. National governments —and, in particular, subnational actors— require technical and institutional support to translate needs into investment proposals that meet the requirements of development banks, climate funds and donors.

The WSFF aims to contribute in that regard by offering a practical methodological framework for designing robust business cases, defining appropriate implementation arrangements and taking advantage of the opportunities offered by emerging financial mechanisms.

C. Summary and strategies for the region

In summary, addressing the water challenges of Latin America and the Caribbean requires, in addition to greater flows of resources, structural reforms that prioritize:

- Investments in resilient water infrastructure systems than can cope with the escalation of climate change.
- The modernization of policies and regulations to ensure the equitable and efficient allocation of water.
- Innovative financial mechanisms, including climate and green finance, together with greater use of emerging mechanisms to mobilize investments.
- Regional cooperation in the governance of cross-border water resources.
- Public-private collaboration that improves service provision while ensuring access by vulnerable populations.

Integrating these strategies would allow the region to transition from water insecurity to sustainable water management, where the resource would become a driver of economic development rather than a constraint.

The methodological and pragmatic approach presented and proposed in this guide connects the local challenges of each country and the region with a broader dynamic: the evolution of the global financial architecture. Over the past decade, the international climate agenda has driven far-reaching transformations in both development finance and private and impact finance for environmental issues: from the rise of green bonds to sustainability finance's shift from niche to mainstream (BlackRock, 2020). Understanding those trends is essential if Latin America and the Caribbean are to position themselves strategically and channel more resources into transformative water security projects.

II. Evolution of the global financial architecture: a systems perspective

This chapter analyses the evolution of the global financial architecture from a systems perspective and shows how changes taking place globally are reshaping water security investment possibilities in Latin America and the Caribbean. The starting point is diagram 1, which illustrates the interactions between external social, environmental, financial and regulatory factors, the instruments available to national and local governments, and the outcomes of interest, expressed through indicators of universal access, climate resilience, financial sustainability and compliance with SDG 6.

Interactions between these elements generate emerging trends in the financial and corporate spheres, which in turn translate into concrete opportunities for the water sector. Those opportunities require a stronger enabling environment, new implementation models and a strategic blend of policy and funding instruments. The chapter is organized according to that logic.

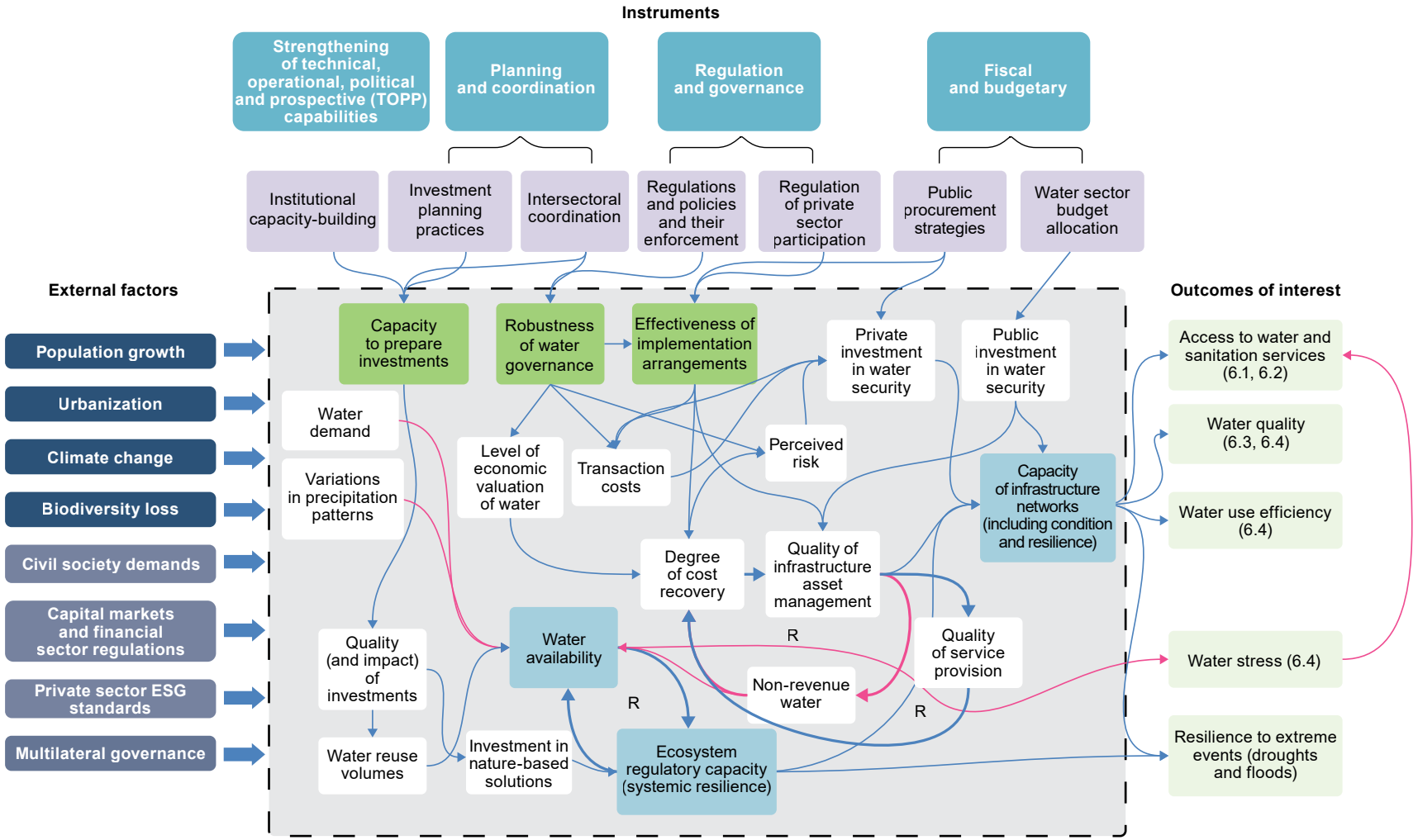
The starting point for analysing the summary of the main dynamics at play in diagram 1 is on the left, where the external factors —climate change, population growth, urbanization, biodiversity loss, variability in rainfall patterns and water availability— are located alongside changes in the capital market and financial sector regulations, ESG standards for the private sector, multilateral governance and the growing demands of civil society.

The upper part of the diagram shows the instruments and leverage points with which national and local governments can act: from investment planning, budget allocation and updating regulatory and policy frameworks, to public procurement strategies, private sector participation and strengthened governance and implementation arrangements.

On the right are the outcomes of interest or performance indicators, expressed through indexes of access to water and sanitation services (SDG 6.1 and 6.2), water quality and efficiency in its use (6.3 and 6.4), resilience to extreme events and better ecosystem regulation.

The diagram also depicts how interactions between external factors and global financial trends are generating emerging guidelines, which in turn translate into opportunities for the water sector. Those opportunities demand new implementation models and a stronger enabling environment. For further clarity, the sequence between emerging trends, emerging opportunities and implementation models is shown in diagram 3. These are, however, the result of changes in the external factors and of the changes they drive in other sectors, such as the private and financial sectors.

Diagram 1
The global financial architecture system



Source: Prepared by the authors.

The structure of this chapter is as follows:

Section A presents the external factors that are redefining the financing context.

Section B addresses the emerging trends in international cooperation, climate and nature financing, the integration of sustainability criteria into capital markets and the growing commitment of the corporate sector. It then explores the new opportunities for the water sector and innovations in business and investment models (implementation arrangements).

Section C explores into the instruments and responses available to national and local governments, organized into four categories: planning and coordination, fiscal and budgetary instruments, regulation and governance, and institutional capacity-building. It also analyses the main mechanisms that explain the system's dynamic behaviour over time, and it identifies those factors where a relatively small change has a disproportionate impact on the system's performance, which are called leverage points.

Section D describes types of high-potential investments that, when aligned with global trends and sustainability agendas, can attract capital and accelerate progress toward water security.

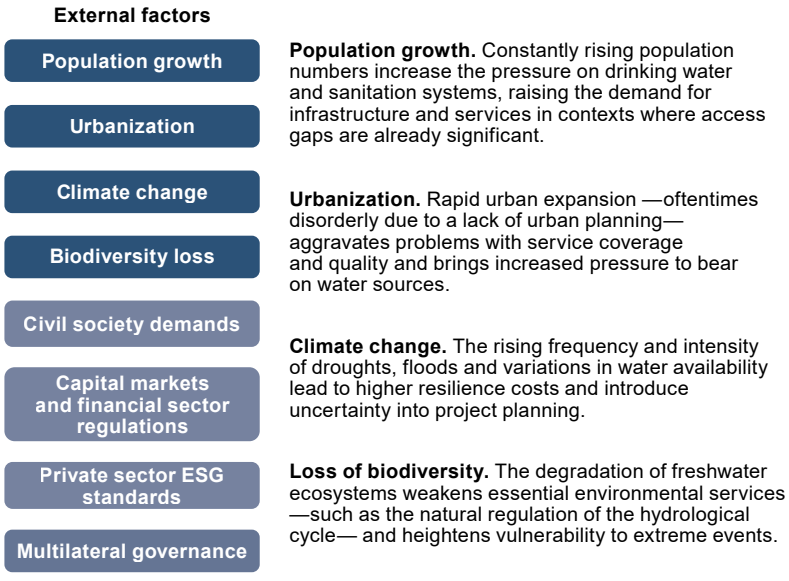
Section E concludes by providing a comprehensive overview of how the region can position itself strategically vis-à-vis the changes in the global financial architecture and pave the way for the implementation of the Water Security Financing Framework (WSFF) presented in the fifth chapter.

A. External factors

The challenges and opportunities for financing water security in Latin America and the Caribbean cannot be understood without an appreciation of the external factors shaping the global and regional context. These factors, shown on the left of diagram 1 and in greater detail in diagram 2, directly influence countries' ability to attract resources, structure projects and ensure sustainable results.

External factors can be divided into two groups. The first comprises demographic and environmental factors:

Diagram 2
External factors



Source: Prepared by the authors.

A second group of external factors includes new social attitudes and financial regulations:

Civil society demands. An increasingly active and aware citizenry is demanding equitable access to water, environmental responsibility and social justice. Recent social movements clearly illustrate this: the 2019 protests in Chile paved the way for a constitutional process in which water governance was a central theme, and in Mexico, Colombia and Argentina, Indigenous and rural communities have mobilized against large-scale extractive projects that threaten ecosystems and drinking water access rights (De Miguel, 2024; International Federation for Human Rights [FIDH], 2024).

Capital markets and financial sector regulations. The ability of countries to attract investment is increasingly dependent on changes in global financial markets and the adoption of sustainable financing regulations. An example of this is the European Union taxonomy for sustainable activities, which influences investment flows to the countries of Latin America and the Caribbean, especially in sectors that make intensive use of natural resources. In turn, development banks such as the Inter-American Development Bank (IDB) and the Development Bank of Latin America and the Caribbean (CAF) have begun to include climate risk assessments in their financing criteria and to set minimum green investment or climate change adaptation targets (Inter-American Development Bank [IDB], 2019).

Private sector ESG standards. Companies face increasing pressure from regulators and investors to incorporate ESG criteria. Governments that do not align with those standards will face higher borrowing costs and restrictions on access to international financing and foreign investment. The case of Brazil is illustrative: backsliding with controlling deforestation in the Amazon led European investors to reduce financing for agro-industrial companies associated with environmental risks (The Climate Champions Team et al., 2024). Table 1 shows the main ESG regulations and standards.

Table 1
International environmental, social and governance regulations and standards

Regulation name	Description	Adoption rate
Task Force on Climate-Related Financial Disclosures (TCFD)	A global framework that guides companies and investors in assessing and reporting nature-related risks and opportunities.	As of 2024, 72% of the world's 250 largest companies (G250) have adopted TCFD-based reporting, up from 61% in 2022 (Institute of Chartered Accountants in England and Wales, 2024).
Global Reporting Initiative (GRI)	The GRI standards allow third parties to assess the environmental impact of a company's activities and supply chains.	The GRI standards remain the most widely used ESG reporting framework, as 78% of the G250 and 68% of the top 100 companies in 58 countries (N100) have adopted them (Global Reporting Initiative, 2022).
Sustainability Accounting Standards Board (SASB)	The SASB standards are designed for investors and are essentially based on material financial considerations.	In early 2020, more than 120 companies worldwide were using the SASB standards, including 76 based in the United States and 44 in other countries (Ashwell, 2019).
Science-Based Targets initiative (SBTi)	Science-based targets that provide companies with a road map, in line with the goals of the Paris Agreement, for reducing their emissions.	By 2024, 10,687 companies worldwide had committed to setting science-based targets, and more than 7,199 companies had received official approval for their targets (Science-Based Targets initiative [SBTi], 2025).
Principles for Responsible Investment (PRI)	The six principles for responsible investment provide a series of steps for incorporating ESG criteria into investment practices.	As of 2024, the PRI initiative has more than 5,000 signatories, including asset owners, investment managers and service providers, who together represent more than US$ 120 trillion in assets (Principles for Responsible Investment [PRI], 2024).
EU Taxonomy for Sustainable Activities	A classification system within the context of the European Green Deal, designed to identify economic activities that are environmentally sustainable.	The EU Taxonomy is mandatory for large European Union-based companies under the Non-Financial Reporting Directive (NFRD), for a total of some 11,700 companies (Technical Expert Group on Sustainable Finance, 2020; Casado Barral, 2023).
Corporate Sustainability Reporting Directive (CRSD)	The European Union's most recent legislative framework, which replaces the NFRD and sets stricter standards for more complete, verifiable and accessible ESG reporting.	The CSRD expands the scope of the sustainability reporting requirements and is expected to affect nearly 50,000 European Union companies (Casado Barral, 2023).

Regulation name	Description	Adoption rate
Sustainable Finance Disclosure Regulation (SFDR)	The SFDR requires asset managers and institutional investors to disclose sustainability risks and impact in their portfolios.	It applies to financial market participants and financial advisors in the European Union, requiring them to disclose how ESG factors are integrated into their investment decisions (Casado Barral, 2023).
International Sustainability Standards Board (ISSB)	The ISSB develops international sustainability disclosure standards, including some related to environmental and nature-based risks.	Established in 2021, the ISSB has developed global sustainability disclosure standards, and take-up rates are expected to increase significantly as the standards are finalized and integrated into global regulatory frameworks (International Financial Reporting Standards Foundation, 2024).

Source: Prepared by the authors, on the basis of Institute of Chartered Accountants in England and Wales. (2024). *ESG reporting now "business as usual" for top companies*. https://www.icaew.com/insights/viewpoints-on-the-news/2024/dec-2024/esg-reporting-now-business-as-usual-for-top-companies; Global Reporting Initiative. (2022). *Four-in-five largest global companies report with GRI*. https://www.globalreporting.org/news/news-center/four-in-five-largest-global-companies-report-with-gri/; Ashwell, B. (2019). *More than 100 companies using SASB standards*. IR Impact. https://www.ir-impact.com/2019/12/more-100-companies-using-sasb-standards/; Science Based Targets initiative. (2025). *Target Dashboard*. https://sciencebasedtargets.org/target-dashboard; Principles for Responsible Investment. (2024). *PRI Annual Report 2024*. https://www.unpri.org/about-PRI/annual-report; Technical Expert Group on Sustainable Finance. (2020). *Taxonomy: Final Report of the Technical Expert Group on Sustainable Finance*. European Union; Casado Barral, A. (2023). *Relationships between CSRD, EU taxonomy, and SFDR*. Greenomy. https://www.greenomy.io/blog/relationships-csrd-eu-taxonomy-sfdr; International Financial Reporting Standards Foundation. (2024). *About the International Sustainability Standards Board*. https://www.ifrs.org/groups/international-sustainability-standards-board/.

Multilateral governance. Uncertainty around multilateralism and the need for improved governance of global common goods such as cross-border water resources —such as the Amazon, the River Plate Basin and the Guarani Aquifer— adds another layer of complexity. The 2022 crisis on the Paraná River, caused by historically low water levels, affected power generation and agricultural exports in Argentina, Brazil and Paraguay, underscoring the urgent need to improve transboundary water governance (National Institute for Agricultural Technology [INTA], 2024).

To summarize, these changes in the global financial architecture present both challenges and opportunities for the region. The private sector in Latin America and the Caribbean is gradually adopting new ESG frameworks, such as Brazil's Green Protocol, which encourages banks to align their financial decisions with sustainability principles (Brazil's Green Protocol, 2008). Meanwhile, in Chile, pension funds have begun to include ESG criteria in their investment decisions (Office of the Superintendent of Pensions, 2021), and the Mexican Stock Exchange (BMV) has launched sustainability-linked bonds to encourage climate-aware investments (Mexican Stock Exchange, 2021).

However, challenges arise from inconsistent regulatory frameworks and the uneven enforcement of existing regulations. The lack of standardized ESG reporting requirements in Latin American and Caribbean countries makes it difficult for investors to compare their sustainability performance. In addition, companies operating in multiple jurisdictions face regulatory fragmentation, which complicates compliance with the rules.

While the region's governments are taking steps to strengthen environmental governance, challenges remain in translating global ESG standards into national regulations and enforceable commitments. The region's ability to navigate these changes in the global financial architecture will determine its ability to attract sustainable investment, mitigate climate risks and ensure water security for future generations.

B. Emerging trends, opportunities and implementation arrangements

New trends arising from changes in the global financial architecture are reshaping water security investments. As shown in diagram 3, they include the evolution of international cooperation, the growth of climate and green finance, the adoption of sustainability criteria by capital markets and the mounting corporate commitment to water resource management.

Evolution of official development assistance (ODA) and blended finance

Traditional ODA, mostly concessional and channelled through governments, is evolving towards results-based financing (RBF) and blended finance models.

Results-based financing includes a variety of mechanisms in which resources are disbursed after the delivery and verification of pre-established outcomes (Global Partnership for Results-Based Approaches, 2023). It includes such schemes as:

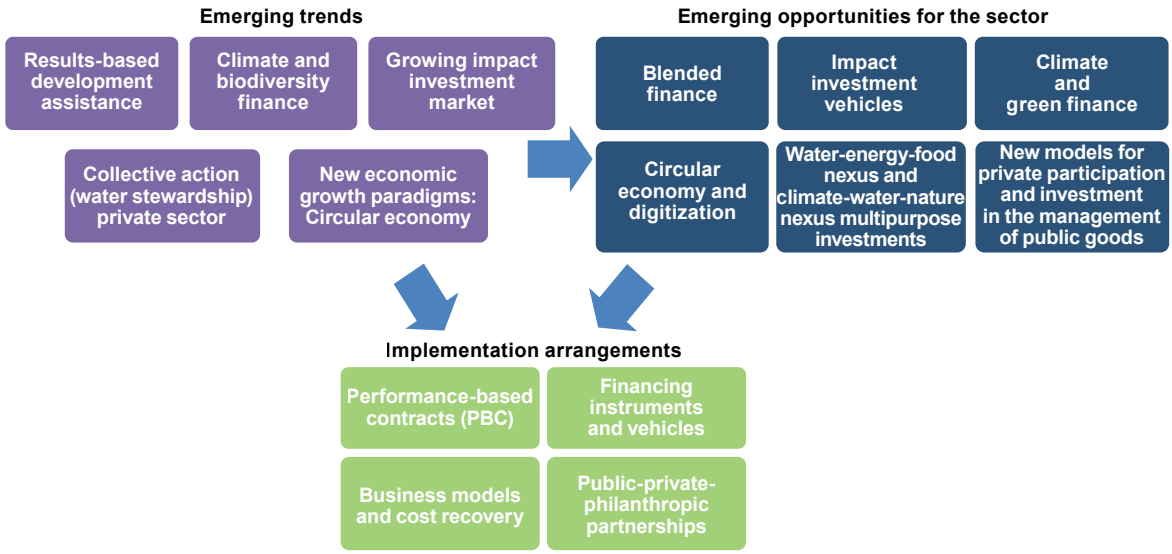
- Output-based aid (OBA)
- Performance-based financing (PBF)
- Impact bonds
- Results-based climate financing
- Programmes for results

Blended finance, in contrast, combines concessional funds with commercial capital, often through financial mechanisms that seek to mobilize private sector investment. However, the report *State of Blended Finance 2024: Climate Edition* identifies a gradual decline in ODA funding for blended finance, excluding guarantees and insurance (Convergence, 2024).

Growth of climate and nature financing

There has been a significant increase in both public and private funding for climate action and environmental conservation. The creation of global funds, such as the Green Climate Fund (GCF), the Climate Investment Funds (CIF) and the Global Environment Facility (GEF), demonstrates that commitment. In addition, impact investors are increasingly interested in biodiversity and conservation projects, driving the impact investing market (World Economic Forum, 2024). This growth is driven by agendas such as "regeneration" and by corporate commitments to become "nature-positive" in the medium term, through which greater attention is being paid to the interdependence between water, climate and ecosystems.

Diagram 3
Emerging trends, opportunities and implementation arrangements



Source: Prepared by the authors.

Expansion of the impact and sustainability investment market: integration of sustainability into capital markets

Sustainability has shifted from being a niche issue to become mainstream in global financial markets. The BlackRock Global Sustainable Investing Survey (2020) shows that 88% of investors consider climate risks as the top concern in their portfolios, and the volume of ESG assets is expected to double by 2025. That trend is reinforced by the growing adoption of international reporting standards —TCFD, GRI, PRI or ISSB— that condition access to international financing and pressure governments and companies around the world to align with more demanding frameworks.

Collective action and greater corporate commitment to the environmental sustainability of the territories in which companies operate

Companies face growing pressure to incorporate water management and environmental risk into their strategies. Driven by pressure from civil society, the material impact of climate change on water resources and the adoption of ESG standards, companies have recognized that their operational viability and social licence to operate are increasingly dependent on the availability of natural resources, particularly water.

According to the World Economic Forum's *Global Risks Report 2025* (World Economic Forum, 2025), five of the top ten long-term global risks are related to water and the environment. The response from business has been an increasing participation in water stewardship and collective action initiatives, which go beyond individual operations and entail integrated management efforts at the watershed level.

To conclude, the growth of circular economy and digitization models reinforces the connection between water sustainability, business resilience and competitiveness.

Reassessment of economic development models. The evident crossing of the planet's limits and the crystallization of climate and water risks have led to the rethinking of traditional development models. In that context, alternative approaches such as the circular economy and regeneration are gaining traction.

Taken together, these trends underscore an apparent global shift towards the incorporation of environmental considerations into financial and corporate strategies, indicating a growing commitment to sustainable development in the medium and long terms.

As shown in diagram 3, global changes in financial trends also offer opportunities for renewing and reinventing the water sector, including:

Blended finance and innovations in impact investment vehicles. The rise of climate and green finance is leading to innovations and increased financing mechanisms that combine public or concessional capital and private commercial capital for use in infrastructure projects that endorse the sustainability and climate change adaptation agenda.

Digitization, the circular economy and new business models. The adoption of circular economy practices and the sector's digitization are already demonstrating the potential for efficiency improvements and new revenue streams for water utility companies.

Multipurpose infrastructure projects and "mosaic" or "nexus" investments. Investments that consider interactions between water-energy-food systems and that take account of trade-offs and the potential for income generation in those sectors are gaining ground. Similarly, infrastructure projects that impact the entire climate-water-nature nexus can access new sources of funding that have traditionally been used by the water sector.

All these opportunities, together with the growth of impact investment, create a fourth opportunity. This involves innovative models for private sector participation in the provision of public goods —or the provision of capital for their management— including water and climate change adaptation: a new generation of partnerships and implementation arrangements to better align incentives for long-term financial and environmental sustainability.

The good news and bad news is that making those opportunities a reality largely depends on the sector's ability to create an enabling environment for private sector participation and on the ability of national and local investment planning authorities to design appropriate performance-based contracts for infrastructure investments that serve multiple purposes and generate impacts across different sectors.

Closing the implementation and financing gap for water security in general and securing access to funding for resilient water infrastructure projects in particular requires suitable implementation arrangements and robust business cases for those investments. In light of the evolution of the global climate and green finance architecture, closing the financing gap requires:

- Performance-based contracts, in which a public or private entity clearly commits to guarantee a certain level of performance or achieve predetermined results, and in which there is another entity that pays for those results after they have been verified.
- Effective leveraging of emerging financing vehicles and mechanisms such as thematic bonds and others, ensuring alignment with long-term sustainability objectives.
- A new generation of public-private-civil society partnerships that include philanthropic capital.
- Mosaic projects using cost-recovery strategies that leverage and combine multiple sources of revenue through innovative business models and financing structures.

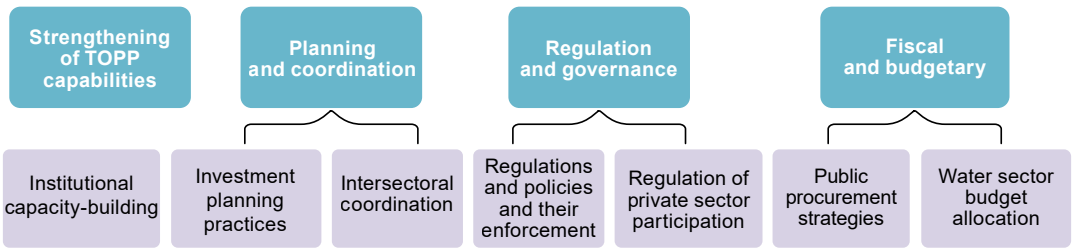
These elements offer the potential to close financing gaps, improve service provision and drive innovation in water resource management and climate change adaptation. However, leveraging those opportunities requires institutional coordination, financial innovation and solid governance frameworks.

C. Instruments, mechanisms and leverage points

1. Instruments available to governments to achieve the outcomes of interest

National and local governments play a crucial role in creating an enabling environment for water security project investments. Faced with the changes in the global financial architecture, and in consideration of the emerging trends and opportunities for water security financing, national and local governments have a number of instruments at their disposal that can enable them to take advantage of these opportunities more effectively and, at the same time, to mitigate the risks that some of those changes pose (see diagram 4). The instruments are the tools or responses available to governments (e.g. planning, fiscal instruments, regulation, capacity-building), while the leverage points are factors that can be impacted through various instruments and where a small change —a 10% shift in their value, for example— results in a significant and relatively larger impact on final and intermediate outcomes or performance indicators.

Diagram 4
Instruments available to national and local governments



Source: Prepared by the authors.

The final objective is to achieve water security and universal compliance with SDG 6, shown in the systems diagram under the heading "outcomes of interest". These include the main indicators for monitoring compliance with that SDG:

- Access to water and sanitation services (SDG 6.1 and 6.2).
- Water quality (SDG 6.3 and 6.4).
- Water use efficiency (SDG 6.4).
- Water stress (SDG 6.4).
- Resilience to extreme events (droughts and floods), SDG 1 (1.5) and SDG 13 (13.1).

To respond to the changing global financial architecture and take advantage of emerging opportunities, national and local government authorities can draw on four broad categories of instruments: planning and coordination, fiscal and budgetary instruments, regulation and governance, and institutional capacity-building. The strategies that have proven most effective are synergistic combinations of those tools that are carefully planned, phased over time and with an awareness of the starting points and unique characteristics of each institutional context.

Planning and coordination:

At the national level, this implies the active involvement of the competent water authorities in drafting a new generation of plans for **nationally determined contributions** (NDC3.0) that seek to leverage private sector resources, participation and capacity for innovation from the very start of projects (NDC Partnership and Green Climate Fund, 2024).

Beyond the plans for nationally determined contributions, investment planning in general must evolve towards **mission-driven approaches** that mobilize the whole of government around strategic objectives, overcoming sectoral fragmentation and a logic based solely on budgetary considerations.

Intersectoral coordination is also essential. Mechanisms such as national water cabinets and watershed organizations provide vital platforms for integrated management. At the local level, municipalities can contribute through the design and deployment of mission-driven development and land use plans, ensuring the incorporation of sustainability criteria into the use and management of water resources.

Fiscal and budgetary instruments

Although public resources are quite limited, they could have a greater impact on achieving the SDGs and ensuring water security if certain changes were made, such as:

- Allocating a greater proportion of national and local budgets to water and sanitation investments through the institution of raw water charges while strengthening water governance.
- Leveraging budgets from other sectors (such as investments in infrastructure and agricultural sector development), adopting environmental and social safeguards and incorporating performance indicators related to water security (water key performance indicators).
- Innovative public procurement strategies that capitalize on the capacity and creativity of the private sector. Correctly designed and with a portfolio approach, these strategies can reduce investment risks, encourage innovation and strengthen micro-, small and medium-sized enterprises (MSMEs) while at the same time driving new markets and promoting private participation in water adaptation and security projects (Altamirano, 2021).

Regulation and governance

A clear and predictable regulatory framework is essential to encourage private investment and ensure that public-private collaboration is synergistic and not parasitic. The measures required include:

- Strengthening water institutions and governance, ensuring that the roles and responsibilities of different levels of government are clearly defined.
- Establishing clear pathways for private sector participation that embrace that sector's multiple roles and potential contributions, both as a provider of services and technical expertise and as an investor and strategically in different water subsectors.
- Ensuring inclusive governance by promoting transparency, equity and accountability mechanisms.

Strengthening of the technical, operational, political and prospective (TOPP) capabilities of institutions

The creation of an enabling environment to attract private sector investment and other alternative sources of water funding largely depends on strengthened institutional capabilities. Sustainable water management requires the development of TOPP capabilities to address the complex challenges facing the sector.

- **Technical capabilities** include the systematic monitoring of water resources, the development of transparent indicators of water use and quality and the construction of resilient infrastructure to counter increasing climate variability.
- **Operational capabilities** are focused on establishing tariffs that reflect users' ability to pay, to ensure equity for low-income households. They also include innovative financing mechanisms, such as green bonds and revolving investment funds or revolving funds, to meet the needs of small and medium-scale water operators.
- **Political capabilities** should focus on recognizing the human right to water in national constitutions and creating a coherent governance structure that fosters intersectoral collaboration and places water security at the top of the political agenda.
- **Prospective capabilities** in order to prioritize strategic long-term planning, including assessments of water availability under different climate scenarios, to foster a culture in which due value is placed on water and to prepare for future crises.

As noted above, the design of effective strategies that combine the different instruments demands a systemic analysis of the challenges faced in each context. The starting point must include assessments of both water risks and gaps in service coverage, together with an analysis of institutional capacities, the effectiveness of regulatory frameworks and the quality of management and investment processes.

2. Mechanisms and leverage points

After explaining all the parts of the systems diagram —external factors, outcomes of interest and instruments— the next step is to explore the mechanisms that explain how the external factors (which are outside the control of governments), in conjunction with the instruments (which are under the control or influence of governments), lead to different levels of achievement in the outcomes of interest.

And it is within that causal dynamic that the leverage points play a special role. As explained above, those points are factors that can be impacted through different instruments and in which a small change —for example, 10% of their value— results in a significant and relatively larger impact on the final and intermediate outcomes and performance indicators.

Before explaining the main mechanisms, some terms should be defined and the symbols used in the diagram should be explained:

First, "mechanisms" are the set or chain of causal relationships between different factors that explain, in greater detail, how the system functions and behaves dynamically over time, as regards both the final and intermediate outcomes of interest.

Second, the portion of the diagram inside the grey box uses the logic of **causal loop diagrams** to show how different factors relate to each other within the system.

Third, the arrows indicate a causal relationship from one factor to another. The arrow indicates the direction, with blue arrows representing positive or directly proportional relationships. If one factor increases, so does the other; if it decreases, the other also tends to fall. In contrast, the red arrows, often represented with a "–" symbol, indicate inverse relationships. If one factor increases, the other decreases, and vice versa.

Fourth, within the system shown inside the grey box, there are different types of factors or nodes:

Most of the factors are shown as white boxes. The green nodes or factors indicate leverage points. At those points, a relatively small change can generate a much larger and multiplying effect on the entire system. For example, a 10% improvement in these variables can translate into an impact greater than 10% on the overall outcomes.

The light blue factors indicate intermediate outcomes: water availability, for instance, which is the result of interactions between several other factors. In turn, those intermediate outcomes influence and largely define the values of the outcomes of interest (shown in light green), which, as explained above, can be formulated as key performance indicators or system targets in terms of SDG 6 (for example, access to services, water quality, efficiency, water stress and resilience).

Taken as a whole, diagram 5 portrays how changes at strategic points can propagate throughout the entire network of causal relationships and produce significant impacts on the outcomes of interest.

The value of various factors within the system can be influenced by the instruments that governments adopt to accelerate progress towards SDG 6. As can be seen in the diagram, the various types of instruments identified have the ability to influence factors such as the capacity to prepare investments, the robustness of water governance, the effectiveness of implementation arrangements, the levels of private investment in water security and public-sector water security investment amounts. Given the multiplying effect they have on the outcomes of interest through various networks of causal relationships, mechanisms and causal loops, three of those five factors have been identified as leverage points. They are outlined below.

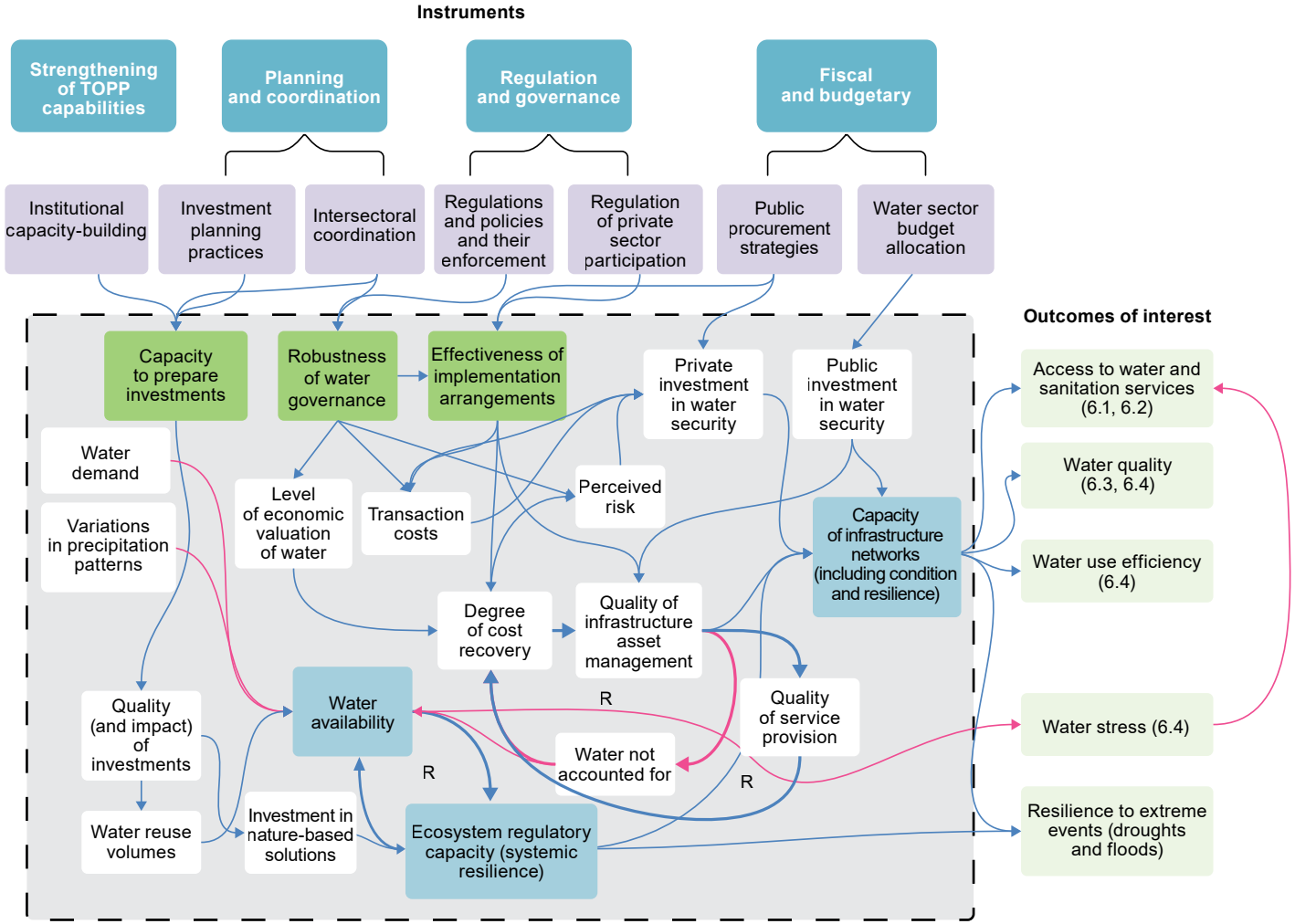
Capacity to prepare viable investments, programmes and projects

The capacity of national and local governments to prepare bankable projects, programmes and portfolios of solid investment projects is critical in securing access to funding. Instruments such as investment planning practices (both NDC 3.0 plans and urban development and land use plans), intersectoral coordination and institutional capacity-building have a direct effect on this leverage point (see diagram 5).

In turn, improvements in the capacity to prepare investments put a series of mechanisms into motion. First, they can be expected to lead to an increase in the quality and impact of investments, resulting in a portfolio of well designed, synergistic and robust projects: for example, wastewater treatment plants than enable higher water reuse volumes and increased investment in nature-based solutions. Through improvements in the regulatory capacity of ecosystems and greater levels of systemic resilience, an increase in those two factors directly and indirectly impacts water availability and, as a result, reduces water stress.

At play here is a feedback loop between water availability, which is the result of water demand (which in turn depends on population growth and urbanization processes), minus supply (impacted by reuse volumes, and by variations in precipitation patterns and the frequency of extreme events —such as droughts— as a consequence of climate change), and the regulatory capacity of ecosystems: increased water availability can be expected to assure the minimum environmental flows needed for freshwater ecosystems to continue to function healthily and, at the same time, improvements in those ecosystems' conditions and health increases their regulatory capacity. Healthy freshwater ecosystems provide a natural buffer or insurance mechanism against extreme hydro-climatic situations: for example, they ensure water availability even in the event of extended periods of low rainfall and thereby improve resilience to extreme events, including both droughts and floods. In addition to this direct effect on the resilience indicator through the increased regulation capacity of ecosystems, which guarantees less fluctuation as a result of extreme precipitation events, this capacity also provides a layer of systemic resilience that protects infrastructure systems and guarantees enhanced infrastructure network capacity in the medium and long terms. For instance, increased water storage capacity in watersheds as a result of the presence of healthy wetlands and aquifers protects WWTPs and other infrastructure assets by mitigating the impacts and damage that they can suffer from both excess water (flooding that damages infrastructure or results in flows of sediment-laden water in excess of a plant's installed capacity) and water scarcity (resulting in network pressure levels that are too low); thus, it impacts not only the system's resilience but also its ability to achieve the goals of access, quality and efficiency.

Diagram 5
Instruments, outcomes of interest and leverage points



Source: Prepared by the authors.

Additionally, an increase in the capacity to prepare investments, by contributing to the preparation of project portfolios with robust business or investment cases, can be expected to lead to increased volumes of both private and public investment in water security and, as result, to an increase in the installed capacity of infrastructure networks, with an impact on access, quality and efficiency in water use.

In terms of investment, this leverage point determines the ability of national or local government entities to use scarce public and concessional resources as a catalyst and to leverage greater private investment flows and the impact of those investments in the medium and long terms, maximizing the social, economic, and environmental benefits of every penny invested.

Robustness of water governance

The second key point is the robustness of water governance, which depends on the clarity of regulatory frameworks, the enforcement of rules and clearly defined roles between levels of government. Instruments such as regulations and policies and their enforcement, the regulation of private sector participation and intersectoral coordination mechanisms have a direct impact on this factor.

Strong governance builds investor confidence, reduces institutional fragmentation and thus significantly reduces transaction costs, which are often prohibitive and thus a major barrier to private investment in water security. Additionally, a greater robustness of water governance results in a higher economic value being placed on water, which in turn positively impacts the degree of cost recovery in water project investments and thereby reduces levels of perceived risk, again promoting an increase in private water security investments. And increased private investment volumes can be expected to result in an increase in the infrastructure network capacity (including conditions and resilience), an intermediate outcome that impacts access, quality and efficiency.

A higher degree of cost recovery also means that projects are better able to generate intrinsic sources of funding through fee schedules that adequately reflect management costs. A change in this factor puts two feedback loops in motion. A higher degree of cost recovery can be expected to improve the quality of infrastructure asset management (including better operation and maintenance), which positively impacts quality in service provision, which will most probably lead to a greater willingness among the population to pay for those services and therefore a higher degree of cost recovery, thus closing a virtuous circle. Similarly, better quality in infrastructure asset management leads to a decrease in water volumens not accounted for and thus to a higher degree of cost recovery, thereby closing another virtuous circle. That same circle can also become a vicious circle, depending on how the assets are managed.

Effectiveness of implementation arrangements

The third leverage point relates to the effectiveness of the implementation arrangements: in other words, how contracts and project finance and delivery mechanisms are designed and executed. A decisive role is played in that regard by instruments such as public procurement strategies and the regulation of private sector participation, in combination with factors such as the robustness of water governance.

The design of performance-based contracts that include properly structured cost recovery mechanisms ensures that investments translate into sustainable services, since they create the necessary incentives for both higher levels of fee collection (level of cost recovery) and better quality in infrastructure asset management. In addition, well-designed implementation mechanisms are effective in reducing transaction costs, thus positively impacting the volume of private water security investments. Through these multiple pathways, the greater effectiveness of implementation arrangements can impact the capacity of infrastructure networks and, as a result, access, quality and efficiency.

To summarize, these three leverage points —project preparation capacity, robustness of water governance and effectiveness of implementation arrangements— act to multiply the impact of public investments. Improvements to them lead to:

- Increased volume and quality of public and private water investments.
- The translation of mobilized financial flows into universal access, efficiency, resilience and improved water quality.
- Progress towards SDG 6 and water security in the region through every public or private spending decision.

D. High-potential investments

Based on the systemic analysis of the water security financing challenge —which includes external factors, emerging trends and opportunities, and new learning about the effectiveness of different measures in pursuit of SDG 6— certain types of investments with a high potential for impact can be identified. As with policy and financing instruments, their effectiveness depends on a rigorous process of diagnosis, analysis and planning that enables each solution to be adapted to the specific context.

It should be noted that this framework does not aim to propose specific measures for adoption, nor to guide the technical design of physical interventions for achieving water security. The purpose of this section is to highlight the existence of investment trends that attract international and philanthropic capital and that are particularly attractive for impact investing and green finance.

Within this framework there are a series of emerging investments and measures that, through their alignment with global trends and the sustainability agenda, offer a strategic opportunity to address the region's water crisis. They include:

Nature-based solutions (NBS) for climate change adaptation. Watershed reforestation, green infrastructure and sustainable urban drainage systems (SUDS) are essential to mitigate water shortages and protect cities from extreme weather events. These solutions improve water retention, reduce risks of flooding and contribute to the conservation of biodiversity (Quirós, 2021).

Circular economy in the water sector. The circular economy approach applied to water offers significant opportunities to reuse wastewater, extract valuable resources and generate renewable energy from methane capture at treatment plants. Plants with treatment capacities from 500 litres per second (l/s) to 4,000 l/s can be converted into energy generating facilities, achieving an average cost-benefit ratio of 1.36 and reducing 0.72 kg of CO_2 emissions per cubic metre of treated water (Saravia Matus et al., 2025).

Technological innovations in the agricultural and industrial sectors. One of the biggest challenges in Latin America is the adoption of advanced technologies to improve water use efficiency in key sectors such as agriculture and industry. Agriculture is an important economic driver in the region, accounting for approximately 7% of gross domestic product (GDP). Brazil, Argentina and Mexico together account for 76% of the gross value of agricultural output and 69% of the region's farmland (Conroy et al., 2024). In addition, some of the region's countries, such as Brazil, Argentina, Chile, Colombia and Peru, are among the world's largest agricultural producers, each focusing on different products. Digital technologies play a crucial role in optimizing costs and ensuring sustainability in production processes. The deployment of precision irrigation systems, real-time monitoring of water use and the reuse of wastewater can significantly reduce water consumption and minimize environmental impact (Winpenny et al., 2013).

Digitization of the water sector. The incorporation of smart technologies into water management has the potential to improve efficiency, sustainability and resilience, supporting the resolution of the region's most pressing water threats. Those technologies include:

- Water quality monitoring sensors for real-time data collection, including the use of Internet of things (IoT) devices, supervisory control and data acquisition (SCADA) systems and digital twin technology.
- Intelligent water management systems to optimize water supply, including SCADA systems and automated leak detection mechanisms.
- Data platforms that analyse and interpret information to support decision-making, using data analytics and artificial intelligence (AI), geographic information systems (GIS) and, in some cases, blockchain applications.

The adoption of new technologies and tools is helping reduce water losses, improve operational efficiency and ensure reliable supplies. Servicios de Agua y Drenaje de Monterrey, which has adopted advanced digital solutions to improve its operational efficiency and reduce losses, provides a good example.

Similarly, the adoption of new technologies and tools is helping reduce water losses, improve operational efficiency and ensure reliable water supplies. A good example from the region is Servicios de Agua y Drenaje de Monterrey (SADM), which received the 2024 Innovation in Water Circularity Award from WEX Global, a prestigious international platform that promotes the exchanges of knowledge and best practices among key global players in the water and energy sectors. Using the Xylem Vue platform powered by GoAigua, SADM has achieved an overall reduction of 17% in water consumption, rising to 37% in certain sectors, through the intelligent control of pressure, flow and consumption (Idrica, 2024). The award highlights how digitization is driving circular economy ideas in water management.

E. Conclusions and recommendations: closing the implementation gap

The systemic analysis presented in this chapter shows that the changes in the global financial architecture offer Latin America and the Caribbean both challenges and opportunities. The increasing incorporation of ESG criteria into financial markets, the rise of climate, green and impact finance, and the increased involvement of civil society and the private sector are redefining the rules of the game for water security financing. However, capitalizing on those opportunities depends on the countries' ability to create enabling environments for investment and collective action, to strengthen water governance and to consolidate their ability to structure robust investment projects that meet international sustainability standards.

Based on that analysis, the following recommendations are offered:

- Align planning and financing strategies with global trends, incorporating ESG criteria and climate commitments into all strategic sectors, not only water sector policies and budgets. Considering implementation criteria and leveraging private sector knowledge from the earliest stages of the investment cycle is essential, particularly during strategic planning.
- Strengthen the three key leverage points: the capacity to prepare investments, the robustness of water governance and the effectiveness of implementation arrangements.
- Take advantage of innovative financial mechanisms, such as blended finance, thematic bonds and performance-based contracts, to mobilize private and impact capital for the water sector.
- Strengthen institutional capacities for the promotion and design of public-private and civil society partnerships, incorporating philanthropic capital and encouraging collaborative arrangements that align incentives towards long-term sustainability.

In summary, the ability of Latin America and the Caribbean to close the water security implementation and financing gap will depend on how it combines those instruments, the strength of its governance frameworks and its institutions' ability to translate global trends into transformative and financially viable local projects.

The following chapters explore various issues with a view to supporting governments in the implementation of these four recommendations. Chapter III examines emerging financing mechanisms and their potential for the region, in order to support the implementation of the third recommendation and, to some extent, the first and fourth. It offers a detailed analysis of the opportunities offered by green bonds, carbon credits, international climate funds, impact investments and blended finance mechanisms to complement existing regulatory and institutional frameworks and thereby scale up investments into larger portfolios. These mechanisms offer concrete alternatives for structuring water security projects and for channelling them towards more robust and diversified financial models that can attract private capital and ensure long-term sustainability.

Chapter IV, meanwhile, presents strategies that local governments —which often face even greater barriers to accessing climate funds— can follow to implement the second recommendation, strengthening the three leverage points identified in this chapter and, thereby, also making progress with the third and fourth recommendations.

III. Impact investment and emerging financial mechanisms

This chapter analyses the emerging financing mechanisms with the greatest potential for strengthening water security in Latin America and the Caribbean. It returns to the discussion in chapter II on the transformation of the global financial architecture —shaped by the expansion of green and blue bond markets, the boom in impact investment and blended finance schemes promoted by multilateral banks— and translates it into concrete instruments at the operational level. Not only do these mechanisms reflect changes in the rules of the global game; they also define new opportunities for aligning public, private and philanthropic capital around water, sanitation and climate adaptation projects.

Based on the gap analysis presented in the earlier chapters and the methodology of the Water Security Financing Framework, the innovative instruments proposed by private, multilateral and philanthropic actors are mapped out. These include thematic bonds (green, blue, sustainable), water and carbon credits, blended finance schemes and the growing impact investment market. Also noteworthy are the initiatives of foundations and cooperation programmes that have mobilized resources for water security and circular economy projects. Taken together, these mechanisms represent a strategic opportunity to bridge the gap between investment needs and the available capital, especially in projects that require greater contractual and financial innovations.

A. Innovative financial mechanisms

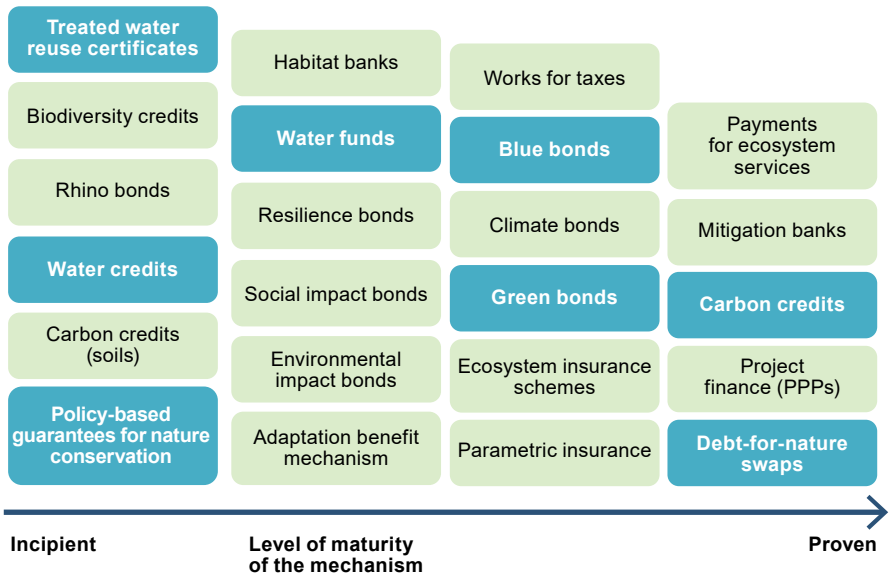
As explained in chapter II, the increasing frequency of extreme events and their repercussions for the continuity of business activities in different sectors are fuelling growing pressure from shareholders and investors for companies to disclose their climate risks —with water risks as the main component of the physical risks— as well as their plans for managing those risks. More recently, their attention has also been turned towards risks related to biodiversity loss. This heightened level of scrutiny, combined with numerous corporate commitments regarding the restoration of nature, has led to a growing number of companies and financial institutions working closely with governments and non-governmental organizations to develop new financial instruments that can facilitate investments in climate action, water security, biodiversity conservation and ecosystem restoration.

Those mechanisms are being developed by a range of private actors (for example, companies, the insurance industry, impact investor associations and institutions such as the Climate Bonds Initiative) and by governments (for example, the Peruvian Government's "public works for taxes" mechanism) seeking to encourage greater private sector participation and investment in objectives that have historically been difficult to finance with private capital, such as climate change adaptation, water security and nature conservation.

A mapping and inventory exercise based on the emerging trends identified in chapter II was used to prepare an inventory of the innovative financial mechanisms that currently exist. This inventory builds on previous efforts to map and analyse innovative mechanisms for mobilizing private investment for adaptation (Altamirano, 2021) and for nature-based water security solutions (Altamirano et al., 2021). The updated final result is shown in diagram 3. Based on the complete inventory of instruments, the analysis of the regional financing landscape and the other analyses carried out for the selected case of the Metapán wastewater treatment plant and the global pioneer cases, those instruments with the greatest potential to be explored, adapted and implemented for water security projects —and, most particularly, for circular economy and reuse initiatives— are shown in light blue.

As diagram 6 shows, those instruments are at different stages of development. Among the most recent are wastewater reuse certificates (2030 Water Resources Group, 2025), a market mechanism developed by the 2030 Water Resources Group to promote circular economy solutions in the water sector, and verified water credits (VWCs) that can be developed for water resource replenishment and conservation projects. Two initiatives that are encouraging the use of water credits globally are NAT5, which focuses on projects in Mexico and Latin America, and Verified Water, which works in the United States (NAT5, 2024; Verified Water, 2025).

Diagram 6
Financing mechanisms for water security projects



Source: Prepared by the authors, on the basis of Altamirano, M. A. (2021). *Leveraging Private Sector Investments in Adaptation: The Evolving Role of Climate Finance in Enabling a Paradigm Shift.* Climate Markets and Investors Association.

NAT5 has developed a verified water credit system as part of its Ases on-chain protocol (AOCP), which uses blockchain technology to certify improvements in the hydrological health of soils. Those credits represent verified reductions in water erosivity and surface runoff, enabling greater water infiltration and aquifer recharge.

Other more proven general instruments that are increasingly being used for water infrastructure and water security projects include carbon credits, blue, green and climate bonds and debt-for-nature swaps.

B. Climate and green financing sources

The most important sources of climate and green finance in the region are identified below.

At the regional level, multilateral development banks such as the World Bank, the Inter-American Development Bank (IDB), the Development Bank of Latin America and the Caribbean (CAF) and the Central American Bank for Economic Integration (CABEI) are important sources of climate finance for developing water infrastructure and for water security projects in general. They provide loans, grants and technical assistance to support projects in areas such as water supply systems, wastewater treatment and flood management.

In addition to the multilateral banks, multilateral funds such as the Green Climate Fund (GCF) and the Global Environment Facility (GEF) also exist. Those funds provide grants and concessional loans for water-related projects that support climate adaptation and mitigation. Latin American countries can access the funds by submitting proposals that are aligned with their national climate strategies.

At the national level, national development banks and government programmes and initiatives are an important source of funding. Some of the region's countries, such as Brazil and Mexico, have national development banks that play a significant role in financing climate-resilient water infrastructure projects.

Finally, another growing source of funding at the global and national levels is private sector investment. Mechanisms such as public-private partnerships, impact investments and blended finance are being increasingly used to attract private sector investment in the water and climate resilience sectors. As explained above, however, private investment remains limited due to perceived risks and regulatory challenges.

The types of water security projects that could, in general terms, be financed by these funding sources are shown in table 2. The measures that constitute a water security or integrated water resources management plan usually include those that create an infrastructure asset (traditional grey infrastructure or a nature-based solution), require considerable capital for implementation and have the potential to generate revenue streams that can most easily be structured as an investment project.

Table 2
Types of water security projects

Project type	Explanation
Water supply and sanitation	Investments to expand access to safe drinking water and sanitation, especially in underserved communities. Includes the rehabilitation of existing infrastructure and the development of new systems.
Flood management and resilience	Projects to improve flood management through the construction of dykes, reservoirs and drainage systems, as well as nature-based solutions such as wetland restoration.
Circular economy, wastewater treatment and reuse	Initiatives to improve wastewater management and encourage water reuse, which can reduce pressure on freshwater resources and improve the health of the environment.
Water efficiency and conservation	Programmes that promote water-saving technologies and practices, such as the modernization of agricultural irrigation, which is a major consumer of water in the region.

Source: Prepared by the authors.

A report by the Blended Finance Taskforce in conjunction with the non-governmental organization WaterAid (Blended Finance Taskforce, 2022) presents evidence that investments in water infrastructure generate significant climate, food security, health and economic development benefits in emerging markets. Mobilizing private capital in the water sector could therefore yield numerous benefits. Private sector investments could be encouraged through the use of blended finance structures, leveraging catalytic sources of public and philanthropic funding. According to this study, there are three main areas where this type of blended finance could help stimulate private sector investment:

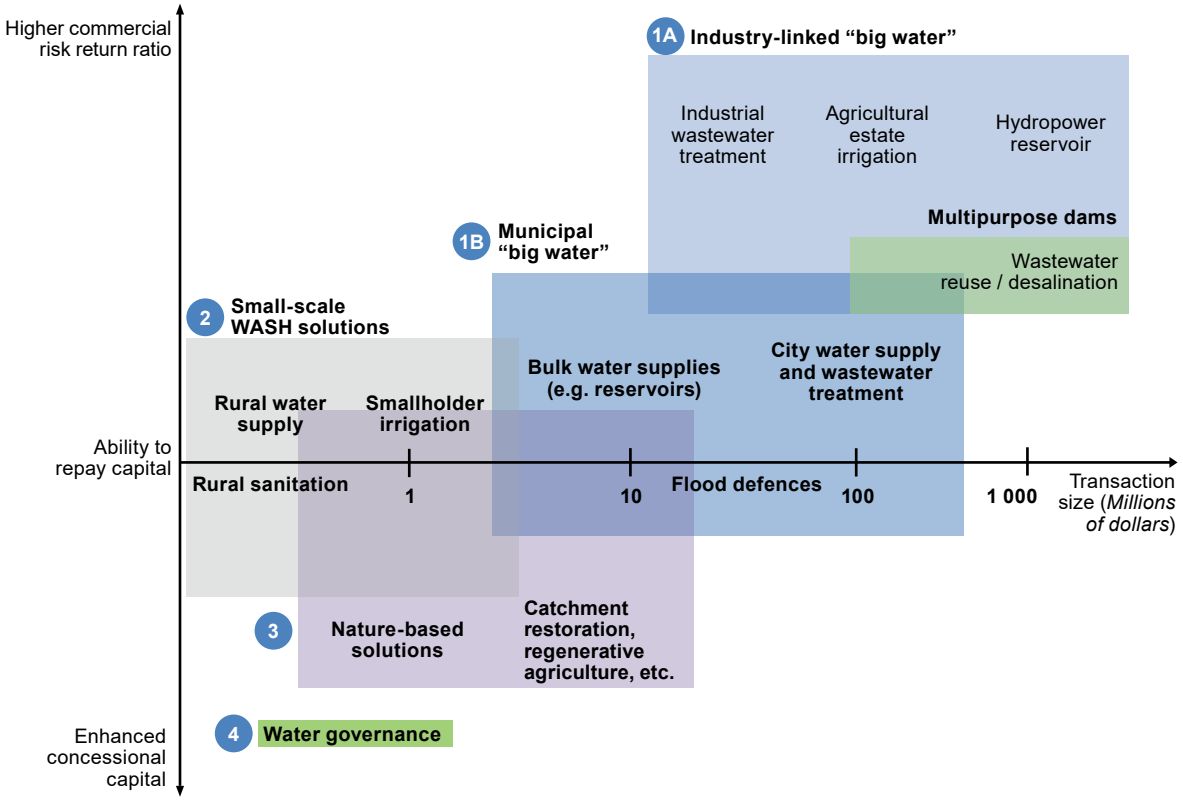
(i) "Big water" infrastructure, with estimated investment opportunities of US$ 157 billion.

(ii) Decentralized and small-scale sanitation and drinking water solutions, with investment opportunities of US$ 29 billion.

(iii) Nature-based solutions, including watershed restoration and protection, with investment opportunities of US$ 21 billion.

A report published by the World Bank and the 2030 Water Resources Group on how to accelerate and scale-up water security investments (Khemka et al., 2023) adds water reuse and desalination projects to this list of high-potential areas. As can be seen, these investments and transactions have different characteristics, as regards both the investment volume per project (ticket size) and their capacity to generate income. Those differences shape how attractive they are to commercial capital and also determine whether implementation will require concessional financing. This is particularly relevant in interventions that enable investments but do not generate tangible assets, such as water governance, or those —such as nature-based solutions— that tend to have more uncertain cash flows (see diagram 7).

Diagram 7
Map of opportunities for private investment in water security



Source: Khemka, R., López, P. and Jensen, O. (2023). *Scaling Up Finance for Water: A World Bank Strategic Framework and Roadmap for Action*. World Bank. http://hdl.handle.net/10986/40225.

As noted above, impact investing in Latin America has expanded significantly over the last decade, reflecting a global trend towards investments that generate both financial returns and positive social or environmental outcomes. According to the Global Impact Investing Network (GIIN), the global impact investment market will account for an estimated US$ 1.164 trillion in 2022, surpassing US$ 1 trillion for the first time in history (Hand et al., 2022). According to recent projections, a compound annual growth rate of 18.8% is expected between 2024 and 2030 (Grand View Research, 2023).

In 2013, Latin America accounted for approximately 19% of the global impact investment market, with close to US$ 2 billion in committed capital (Leme et al., 2023). Given the market's global growth, the current investment level is expected to rise significantly.

According to a recent study by the Aspen Network of Development Entrepreneurs (ANDE) (Almaguer and Davidson, 2023), there are several key indicators that the market is evolving positively:

- Mobilization of local capital: Approximately 80% of impact investors headquartered in Latin America said they were raising capital within the region, which indicates high levels of local investment activity.
- Sectoral approach: Investments are mainly focused on sectors such as agriculture, education and health. The COVID-19 pandemic had a major impact on demand for innovative education and healthcare solutions.
- Environmental projects and initiatives: Interest in biodiversity and ecosystem conservation is rising, with nearly half of impact investors prioritizing those areas in their portfolios.

However, there are still some challenges to be overcome before that progress can translate into opportunities for investment in resilient infrastructure projects, the circular economy and water security in general. The first involves the expected financial returns. While many investors are willing to accept lower financial returns in exchange for a greater social or environmental impact, more than 60% of impact investors in the region seek market-level financial returns (Almaguer and Davidson, 2023). The second challenge is the limited understanding of impact investing among some investors and the need for financial instruments that are more specifically tailored for the intended purpose (Latimpacto, 2023).

To summarize, the impact investment market in Latin America is evolving and has great potential for growth as investors increasingly align their financial goals with social and environmental objectives.

C. Blended finance

The Organisation for Economic Co-operation and Development defines blended finance as "the strategic use of development finance for the mobilization of additional finance towards the SDGs in developing countries" (OECD, 2018). Combining capital with different risk/return requirements can increase the total pool of resources available to invest in high-impact sectors, such as water.

Investing in resilient water infrastructure through blended finance offers governments and private actors a key economic opportunity. Although official development assistance (ODA) remains crucial, it is expected to be insufficient to close all the existing gaps.

Alternative sources of financing must be leveraged, and existing funding sources must be used in a more strategic and catalytic way to ensure universal access to water and sanitation and the sustainable provision of those services. Blended finance, which uses development funds to mobilize additional resources for sustainable development, can assist national and local governments in pursuing their objectives and enable them to attract commercial investment; it can also facilitate the transition to more self-sustainable financing and funding systems over the long term. In 2017, OECD endorsed the Blended Finance Principles with the specific aim of guiding governments and donors in mobilizing commercial capital for the SDGs.

The design of appropriate blended finance structures (such as first-loss capital, guarantees, insurance, exchange rate hedges and targeted technical assistance) could allow a better alignment between the public sector's development and socioeconomic impact objectives and the financial goals of impact investors and the private sector (WaterAid & Blended Finance Taskforce, 2020).

Unfortunately, despite some progress, blended finance for water-related investments has not yet gained sufficient traction (OECD, 2019). To date, investments in this sector are limited to a small number of successful projects, and water and sanitation infrastructure projects remain less attractive to private and impact investors than projects targeting other sectors and addressing other SDGs. For example, according to the study conducted by WaterAid (2020), only 9% of investment in water and sanitation infrastructure assets and services comes from the private sector, compared to a private sector participation rate of 87% in telecommunications and 45% in energy.

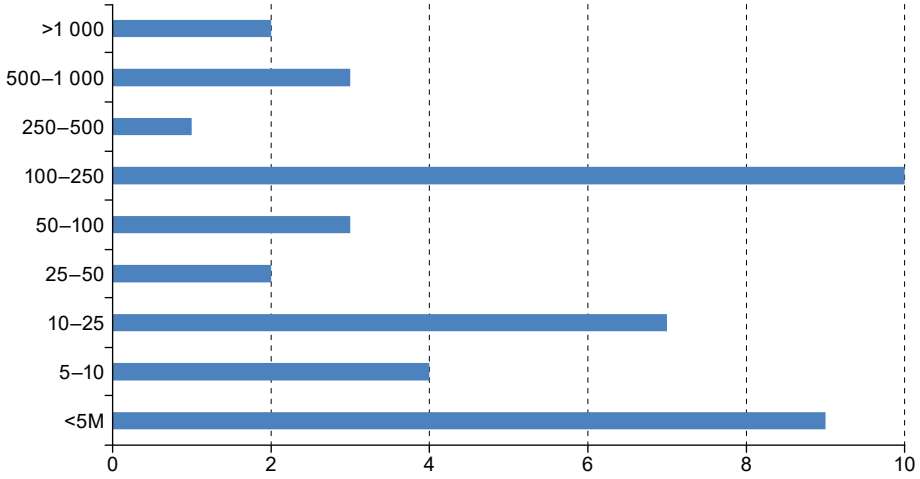
This conclusion agrees with Convergence Blended Finance's report on blended finance and its issue on climate investments (Convergence, 2024). As can be seen in table 3, blended finance investments intended to close gaps with SDG 6 are limited, accounting for a mere 7% of the total number of such investments for climate projects. And that universe of transactions involves 173 investors and 262 investment projects, which, with an average size of US$ 28 million (see figure 1). Figure 2 shows that of that limited universe of transactions, an even more limited number have been deployed in the Latin American and Caribbean region, with most of the transactions involving Asia and Africa.

Table 3
Shares and volumes of blended finance investments, by SDG

SDG	Share *(Percentages)*	Volume *(Billions of dollars)*
1: No poverty	13	3
2: Zero hunger	21	4
3: Good health and well-being	4	4
4: Quality education	1	0
5: Gender equality	22	5
6: Clean water and sanitation	7	6
7: Affordable and clean energy	56	23
8: Decent work and economic growth	60	26
9: Industry, innovation and infrastructure	26	15
10: Reduced inequalities	9	3
11: Sustainable cities and communities	21	12
12: Responsible production and consumption	9	2
13: Climate action	36	17
14: Life below water	5	3
15: Life on land	7	1
16: Peace, justice and strong institutions	0	0
17: Partnerships for the goals	100	39

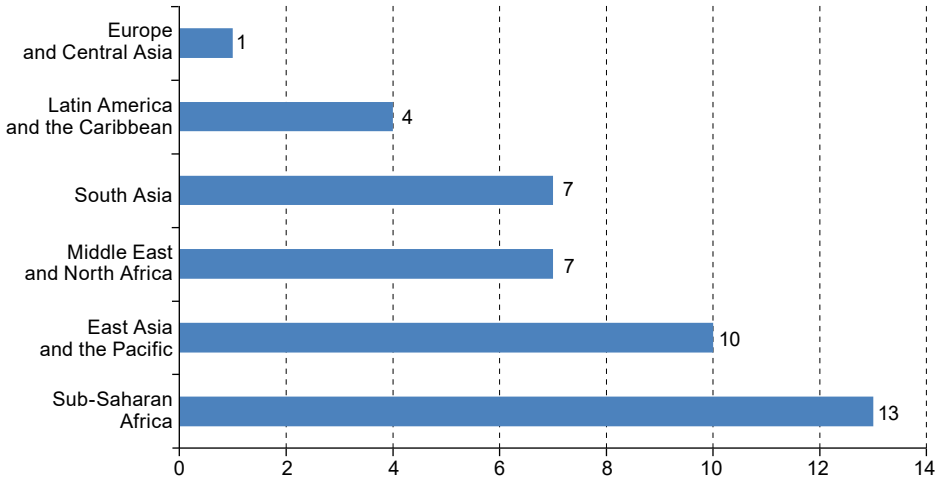
Source: Prepared by the authors, on the basis of Convergence. (2024). *State of Blended Finance 2024: Climate Edition*. https://www.convergence.finance/resource/state-of-blended-finance-2024/view.

Figure 1
Number of deals, by blended finance transaction size, Goal 6
(*Millions of dollars*)



Source: Prepared by the authors, on the basis of data from Convergence Blended Finance database; and Convergence. (2023, October). *Blended finance for water* [Presentation].

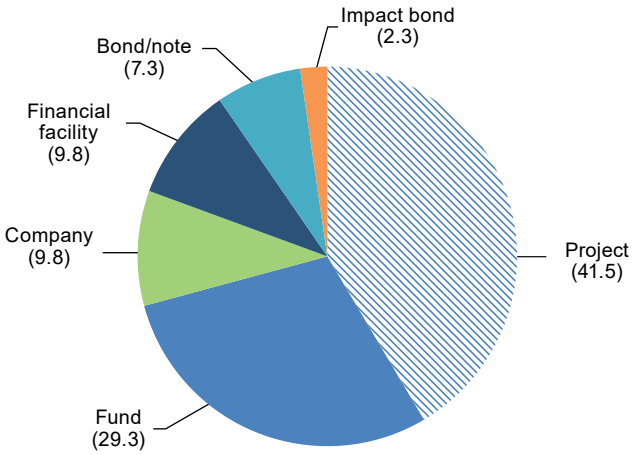
Figure 2
Number of blended finance transactions, by region, Goal 6



Source: Prepared by the authors, on the basis of data from Convergence Blended Finance database; and Convergence. (2023, October). *Blended finance for water* [Presentation].

One of the pioneering cases of blended finance implemented in the region is the Water Security Trust Fund (FIDEAGUA). Catholic Relief Services (CRS) and the Inter-American Development Bank set up an impact investment capital fund, which seeks financial returns and a social and environmental impact: Azure Source Capital. The Water Security Trust Fund, known as FIDEAGUA, was created as part of the search for sources of financing. As figure 3 shows, most of the transactions were investment projects (41.5%), followed by investments through funds (29.3%) and with impact bonds accounting for only a limited percentage.

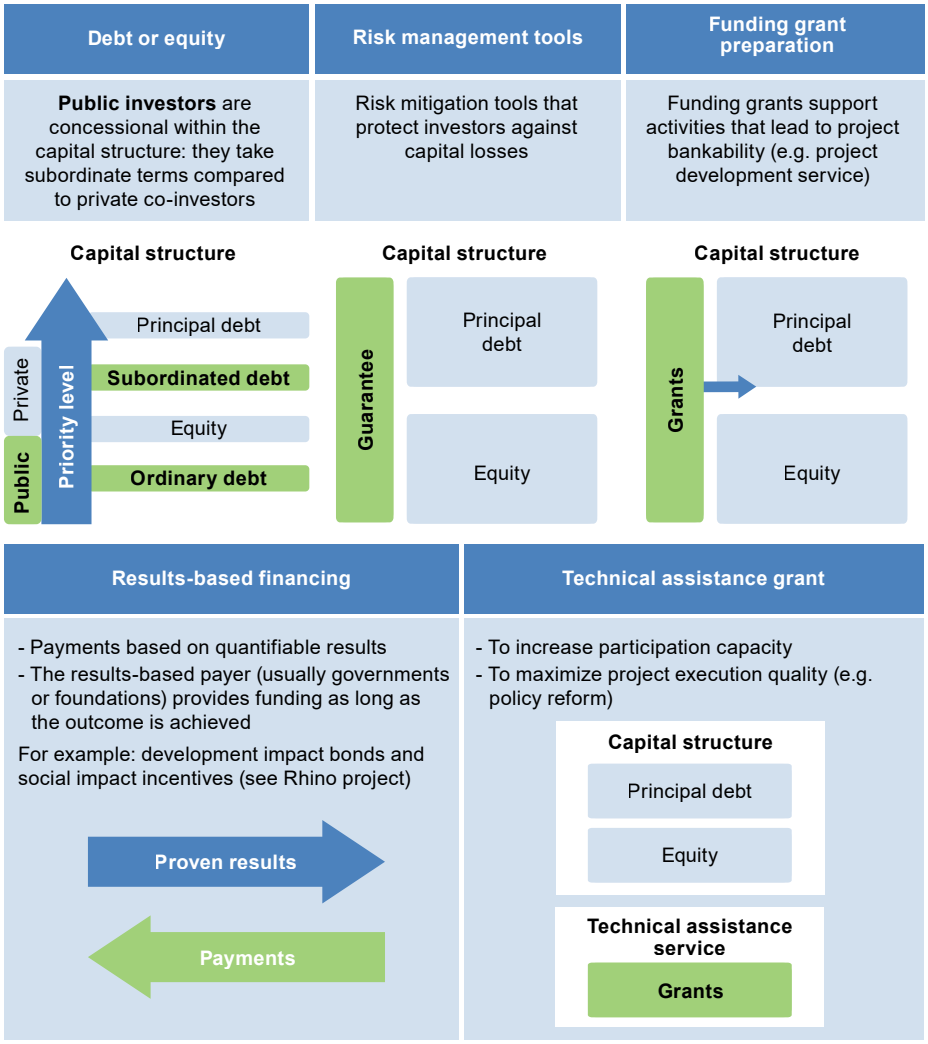
Figure 3
Types of blended finance transactions
(Percentages)



Source: Prepared by the authors, on the basis of Convergence. (2023, October). *Blended finance for water* [Presentation].

The forms of blended finance most commonly used for water infrastructure investments are shown below in diagram 8.

Diagram 8
Archetypes of blended finance



Source: Prepared by the authors, on the basis of Convergence Blended Finance.

The most important sources of global blended finance for investments in the water sector, according to the Convergence study, are shown in table 4. The region's sources were identified by using this list to review the activities of those donors and investors in the region in conjunction with a parallel analysis to identify the region's most active partners. The results of that identification and analysis process are presented below.

Table 4
Sources of blended finance for water security investments

Multilateral donors and funds	Multilateral and development banks	Foundations	Private sector investors	Impact investors
United States Agency for International Development (USAID)	International Finance Corporation (IFC)	Shell Foundation	Standard Chartered	Ceniarth
USAID West Africa Trade and Investment Program	Entrepreneurial Development Bank (FMO)	Gates Foundation	Société Générale (SocGen)	Calvert Impact Capital

Multilateral donors and funds	Multilateral and development banks	Foundations	Private sector investors	Impact investors
Guarantco	International Development Finance Corporation (DFC)	Omidyar Network	Sumitomo Mitsui Banking Corporation	Oikocredit
Emerging Africa Infrastructure Fund	European Investment Bank (EIB)	Rockefeller Foundation	DWS	responSAbility
BMZ Germany	IDB Invest	Lemelson Foundation	Mitsubishi UFJ Financial Group (MUGF)	GLS Bank

Source: Prepared by the authors, on the basis of Convergence. (2023, October). *Blended finance for water* [Presentation].

The foundations playing the largest roles in blended finance investments in the sector globally are the Gates Foundation, the Omidyar Network, the Rockefeller Foundation, the Shell Foundation and the Lemelson Foundation. Table 5 shows the most active foundations in Latin America and the Caribbean and their most significant activities and initiatives in closing implementation and financing gaps for water security and in building local capacities for the preparation of viable, high-impact investment projects.

The Gates Foundation focuses on improving global health, reducing extreme poverty, expanding access to education and promoting equal opportunities. The Omidyar Network promotes social and economic inclusion through investments in technology, government transparency, education and digital rights. The Rockefeller Foundation pursues innovative solutions to promote human well-being, with a focus on health, sustainable urban development, clean energy and climate resilience. The Shell Foundation supports the development of sustainable businesses and clean energy solutions to combat energy poverty and promote economic development in emerging markets. Finally, the Lemelson Foundation fosters invention and innovation as tools to improve the quality of life, focusing on education and accessible technologies for disadvantaged communities.

In addition to these globally important foundations, the most important foundations in the Latin American impact investing ecosystem are the Avina Foundation, FEMSA, Globe Nature, Chagres, One Drop and Water.org. Table 5 summarizes the types of initiatives and projects that these foundations have carried out in the Latin America and Caribbean region.

Table 5
Foundations active in the Latin America and Caribbean region

Foundation	Activities and initiatives
One Drop	Founded by Guy Laliberté, one of the founders of Cirque du Soleil, One Drop pursues water, sanitation and hygiene projects worldwide through an innovative model that combines infrastructure with artistic activities and market-based solutions.
	Its Social Art for Behaviour Change approach has generated sustainable impacts by combining technical solutions with cultural and participatory activities that strengthen the social fabric and encourage the adoption of healthy water, sanitation and hygiene practices.
	Lazos de Agua Program A partnership between the One Drop Foundation, the Inter-American Development Bank (IDB), the Coca-Cola Foundation and the FEMSA Foundation, managed by the Avina Foundation, that promotes sustainable water, sanitation and hygiene projects in Latin America.
	Through its interventions, more than 235,000 people enjoy improved access to sustainable water services. Lazos de Agua is now working to improve the quality of life of more than a million people in Latin America by 2030.
Water.org	Founded by actor Matt Damon and the engineer Gary White, Water.org specializes in addressing the global water crisis through innovative financial solutions, such as microloans to improve access to clean water and sanitation systems.
	Microfinance solutions for water and sanitation.
	Its microfinance model, which promotes scalable and sustainable solutions, has proven to be highly effective in empowering communities to resolve their own water and sanitation challenges.
	It provides microcredits for low-income families to install drinking water and sanitation systems in Brazil, Peru, Mexico and other countries. It has impacted more than 1.2 million people in the region by providing them with access to funds.

Foundation	Activities and initiatives
	Brazil. Works alongside local financial institutions, such as Agroamigo Banco do Nordeste and the Bank of Brazil, to implement financing solutions that enable communities to build sustainable water infrastructure.
	Mexico. Supports rural communities with microcredits to install rainwater harvesting systems and improve sanitation.
FEMSA Foundation	The corporate foundation of FEMSA is dedicated to the conservation and sustainable use of water and to improving the quality of life in communities.
	It is a co-founder of the Latin American Water Funds Partnership, which promotes water security in the region through watershed conservation and nature-based solutions.
	FEMSA Foundation and Inter-American Development Bank (IDB). Confers the IDB-FEMSA Water and Sanitation Award, which recognizes innovative solutions in water, sanitation and solid waste management and in Latin America and the Caribbean.
Avina Foundation	A Latin American organization that promotes sustainable development through collaborative processes. Participates in drinking water and sanitation access projects in rural and urban communities and supports water conservation initiatives.
	Brazil: Água+ Acesso Alliance. An initiative to improve access to water in vulnerable communities through the implementation of sustainable systems and the promotion of technological innovations. It has benefited more than 83,100 people in 122 communities across nine Brazilian states.
	Mexico. Support for the Municipal Agency for Community Water and Sanitation Services (OMSCAS) in Berriozábal, Chiapas. The agency strengthens the community management of water and sanitation in rural areas, improving service quality and sustainability.
	Ecuador: Network of Community Water and Sanitation Service Organizations of Ecuador (ROSCGAE). The Avina foundation supported the consolidation of this network, which represents community organizations in the country's 24 provinces, strengthens their interactions with the public sector and promotes sustainable water management.
	Chile: Water Fund for the Santiago Basin. Signed a memorandum of understanding for the creation of this fund, which is an innovative conservation model aimed at ensuring water availability in the Metropolitan Region and managing the associated risks, to the benefit of both people and the environment.
Gates Foundation	Has funded water infrastructure and sanitation projects in Latin America, with a focus on improving vulnerable communities' access to drinking water and sanitation systems.
	Partnerships: The Foundation has cooperated with local governments, NGOs and international organizations to implement sustainable solutions in rural and urban areas. It also collaborates with multilateral banks.
	Sanitation programme in Ecuador. In 2013, it awarded a US$ 973,689 grant to the In Terris Foundation in Guayaquil to develop waterless, energy-free toilets, benefiting low-income rural families and encouraging water conservation.
Omidyar	Has invested in projects to foster innovation and social entrepreneurship in Latin America.
	Although not directly focused on water infrastructure, the network supports initiatives that may include nature-based solutions and watershed conservation as part of sustainable development.
Rockefeller Foundation	Has financed water infrastructure and sanitation projects in Latin America, including the improvement of drinking water and sewerage systems in disadvantaged communities.
	Partnerships. With other foundations and international organizations, aimed at increasing investment in developing countries and addressing critical social challenges.
	Latin American Alliance for Civic Technology (ALTEC). Finances technological platforms that promote citizen participation in environmental issues, including water management and watershed conservation, in collaboration with the Avina Foundation.
	Urban Resilience. Supports Latin American cities in the implementation of nature-based solutions for water management and flood reduction, strengthening water infrastructure and watershed conservation.
Shell Foundation	Has invested US$ 344 million in grants in Africa, Asia and Latin America since 2000, supporting 71 early-stage companies and market builders. While the main focus has been on energy and transportation, it has collaborated on projects that provide energy solutions for rural communities, indirectly benefiting water management and sanitation.
Programmes and projects	**Sistema.bio**. Support for a company that provides biodigesters to convert organic waste into biogas and fertilizers, improving waste management and water quality in rural communities[a].
Lemelson Foundation	Focused on fostering invention and innovation to improve lives. In Latin America, the foundation has supported programmes that promote engineering education and the creation of affordable technologies for low-income communities, which can include innovative solutions for water and sanitation management.
	Global Development Incubator. Support for this organization that works for water and sanitation innovations in Latin America, providing low-income communities with affordable technologies.
Globe Nature Foundation	A Spanish organization engaged in nature conservation and sustainable development. Conducts projects in Latin America, such as "Baña Do Bari", which improves water quality in indigenous communities in Colombia through nature-based solutions.

Foundation	Activities and initiatives
Chagres Foundation	A Panamanian organization dedicated to the conservation of natural resources and sustainable development.
	Participates in the Water for the Future programme, which supports watershed conservation and the funding of sustainable activities in strategic areas of Panama.

Source: Prepared by the authors, on the basis of information from the foundations.
[a] https://sistema.bio/

D. Thematic bonds

According to a study by the IDB and the United Nations Global Compact, the bond market was the largest asset class in the global financial market, with an estimated volume of US$ 128.3 trillion in 20201 (Blanco-Iturbe et al., 2021). The bond market can therefore be expected to play a significant role in catalysing increased investment flows to achieve the Sustainable Development Goals (SDGs). Investors still have a strong appetite for a range of thematic bonds, such as green bonds, that meet the demand for greater transparency and alignment with the SDGs.

Thematic bonds are a traditional debt instrument very similar to standard bonds. The difference is that thematic bond funds are channelled exclusively into projects that contribute to sustainable development, and additional reporting is therefore required to demonstrate that impact. While there was a peak in the first half of 2021, issuance of sustainable debt in general —including thematic bonds and loans in pursuit of sustainability— was also significant in 2022 and 2023, with green bonds accounting for the largest share. The different types of thematic bonds and the projects in which the proceeds from their sale can be invested are shown in table 6.

Table 6
Types of thematic bonds

Thematic bond	Projects eligible for investments
Green bonds	Green bond funds are exclusively used to finance projects with a clear environmental benefit.
Social impact bonds	Social bond funds are used to finance projects that focus on directly addressing or mitigating a specific social problem and/or achieving positive social outcomes, especially for vulnerable or prioritized populations.
Sustainability bonds	These bonds combine the objectives identified above: funds are earmarked exclusively for financing or refinancing a combination of green and social projects.
Blue bonds	Blue bond funds are used to finance or refinance water- and ocean-related projects with a demonstrable positive impact on the achievement of the Sustainable Development Goals.

Source: Prepared by the authors.

Sustainable bonds are debt instruments designed to finance projects, activities or assets that are clearly defined as sustainable. Most such bond issuances are governed by a "use of funds" framework (UFF), which clearly specifies what the proceeds will be used for. The most common models are green, social, sustainable and sustainability-linked bonds.

The principles developed by the International Capital Market Association (ICMA) have been instrumental in standardizing this emerging market by providing guidelines that cover the use of funds, project evaluation and selection processes, resource management methods and reporting requirements. These frameworks reinforce the transparency and integrity of thematic bonds, which are key elements for building investor confidence and the global scaling of sustainable financing.

Among a diverse range of thematic bonds, blue bonds are emerging as an innovative financial instrument for raising capital to resolve social and environmental challenges and to create ocean- and water-related sustainable business opportunities. It is believed that a sustainable ocean economy can create a triple win for people, nature and the economy by fighting climate change, providing nutritious food for a growing population and providing almost unlimited renewable energy (Blanco-Iturbe et al., 2021).

A blue bond is a financial debt issuance instrument that aims to protect the oceans and marine ecosystems by preserving them. Through such bonds, infrastructures for water treatment and management are put in place or measures are adopted to preserve marine biodiversity.

Blue bonds are structured in much the same way as other thematic bonds. And just like standard bonds, blue bonds enable the issuers to access capital, subject to repaying the debt with interest over the bond's term in accordance with the conditions of the issuance. In addition, issuers undertake to finance or refinance blue projects involving oceans, water resources and access to water.

In September 2023, ICMA —together with the International Finance Corporation (IFC), the United Nations Environment Programme Finance Initiative (UNEP FI), the United Nations Global Compact and the Asian Development Bank (ADB)— published the global road map *Bonds to Finance the Sustainable Blue Economy: A Practitioner's Guide*.

Even before the guidelines were adopted, several blue bond issuances were made in the region, using the issuance principles of green thematic bonds. For example, between 2017 and 2021, IDB structured and/or purchased a total of 20 thematic bond issuances in Latin America and the Caribbean, including six green bonds, eight social bonds and six sustainability bonds valued at US$ 1.3 billion, with the mobilization of US$ 500 million in private capital. An account of the largest issuances in the region to date can be found in table 7.

Blue bond funds can be used in different areas, including renewable marine energy projects, transport, agribusiness and manufacturing, social infrastructure and tourism, and water and sanitation. Within the latter category, all projects that promote sustainable water management are eligible, as are infrastructure projects for the treatment, storage and sustainable supply of drinking water.

Several kinds of water and sanitation activities and investments can be financed by blue bonds:

- Activities to support sustainable water management, including the reduction of water use in agriculture, manufacturing and other commercial operations.
- Infrastructure investments for the treatment, storage and sustainable supply of drinking water.
- Capacity-building for analysing and responding to risks in watersheds.
- Funding for desalination and water treatment plants, especially in coastal areas with connections to the ocean and the potential to impact the ocean.
- The transition from anaerobic to aerobic wastewater treatment, and separating solids from wastewater management systems.
- Power generation from methane or biogas produced from sewage by thermal hydrolysis.
- Road surfacing renovations: creating new substrates to enhance groundwater absorption and reduce runoff.

Table 7
Blue bond issuances in Latin America and the Caribbean

Country	Issuer or institution	Amount and term	Key details
Latin America and the Caribbean 2021	IDB Invest	50 million Australian dollars (~US$ 37 million), 10 years	First blue bond in Latin America and the Caribbean; funds drinking water and sanitation projects.
Peru 2021	Financial Development Corporation (COFIDE), Peruvian Federation of Municipal Savings and Credit Unions (FEPCMAC), and Municipal Savings and Credit Bank (CMAC) Arequipa, Huancayo, Cusco, Ica, Piura and Trujillo	100 million soles (~US$ 26.3 million), 3 years	The country's first blue bond; funds water and sanitation projects in rural and peri-urban areas.
Mexico 2022	Desarrollos Hidráulicos de Cancún (DHC) + BBVA	1.4 billion pesos (~US$ 70 million), 3.5 years	The country's first blue bond; funds drinking water and sanitation infrastructure in Quintana Roo.

Country	Issuer or institution	Amount and term	Key details
Ecuador 2023	Banco Bolivariano + IDB Invest + FinDev Canada	US$ 80 million, 5 years	World's first target-linked blue bond; adheres to Taskforce on Nature-related Financial Disclosures (TNFD) and funds water management and circular economy projects.
Colombia 2023	BBVA + IFC	US$ 50 million	The country's first blue bond; funds water treatment, ocean conservation and aquatic ecosystem protection projects.

Source: Prepared by the authors, on the basis of IDB Invest. (2020, 14 September). *IDB Invest Issues First Blue Bond in Latin America and the Caribbean*. https://idbinvest.org/en/news-media/idb-invest-issues-first-blue-bond-latin-america-and-caribbean; Blanco-Iturbe, M. A., Samtani, M. and Sanz-Paris, C. (2021). *Accelerating Blue Bonds Issuances in Latin America and the Caribbean*. IDB Invest and United Nations Global Compact; BBVA. (2022, 14 October). *BBVA México acompañó a Desarrollos Hidráulicos de Cancún en la emisión del primer bono azul en México*. https://www.bbva.com/es/sostenibilidad/bbva-mexico-acompano-a-desarrollos-hidraulicos-de-cancun-en-la-emision-del-primer-bono-azul-en-mexico/; BBVA. (2024, 14 May). *BBVA e IFC anuncian lanzamiento del primer bono azul en Colombia*. https://www.bbva.com/es/sostenibilidad/bbva-e-ifc-anuncian-lanzamiento-del-primer-bono-azul-en-colombia/; and Financial Development Corporation. (2024, 24 September). *COFIDE lanza el primer bono azul por hasta S/ 100 millones para impulsar acceso al agua y saneamiento*. https://www.gob.pe/institucion/cofide/noticias/1023658-cofide-lanza-el-primer-bono-azul-por-hasta-s-100-millones-para-impulsar-acceso-al-agua-y-saneamiento.

E. Conclusions

The mechanisms analysed show that the region now has a more diverse financial ecosystem than a decade ago, but that it is still underused for the water sector. Blue bonds, debt-for-nature swaps and blended finance schemes are already being implemented in such countries as Peru, Ecuador, Mexico and Colombia, and they offer replicable lessons. Their scale, however, remains limited compared to the volumes of investment needed.

An examination of the results of the demonstration cases in chapter IV shows that these instruments can be decisive in closing gaps: in Metapán, green bonds and carbon credits supported the design of a road map; at La Farfana, circular investments were capitalized through thematic bond financing; in Aquapolo, public-private partnerships were scaled up to institutional markets; and in Tenorio, they were used to diversify sources beyond the development banks. Thus, many of the instruments identified reflect the shifts in the global financial architecture described in chapter II, but they need to be grounded in specific local and sectoral contexts to deploy their full potential.

The main conclusion is that the instruments exist and are evolving, but that their effective use requires enabling regulatory frameworks, local capacities to structure investments and strategies for alignment with national and regional priorities in the fields of water security and sustainable development. Chapter IV therefore explores how these innovative funding and financing mechanisms can also be leveraged by local governments and operators responsible for implementing water and adaptation investments. By presenting two examples from elsewhere in the world —one from India and the other from South Africa— the chapter offers concrete recommendations on how local governments can ready themselves to take advantage of the opportunities that this new global financing context and architecture offers (chapter II).

IV. Strategies for local government access to climate funds

The aim of this chapter is to prepare local governments in implementing the recommendations in chapter II, which identified three key leverage points for taking advantage of the emerging financing opportunities in the global financial architecture: (i) the capacity to prepare investments, (ii) robust governance, and (iii) effective implementation arrangements. In practice, local authorities and municipalities face recurrent obstacles: for example, dependence on national transfers, limited fiscal autonomy and insufficient technical capacity to structure bankable projects. Moreover, in many cases, they are unable to directly access funds from multilateral banks or global climate and environmental funds such as the Green Climate Fund (GCF). Given that the vast majority of water security interventions and investment projects are managed at the local level, alternatives must be offered that allow local authorities effective access to those opportunities.

Two cases —the Climate Change Trust Fund implemented by the Indian city of Surat and the Water Reuse Programme in South Africa— are presented as examples of institutional and financial innovations that have enabled local governments to overcome these barriers to access, and they both offer replicable lessons for local governments in Latin America and the Caribbean.

A. Surat, India

Surat, in the State of Gujarat, is one of India's fastest growing cities. With more than 7 million inhabitants and rapid industrial development, it also has to contend with pressure on basic services and vulnerability to flooding. In 2006, heavy rains covered 75% of the city, prompting its incorporation into the Asian Cities Climate Change Resilience Network (ACCCRN) in 2008 and the publication of its Resilience Strategy in 2011.

The most significant development was the creation of the Surat Climate Change Trust (SCCT). This public-private body, independent of the municipality, brings together the Surat Municipal Corporation, the State Disaster Management Authority, the local Chamber of Commerce and technical universities. Its independence allowed it direct access to international financing without going through the national government, which is a constraint that cities normally face. Additionally, the elimination of dependence on municipal political cycles ensured the continuity of the adaptation agenda.

At the same time, Surat faced a major fiscal challenge: the 2006 elimination of the octroi tax, which represented more than 50% of its revenue. To compensate, the city reformed its property taxes and service charges and conducted campaigns to broaden the tax base. While revenue never reached the previous levels, the reforms strengthened local financial autonomy. In 2013, an annual budget line of US$ 300,000 was established for climate studies and investments, demonstrating a sustained commitment.

One unique feature of Surat and its governance is that because of its status as an industrial centre, the local government strives at all times to involve the private sector in the formulation and governance of economic and industrial policies. For that reason, stakeholders such as the Gujarat Industrial Development Corporation (GIDC) and the Southern Gujarat Chamber of Commerce and Industry (SGCCI) have a significant influence on the city's policy formulation process.

1. Municipal climate fund access strategy

The chronology of Surat's strategies to access finance shows that the city's first innovative arrangement for climate adaptation financing dates back to the strategy adopted to fund the reconstruction of the Anjana WWTP in 2006. Funds from the Jawahar Lal Nehru Urban Renewal Mission (JnNURM) were earmarked for general urban development, infrastructure improvements and the provision of public sanitation services. However, by combining its own revenues with the JnNURM grants, the Surat Municipal Corporation (SMC) succeeded in including both urban adaptation and development co-benefits in the plant's reconstruction.

The Surat Climate Change Trust (SCCT)

After joining the Asian Cities Climate Change Resilience Network (ACCCRN) initiative in 2008, the city sought to ensure the continuity of adaptation actions beyond that temporary funding. The solution was to create the Surat Climate Change Trust (SCCT), a public-private body independent of the municipality and registered as a public-municipal trust under the Bombay Public Trust Act 1950. SCCT brings together the Surat Municipal Corporation, state agencies, the Chamber of Commerce and universities, making it one of the first multisectoral municipal trusts in India.

Its mandate is to serve as a neutral and permanent platform to promote the adaptation agenda, build capacities, facilitate collaboration between sectors and channel climate funds directly. Its objectives include promoting flood resilience policies and measures, supporting vulnerable communities and disseminating technical practices to address climate change.

The design of SCCT represents a response to the barriers municipalities face in securing access to funding. Because it is not formally part of the local government, it can receive international funds without going through the national government's centralized mechanisms, thereby reducing political dependence. In addition, by separating the climate agenda from electoral cycles, it ensures the continuity of investments. To reinforce that commitment, in 2013 an annual US$ 300,000 item for adaptation studies and investments was included in the municipal budget.

SCCT is made up of multiple stakeholders at the municipal and state level, led by the Surat Municipal Corporation. It includes members from various institutions, such as the Gujarat State Disaster Management Authority (GSDMA), the Narmada Water Resources Water Supply and Kalpsar Department (NWRWS), the South Gujarat Chamber of Commerce and Industries (SGCCI) and two academic institutions: the Sardar Vallabhbhai National Institute of Technology (SVNIT) and the Central Secretariat Service (CSS). SCCT is one of India's first municipal-level multisectoral trusts.

The octroi tax and its implications

In Surat, the local government worked to adapt to the loss of revenue by diversifying its tax base and channelling transfers into projects with adaptation benefits (Cook and Chu, 2018). The biggest challenge came in 2006, when the octroi tax —which accounted for more than 50% of municipal revenue— was abolished as a condition for accessing JnNURM funds. To compensate, the State of Gujarat transferred

additional subsidies and the city reformed its property taxes and service charges and expanded the taxpayer base through door-to-door surveys. Those measures bolstered its revenues, although they never reached pre-octroi levels.

The combination of this reduction in income and the growing priority of adaptation, bolstered by Surat's integration into the ACCCRN network in 2008, led to a rethinking of climate adaptation as a central component in the management and financing of urban services and infrastructure.

2. Lessons learned

An analysis of the mechanisms adopted by Surat highlights the difficulties in accessing climate finance faced by many cities in developing countries and how they can be overcome. Those lessons are largely aligned with the three leverage points identified in chapter II:

- **Fiscal strengthening and capacity-building:** Surat strengthened its fiscal autonomy by modernizing the collection of property taxes and service fees, which broadened the taxpayer base. The creation of a specific annual budget line for adaptation (US$ 300,000) ensured municipal resources to co-finance projects and bolstered confidence among donors and investors. The modernization of the property tax system —including door-to-door censuses and updated databases— introduced cadastral management skills, information systems and modern tax administration practices that strengthened the municipality's financial credibility. This underscores the importance of strengthening the municipal tax administration, given that international funds rarely cover every need and local contributions are required. Not all cities share the same starting point, but even in fast-growing contexts, adopting modern fiscal practices is essential.
- **Capacity to prepare investments:** The Surat Climate Change Trust (SCCT) served as a space for technical coordination, which in turn enabled skill-building in multisectoral project formulation, the assessment of co-benefits and the preparation of business cases aligned with donor and investor priorities. Those capabilities stand at the core of preparing bankable, replicable projects.
- **Robust governance:** As an independent public-private platform, SCCT reduced the vulnerability of the adaptation agenda to local political changes and allowed the participation of state, private and academic actors. Since it did not depend directly on the municipality, SCCT was able to receive international funding directly without going through the national government, thereby overcoming one of the most common barriers in developing countries. This structure also favoured the strategic fit of the adaptation projects with national and international priorities, thus strengthening their attractiveness to donors and financing agencies.
- **Effectiveness of implementation arrangements:** SCCT served as a technical and coordination platform to structure comprehensive solutions within a fragmented institutional environment. By combining its own revenues with external resources (from JnNURM, ACCCRN and international cooperation), Surat acquired experience in small-scale blended finance and in the design of co-financing schemes. This practice strengthened local capacities to incorporate different sources of funding, allocate risks and ensure the continuity of project execution. The continuity of investment plans beyond political cycles was crucial in leveraging additional funds and investments for water security and climate resilience.

To summarize: the case of Surat shows that the capacity to prepare investments does not depend solely on access to financial resources, but also on developing concrete skills in modern tax management, multisector project formulation, analysing co-benefits and managing external funds. Those skills, coupled with SCCT's institutional innovations, enabled the city to attract international climate finance, ensure the continuity of its adaptation and water security agenda and leverage private sector investments. The case shows that with political leadership, institutional innovation and fiscal strengthening, local governments can become strategic players in closing the water resilience implementation gap.

B. South Africa: Water Reuse Programme – Green Climate Fund

The case of South Africa and its Water Reuse Programme provides an example of a programmatic approach to climate finance, in which the Green Climate Fund (GCF), through the use of blended finance and in cooperation with the Development Bank of Southern Africa (DBSA), enables municipal governments to access those funds. An analysis of this programme was carried out, based mostly on the official information available for this programme on the GCF website (GCF, 2023) and supplemented with other sources, and the most salient aspects are presented below.

South Africa is facing extreme water stress. With only 60% of the world's average rainfall and burgeoning urban demand, it is projected that the country will face a 17% deficit in water availability by 2030. The "Day Zero" crisis in Cape Town (2017–2019) showcased the system's fragility and the urgent need for structural solutions.

In response, the Department of Water and Sanitation and the Development Bank of Southern Africa (DBSA) designed the National Water Reuse Programme (WRP), which was approved by the Green Climate Fund (GCF) in 2023. The programme's aim is to transform the wastewater system into a strategic source of supply. It has a total budget of US$ 1.472 billion, including US$ 235 million in catalytic capital from GCF, which reduces risks and attracts co-investment from DBSA and the private sector.

The programme follows a programmatic approach: instead of isolated projects, it is developing a national portfolio of reuse plants, starting with around 10 facilities that will produce 440 million litres of treated water a day. This approach reduces transaction costs, facilitates standardization and builds investor confidence.

One key element in the programme is the Water Partnerships Office (WPO), which is situated within DBSA but has a public mandate. WPO provides technical assistance to municipalities, drafts model contracts and promotes public-private partnerships. In this way, it addresses common barriers: the municipalities' limited technical capacity, institutional weaknesses regarding contracts and limited ability to attract private capital. WRP also incorporates social and environmental sustainability principles: it creates jobs, includes gender criteria and promotes nature-based solutions such as artificial wetlands.

1. National Reuse Programme and its financing

The National Water Reuse Programme (WRP), approved by the Green Climate Fund (GCF) in 2023, has a budget of US$ 1.472 billion, including US$ 235 million in catalytic capital. Its blended finance structure combines concessional resources from GCF, co-investment from DBSA and private capital. With an initial 10 plants, it will put out 440 million litres of reused water a day. The WRP Programme Office supports municipalities in project preparation, training and contractual standardization, while concessional loans encourage investment bankability and sustainability.

The Department of Water and Sanitation of South Africa (DWS), through its National Water Resource Strategy (NWRS) and Water and Sanitation Master Plan (2018), forecasts a water deficit of 17% by 2030. To address this, it launched the National Water Partnerships Programme (NWPP), which includes the National Water Reuse Programme, approved by GCF in 2023 with a catalytic contribution of US$ 235 million.

WRP aims to make reuse into a strategic source of water, ensuring reliable supplies for human consumption, agriculture and industry, reducing pressure on ecosystems and generating co-benefits such as employment, climate resilience and economic growth.

The programme follows a blended finance structure: concessional financing from GCF, co-investment from the Development Bank of Southern Africa (DBSA) and private capital. With a total budget of US$ 1.472 billion, it has plans for 10 advanced treatment plants that will provide 440 million litres of reused water per day.

The WRP Programme Office, initially funded with US$ 4 million, supports municipalities in project preparation, training and contractual standardization. The financing scheme combines credit enhancement and concessional lending to reduce risk, attract private investment and consolidate a new class of climate assets.

WRP involves different types of entities in its financing, as well as different financial instruments. The first of those components, the WRP Programme Office, is in charge of preparing projects and training local stakeholders. An initial amount of US$ 4 million is foreseen for the office's operations for the first three years, after which it is expected to fund itself through a project preparation fee. Second, the projects' blended finance uses credit enhancement to provide attractive investment opportunities for the private sector to invest in these projects and provide the majority of the senior debt. When that configuration is not sufficient, the concessional loan (financed by GCF and DBSA) can also be used to give projects a final push towards bankability and sustainability.

2. Strategic case and climate rationale for investments

Water reuse as a new asset class aligns with GCF's strategy in the area of adaptation outcomes linked to health, well-being and water security, as well as with the sectoral water security guideline that promotes integrated resource management and the development of alternative water sources.

The programme will contribute to the climate resilience of more than 3.4 million people directly and 3.8 million people indirectly, through an initial portfolio of 10 projects, with the potential for expansion. It offers: environmental co-benefits, by improving water quality and relieving pressure on watersheds; economic co-benefits, by enabling new productive activities; and social co-benefits, by reducing the water collection burden borne by women and girls.

To ensure the climate soundness of the investments, the South African Council for Scientific and Industrial Research (CSIR) conducted risk and vulnerability assessments in 47 municipalities, with a priority on metropolitan areas and intermediate cities. The outcome of this process was a list of eligible municipalities and a pipeline of projects that will evolve into a solid portfolio, often structured as public-private partnerships (PPPs) and with the potential to consolidate a new class of climate assets.

3. Removing barriers to funding access at the local level

WRP was explicitly designed to overcome the barriers municipalities commonly face: fragmentation of initiatives, limited technical capacity, institutional weakness for drafting contracts, a shortage of financing for structuring and low levels of private participation. It combines a programmatic approach, cost-reducing concessional capital, blended finance to attract private investment, the use of hybrid infrastructure, institutional strengthening and clear intersectoral collaboration between the national government, municipalities and the private sector. The complete list of those barriers and the programme components intended to mitigate them are listed in table 8.

GCF's climate finance helps overcome the main constraints municipalities face in investing in water security and reuse by means of three mechanisms:

(i) Programmatic approach, which supports the identification and structuring of bankable and scalable projects at the national level.

(ii) Reduced finance costs, by offering concessional capital with lower rates and longer terms, which facilitates affordable tariffs and greater financial viability.

(iii) Private sector leverage, through blended finance that reduces risks and promotes private participation in reuse projects.

Table 8
Local barriers to climate finance access and solutions

Barrier	Explanation	Solution
Fragmentation and inconsistency in water security initiatives	Because of the multisectoral nature of water security, together with the scant understanding of how climate resilience is achieved and of how to manage the complexity of the water-energy-food nexus, numerous projects are structured in parallel, without taking advantage of synergies.	The provision of **programmatic support to municipalities** will improve coordination and ensure more coherent and climate-resilient outcomes by aligning water reuse interventions with other initiatives (such as reducing volumes of water not accounted for and regulatory improvements).
Limited municipal technical capacity to design and prepare water reuse projects	Many municipal governments lack technical expertise on climate change and on the adaptation and resilience solutions required, which hampers the introduction of innovative solutions.	The establishment of a **centre of excellence** to provide municipalities with technical support will encourage the development of catalytic projects with a robust climate change rationale.
Low institutional capacity to structure contracts and new business models	Weak systems for managing municipal procurement prevent the structuring of new institutional or contractual arrangements.	WRP will provide **technical and financial assistance to structure innovative contracts**, as well as to strengthen municipalities' long-term capacity for project supervision.
Limited access to financing for proper project preparation	Catalytic funding for the structuring stage is scarce and difficult to access, and this problem is further compounded by the limited technical capacity of municipal staff to develop proposals for robust investment projects and proposals for climate funds or impact investors.	WRP will offer **structured support in project preparation**, market analysis and risk allocation schemes, to enable the development of viable, bankable solutions.
Limited private sector participation in the financing, development, operation (and, if applicable, ownership) of infrastructure works and assets for climate resilience and water security	The wide and urgent water infrastructure funding gap in South Africa demands alternative solutions. Currently, private sector participation is limited because most projects have unattractive risk profiles and there is lack of trust between public and private actors.	WRP will promote the use of **blended finance** and risk allocation protocols to facilitate private sector participation, and it will also provide **transactional advisory services** to structure public-private arrangements. A greater degree of standardization in those aspects across the country could also reduce the transaction costs incurred by interested investors and, at the same time, improve the risk/reward profile of those projects and contractual arrangements by making them scalable.
Poor understanding of the impact of climate change on water security and the solutions required	Both nationally and locally, there is still very little understanding of the impact of climate change on water security and of the need to develop alternative sources such as water reuse. In addition, a global **public distrust of water reuse** exists.	WRP follows a structured approach of **awareness-raising**, **training and outreach**, which will generate social acceptance and support.

Source: Prepared by the authors, on the basis of Green Climate Fund. (2023). *Climate change resilience through South Africa's Water Reuse Programme ("WRP")*. https://www.greenclimate.fund/project/fp209.

The programme design also includes important elements such as the combined use of green and grey infrastructure (including nature-based solutions), technical capacity-building for local governments, risk management and monitoring systems, and cooperation between different levels of government, the private sector and communities. This multilevel architecture clearly defines the national government's role in framework policies, that of the municipalities in implementation and that of the private sector in financing and deploying solutions.

4. The Water Partnerships Office: building on public-private synergies

To address the financial and technical constraints faced by municipalities, the Water Partnerships Office (WPO) was created as part of the National Water Partnerships Programme. Located within DBSA but with a public mandate, WPO facilitates public-private collaboration in the provision of water services. Its purpose is to generate investment opportunities and support municipalities in the preparation of projects by combining public and private financing.

WPO works to standardize contractual models, terms of reference and bidding tools in order to reduce costs, speed up implementation and favour learning within municipalities. Its six national programmes cover water reuse, reduced volumes of water not accounted for, wastewater treatment, non-sewer sanitation, desalination and management contracts.

This programmatic approach strengthens the municipalities' capacity to structure bankable projects and attract private investment. As a centre of excellence, WPO provides technical guidelines and protocols that facilitate the execution of subprojects and promote the creation of a new class of water reuse climate assets. It also leads communication and training initiatives to improve social acceptance of reuse, which were of key importance after the Day Zero crisis. Close collaboration between levels of government and the private sector reinforces the programme's sustainability and paves the way for new initiatives.

5. Lessons learned in the first stage

The National Water Reuse Programme (WRP) and the Water Partnership Office (WPO) were designed not only to finance projects, but also to build technical, institutional and financial capacities within municipalities. The main lessons learned are in alignment with the three leverage points identified in chapter I.

Capacity to prepare bankable investments and projects: WPO has established itself as a centre of excellence in project preparation, providing direct technical assistance to local governments in the following areas:

- Technical design and feasibility: standardization of demand studies, climate risk assessments and economic feasibility analyses.
- Financial structuring: preparation of business models, revenue stream analyses and fee schemes, which equipped the municipalities with project finance competencies.
- Contract management: development of specifications and model contracts that facilitated the structuring of public-private partnerships.
- Access to external financing: support in preparing proposals for GCF and other funders, strengthening local capacities to formulate bankable projects.

These functions enable skills in project formulation, risk assessment and the structuring of public-private partnerships to be transferred to municipalities, thus closing the gap that often prevents middle-income cities from accessing climate finance.

Robust governance: WRP established a clear architecture with defined roles for the national government, the municipalities and the private sector. That clarity reduced fragmentation and built institutional capacities for multilevel coordination, which is essential for water and adaptation projects. The WPO, located within DBSA but with a public mandate, acted as a bridge of trust between municipalities and investors, building local competencies in collaborative governance and partnership management.

Effectiveness of implementation arrangements: WRP's blended finance scheme —with concessional capital from GCF that reduces risks and attracts private co-investment— not only mobilized resources, but also trained municipalities to integrate different sources of financing and manage financial risks. The practice of grouping projects into a programmatic portfolio also strengthened local capacities to standardize processes, reduce transaction costs and replicate models at the national level.

To summarize, the South African case demonstrates that climate funds can play a transformative role beyond direct financing: when combined with technical offices like WPO, they build local skills for preparing projects, structuring public-private partnerships and blended finance schemes, enabling municipalities to access climate capital in a sustainable way.

C. Conclusions and recommendations

The cases of Surat and South Africa show that local governments can become strategic actors in water resilience if they are capable of political leadership, institutional innovation and public-private collaboration. Beyond their different contexts, both cases strengthen the three leverage points of the global financial architecture identified in chapter II.

Capacity to prepare investments and fiscal management

- Surat: The project modernized tax collection, broadened the taxpayer base and earmarked a specific budget item for adaptation, which financed studies and project design. This built local skills in cadastral management, risk analysis and multisector project formulation.
- South Africa: Through the Water Partnerships Office (WPO), municipalities were provided with technical assistance in financial structuring, preparing proposals and standard contracts. This transferred competencies in project funding, public-private partnership structuring and blended finance.

Robust governance

- Surat: The Surat Climate Change Trust (SCCT) was consolidated as an independent trust fund that protects the climate agenda from political cycles, facilitates participation by the private sector and academia, and allows direct access to international financing.
- South Africa: The Water Reuse Programme (WRP) defined clear roles between the national government, the municipalities and the private sector, reducing institutional fragmentation and creating a replicable programmatic architecture.

Effectiveness of implementation arrangements

- Surat: The project combined its own revenue with international financing (JnNURM, ACCCRN, international cooperation), thus consolidating experience in blended finance at the local level. In addition to combining those sources of funding, the main contribution was the design of a public-private institutional arrangement (SCCT) that facilitated collaboration between the municipality, state agencies, the private sector and academia. This scheme enabled the coordination of multisectoral investments, reduced dependence on national transfers, guaranteed continuity beyond political cycles and channelled international resources directly. In practice, SCCT functioned as a mechanism for project pooling and interconnecting co-benefits, strengthening implementation capacity and increasing credibility with donors and investors.
- South Africa: The project structured a national programme with scalable project portfolios, using blended finance with GCF concessional capital to reduce risks, attract private investment and generate a new class of climate assets.

The most important lessons from the two cases, which are relevant to the region and could be transferred there, are the following:

- Fiscal autonomy and the modernization of tax structures are preconditions for attracting and co-financing climate investments.
- Neutral institutional vehicles (trusts, technical offices) ensure continuity beyond political cycles.
- Programmatic design and project pooling reduce risks and transaction costs, generating the critical mass needed to attract investors.
- The use of blended finance schemes, supported by international funds such as GCF, is of key importance in mobilizing private capital for water and adaptation.

Taken together, these cases provide a practical road map: strengthen municipal project preparation capacities, consolidate multilevel and collaborative governance and design scalable implementation schemes. In short, this entails going beyond the formulation of individual projects, adopting a programmatic approach and moving forward on three complementary fronts:

- Local tax reforms: modernize cadastres and collection systems to broaden the tax base, create specific budget lines for investments in adaptation and water security, and generate the financial credibility needed to access climate funds.
- Institutional innovations: establish municipal trusts, technical offices or multisectoral platforms that guarantee continuity beyond political cycles and coordinate public, private and community actors.
- Leveraging global climate funds: use concessional capital (such as GCF funds) as a catalyst to reduce risk, structure portfolios of water and adaptation projects, and attract private and philanthropic investment at scale.

In this way, the region's water challenges can be turned into sustainable investment opportunities, simultaneously supporting water security, climate resilience and local economic development.

V. Methodological guide to the Water Security Financing Framework and its application to cases in the region

This chapter sets out the methodology selected for the Water Security Financing Framework (WSFF). It is a methodology designed to transform water security strategies into viable and bankable investment portfolios, structured around the five business cases —strategic, economic, commercial, financial and management— that progressively strengthen a project's justification and define its strategies for governance, funding, financing and procurement to ensure its sustainability over the course of its life cycle.

The WSFF proposes a collaborative and transdisciplinary process that enables public, private and civil society actors to jointly gather the evidence needed to attract funding and implement water security projects. This chapter provides a step-by-step explanation of the process, from defining the preferred strategy to structuring the contractual and financial arrangements, and includes examples when appropriate.

A. Scope of the methodology

This methodology is a response to the gaps identified in the literature and in international practice. A thorough review of the existing literature on water security financing and the approaches developed by various institutions indicates that although many studies documenting good practices and success stories exist (World Water Council, 2022; WaterAid and Blended Finance Taskforce, 2022; World Bank Group, 2020; OECD, 2022; Khemka et al., 2023), together with analyses of enabling environments for water security investments (Castro and Delmon, 2018; Jiménez et al., 2019; World Bank, 2022; OECD, 2024), climate change adaptation (Stenek et al., 2013; Altamirano, 2021) and public infrastructure in general (Economist Intelligence Unit, 2019), none offers a step-by-step structuring process specifically adapted to water security and adaptation projects that can also guide non-specialized actors in structuring investments and projects. When appropriate, reference is made to these other resources, which can be used to further develop specific aspects.

In that context, the Water Security Financing Framework structures a multisectoral and transdisciplinary process that acts as a bridge between adaptive strategic planning and investment planning, enabling water security strategies to be translated into concrete investment proposals. It also facilitates the development of scaled investment portfolios in line with national and regional priorities.

The WSFF combines contributions from new institutional economics (Menard, 2001, 2004), transaction costs economics (Williamson, 1998), infrastructure economics and engineering design theory; it also incorporates concepts of engineering asset management and public infrastructure network financing (Altamirano, 2010) the world has seen a proliferation of innovative approaches for the delivery and financing of public services, such as Public-Private-Partnerships (PPPs). All these theoretical and methodological frameworks and approaches are applied in coordination with the "five case model" used by HM Treasury in the United Kingdom, which reinforces their practical relevance in supporting the preparation of investment projects.

Across the world, the WSFF has been applied in eight countries on different continents, in projects of different scales and types, which demonstrates its adaptability and practical validity. In the framework of the European NAIAD project (2016–2020) of the Horizon 2020 programme, specific guidelines were developed for use in projects deploying nature-based solutions, which were subsequently published in the *Handbook for the Implementation of Nature-based Solutions for Water Security* (Altamirano, 2019; Altamirano et al., 2021).

1. From water security strategies to investment portfolios: closing gaps

The WSFF makes a concrete contribution to closing two fundamental gaps that have historically limited water security financing.

The first is the gap between political decision-makers and technical experts. Political cycles tend to favour short-term, high-visibility projects, even when they lack complete feasibility studies. Financial sustainability, asset management and institutional structuring are often considered at much later stages, rather than being included in the initial design. The WSFF responds to this challenge by providing a structured process that allows decision-makers to understand, from the outset, the implications of their decisions in terms of life-cycle costs, risks, service levels and financial viability, thus facilitating more informed and responsible decision-making.

The second is the gap between investment needs and existing financial mechanisms. Despite the increasing availability of climate funds, impact investment vehicles and blended finance schemes, many water security projects are unable to access them because they do not meet the required structuring standards. Funds usually require clear performance contracts, evidence of socioeconomic returns and well-defined economic governance mechanisms, prerequisites that many projects explicitly lack. The WSFF addresses this situation by guiding project preparation with robust investment cases and implementation arrangements that are recognized by development banks, donors and potential private investors.

In this way, the framework encourages the mobilization of additional resources and guides the preparation of solid investment portfolios that are scaled over time and aligned with water security and sustainable development goals. Its use helps national governments —and, in particular, subnational actors, who often face greater technical and financial capacity constraints— to strengthen their project preparation processes and to design viable and sustainable proposals. The methodology also allows projects to be visualized in an integrated way, using a nexus-based logic, showing how each measure is connected to a broader strategy for water security, climate change adaptation and biodiversity conservation.

2. Developing the investment case: from project ideas to investment proposals

The core of the WSFF is the development of a complete investment case. It aims to transform a water security need or priority into a structured, credible investment proposal that can attract financing. As international project preparation methodologies indicate, a solid justification requires moving progressively

from vision and strategic planning to the management and economic governance arrangements that will sustain the infrastructure throughout its life cycle. Having the investment case as the final objective enables this project preparation process to be organized and ensures, at each stage, that the proposed solution responds to a logic of development, is technically feasible, provides socioeconomic value and can be funded, financed and managed sustainably.

The process begins with a broad (zoomed out) vision that situates the intervention within a broader agenda of territorial development and climate resilience. In this early phase, the definition of the problem is fine-tuned, the expected strategic impacts are clarified and alternatives are compared with a "business as usual" (BAU) scenario, which makes it possible to justify why an intervention merits advancing to later phases. In addition, work can begin on developing the economic case. A systemic understanding of the costs and benefits of an investment programme or project provides the necessary basis for developing a funding and blended finance strategy.

Once this initial justification is established, the analysis is zoomed in by progressively structuring the five WSFF business cases, with the incorporation of technical, commercial, financial and management evidence. This iterative process improves design quality, reduces uncertainties and guides decisions on governance, funding sources, risk sharing and performance incentives.

The five business cases provide a coherent framework for consolidating the evidence required. The strategic case defines the need for an investment, links the intervention to development objectives and demonstrates its relevance compared to alternatives. The economic case identifies the socioenvironmental benefits, analyses the distributional impacts and assesses whether the intervention generates net value for society. The commercial case determines how the exchange of goods and services will be organized, what actors will be involved and what contractual arrangements can maximize efficiency and performance. The financial case evaluates costs, funding sources, recovery mechanisms, financial viability and possible risk mitigation instruments. Finally, the management case defines the institutional capacities required to plan, execute, operate and maintain the project, as well as the interdependencies that must be managed to ensure its sustainability over time.

The end result is a robust investment case that not only justifies the intervention from multiple perspectives —public, social, technical and financial— but also organizes the preparation process and facilitates the transition to contractual structuring and resource mobilization. This approach enables the entities involved to move from a statement of needs to a bankable proposal, thereby reducing uncertainties, aligning incentives and bolstering confidence among the actors called upon to finance, implement and operate the water security solution.

3. Conceptual elements for analysing the transaction, the institutional context and the implementation arrangement

The Water Security Financing Framework guides proponents through a planning process to design the institutional, contractual, and financial "incentive engineering" needed to develop a water security measure from a strategic concept to an implementation-ready project. This process requires thinking not only about the technical solution, but also about how the asset will be delivered, financed, governed and operated throughout its life cycle. To that end, the WSFF organizes the analysis and design of effective implementation arrangements around three core elements:

The transaction and its fundamental characteristics

The first step is to understand the project's technical and economic nature: the capital intensity, the degree of specificity of the asset (i.e. whether it can be reused for other purposes) and, above all, the functions and services that the resulting infrastructure will provide. These services should be classified according to the type of economic good involved (private, club and public goods or common-pool resources), as this classification determines both the incentive structure and the options for governance, cost recovery and public-private participation.

Level of service required over time

Also necessary is a clear definition of the level of service expected over time, operationalized through key performance indicators (KPIs) that will serve as the basis for contracts, tariff schedules and oversight mechanisms.

Institutional environment and stakeholder capabilities

The WSFF incorporates principles of new institutional economics to examine how formal rules, social norms, incentives and stakeholder capabilities determine which implementation arrangements are feasible and sustainable. This analysis identifies the key actors for implementation —public authorities, operators, communities, industrial users, financial entities and technology providers— along with their strengths, resources, limitations and motivations. Understanding that environment is essential in defining what formal arrangements (contractual, regulatory or coordination-related) are required to ensure sustainable service delivery and maintain the defined performance levels.

Key questions for structuring the implementation and financing arrangement

The WSFF considers the full spectrum of provisioning, governance, financing and funding options for different water security measures. In order to turn a conceptual justification into a structured proposal, proponents must answer a number of basic questions:

- How will the funding sources be generated? (taxes, fees, tariffs, transfers)
- Who will manage the financing during the investment phase, and who will pay for it in the long term? (project finance, municipal bonds, corporate debt)
- Who is best positioned to implement the project and build the infrastructure?
- Who should operate and maintain the asset to ensure efficiency and quality in service delivery?
- Who will monitor service levels and delivery quality?
- Throughout all phases of the life cycle, who should act as the principal (responsible for commissioning) and who should act as the agent (responsible for execution)?
- What contractual incentives should be included to ensure an optimal relationship between quality, risk and cost?

These questions enable the identification of institutional and contractual arrangements that align incentives, reduce risks and guarantee service sustainability. Based on that analysis, the following chapters of the WSFF go into the progressive structuring of the five business cases.

B. The process in brief

The process that the WSFF proposes entails two major stages that culminate in the design of an implementation arrangement for each of the investments envisaged for a given water security plan or programme. If this is not done at the plan level, but instead at the level of a specific infrastructure investment such as a WWTP, some of the planned sub-activities may be modified.

1. Stage I. Zooming out: strategic and economic investment case

This phase is intended to expand the water security project's perspective and place it within a broader economic development context that increases opportunities for access to financing and for implementation. The aim is to strengthen the strategic and economic cases for the water security programme or project

by actively engaging sectors other than those involved in water and the environment to develop a shared vision, an explicit and robust theory of change and an assessment of its strategic alignment with the priorities of the city, watershed, region or decision-maker.

This process also seeks to increase awareness and recognition of ecosystems as an essential part of critical infrastructure, promoting hybrid infrastructure solutions that, if possible, include nature-based solutions (NbS) as pillars of a new paradigm of sustainable and resilient economic development, in addition to generating political support.

This approach increases the possibilities of securing additional sources of financing from different economic sectors, as well as of generating income from the multiple beneficiaries of the services provided by the investment. The expected outcome is a strategic investment road map that defines clearly planned investment project clusters, which will be detailed in stage II.

The first step is to clarify the strategic case by making the proposed water security investment's theory of change explicit. How will the proposed investment enable a paradigm shift towards resilient economic growth?

To develop the strategic case, a collaborative modelling protocol is proposed using group model building techniques that facilitate transdisciplinary collaboration. This exercise begins by building an understanding of the system's current dynamics at the basin scale and identifying the factors that increase vulnerability to water and climate risks, together with any dilemmas or conflicts between economic development and environmental health; the next step involves identifying leverage points to drive a paradigm shift towards more regenerative economic development models.

Once those elements are identified, the design of alternative water security strategies encourages explicit consideration of, for example, the potential for nature-based solutions, considering the role of freshwater ecosystems as a critical infrastructure network of equal importance as traditional infrastructure networks. It is not a matter of choosing between traditional grey infrastructure solutions or natural infrastructure, but rather of identifying the most appropriate combination in light of the nature of the problem and each context's institutional, financial and environmental constraints. It must be borne in mind that healthy ecosystems play a key role by strengthening systemic resilience, as they act as buffers against extreme hydroclimatic events that are gaining strength.

The second step within this first stage is the economic case, which aims to determine, from a social perspective, whether it is worth investing in the selected strategy and chosen measures and investments. To achieve this, multiple variations and combinations of measures are considered and compared. The resulting preferred strategy is likely to be a combination of structural measures (green and grey infrastructure), non-structural measures (information and early warning systems) and economic instruments to manage demand that prove to be cost-effective in addressing the water risks and challenges identified. That list of measures is then organized into clusters of projects for further analysis. Collaborative modelling techniques build a shared understanding and explicitly reveal the functions and service levels that different project clusters can provide over time. Alternative mechanisms for generating revenue based on an explicit hierarchy of functions and derived services are also considered.

Collaborative modelling techniques enable the developers of analytical models for solving complex water management problems to work alongside stakeholders and decision-makers, thereby improving the decision-making process. This approach aims to improve cooperation among stakeholders, as this is a critical factor for the viability and sustainability of integrated watershed master plans. Collaborative modelling techniques include group model building (GMB) and shared vision planning (SVP).

The final outcome is a clearer narrative about the need for a water security investment and about how the proposed strategy maximizes impact compared to the problem's other possible solutions. A systemic understanding, a good understanding of the drivers or root causes of water risks and a consideration of the multiple benefits of the proposed strategy offers a solid starting point for the development of a blended finance strategy that can leverage different sources of thematic concessional funds (such as water finance, climate finance and conservation finance) and synergistically catalyse the creation of new value chains and local service provider markets.

The strategic investment road maps resulting from this process, which will typically consist of clearly planned clusters of investment projects for the short, medium and long terms, have the potential to close the sizeable gaps that exist in the implementation of SDG 6. To summarize, this first phase enables the strategic and economic case for the investment to be developed:

- It focuses on the analysis of the broad context of economic development, climate resilience and well-being that the water security programme or project is to create.
- It seeks to establish a strategic narrative that justifies why the proposed project and investment is essential and represents the most effective option for addressing water and climate risks.
- It promotes the identification of strategic investment road maps that integrate structural solutions (green and grey infrastructure) with non-structural measures (information systems and economic mechanisms to manage demand).

2. Stage II. Further development of implementation arrangements: financial, commercial and management cases

This stage of the process focuses on the in-depth preparation of the selected clusters or investment projects of a water security programme or strategy and, through the development of robust implementation arrangements, on structuring the commercial, financial and management case for each of those. Robust management strategies and contractual mechanisms that minimize implementation and transaction costs strengthen projects' financial viability. The long-term impact and cost-effectiveness of projects can also be strengthened by combining functions. Around the world, multipurpose investments and multifunctional projects are increasingly being considered in order to close financial and equity gaps.

A project's financial viability and its potential to access financing and attract impact investment (financial case) largely depend on a suitable implementation arrangement: one that defines a governance structure and a coherent set of contractual and financial mechanisms that, based on a clear hierarchy of roles and service levels, allocate risks and responsibilities to the parties best able to manage them (management case). In addition, this structuring process facilitates greater alignment between the incentives of different stakeholders (public, private and community) that motivate them to work together towards long-term sustainability in service delivery.

The nature of the resulting contractual arrangements —whether integrated projects for the implementation of traditional or hybrid infrastructure or nature-based solutions, or separate contracts for the design, construction and maintenance of infrastructure— will depend on economies of scale and scope and on the incentives created by different project delivery and finance methods (commercial case). All these factors are weighted according to the long-term objectives of the authorities responsible for contracting and implementing the water security project.

Those decisions are the result of a design and selection process similar to how transport authorities decide whether to contract road lighting separately from other routine maintenance activities and how they determine the volume and types of assets to include in a typical road maintenance cluster and

contract (Altamirano, 2010) the world has seen a proliferation of innovative approaches for the delivery and financing of public services, such as Public-Private- Partnerships (PPPs). Using collaborative modelling techniques, the following key aspects of green and hybrid infrastructure projects are clarified and agreed on with the relevant stakeholders:

- Hierarchy of functions: Combinations of measures that ensure between one and four (as a maximum) main functions or purposes of the infrastructure asset to be created, with clear priorities in the event of conflicts between them. The resulting hierarchy depends not only on the technical design of the work projects or purely biophysical processes, but will also be influenced by the preferences of the responsible entities, depending on which function is most valued by the direct and indirect public and private beneficiaries.
- Function curves, life-cycle costing (LCC), cash flow profiles and risk profiles of infrastructure works. The function curves, risk matrices and total life-cycle costs of grey infrastructure are usually known, but this is not the case for many nature-based solutions (NbS). A wide range of technical expertise (about ecology, morphology, civil engineering and so on) and simulation models are needed to define these variables, which ultimately shape the cash flow and risk profiles of NbS investment projects.

These two building blocks lay the groundwork for further analysis that will lead to the identification of alternative revenue generation strategies (funding strategy) and the selection of an implementation arrangement and/or public procurement strategy. Depending on whether the services provided —not the assets— are deemed public goods, club goods, common-pool resources or private goods, different sources of funding will apply: fees may be imposed on private goods, club goods or goods subject to tolls, while taxes or subsidies (also called transfers) will be required to finance purely public services. In addition, depending on whether taxes, fees or subsidies are identified as the main source of revenue and funding, as well as on whether the public or private sector will be the main sponsor of the project, different types of implementation arrangements will be considered.

Although the design process will vary depending on the type of implementation arrangement, infrastructure investment projects will often require construction, operation or maintenance activities to be delegated to third parties. Whenever a national or local public entity has to implement the activities foreseen for the infrastructure's creation, operation and maintenance, it must decide whether to do so itself or delegate them to another body, be it public, private or community-based. Thus, regardless of the road map or type of implementation arrangement, the project sponsor will have to make financing and procurement decisions and, to that end, the WSFF provides a process to provide guidance in selecting a mechanism for project funding, financing and implementation that reduces transaction costs and creates the right incentives for sustained service delivery.

3. Design of an implementation arrangement

One key element in the development of the five cases is the design of an appropriate implementation arrangement for each water security project or project cluster. The process for designing a fit-for-purpose implementation arrangement requires:

- Characterizing the transaction: This entails analysing the technical and financial characteristics of the infrastructure project or asset, along with the type of economic good the asset provides.
- Explicitly determining the level of service required over time: Level of service (LoS) refers to the defined quality for a specific activity or service area, against which performance can be measured. Usually, levels of service are related to quality, quantity, reliability, responsiveness, environmental acceptability and cost. For example, the quality of the flood mitigation services provided by an urban forest improves over time as the trees mature.

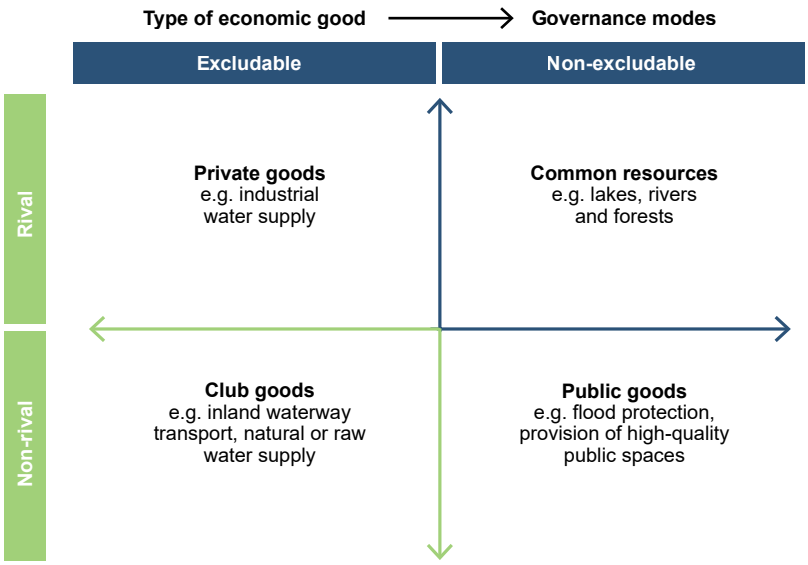
- Assessing the enabling environment through an analysis of the institutional framework: This includes, *inter alia*, (a) an analysis of the stakeholders, mapping their interests, resources and capacities that drive or hinder project implementation, and (b) an analysis of the incentives and disincentives for investment sustainability and their impact over time created by different layers of formal and informal institutions.

The WSFF guides a water infrastructure project through the process of selecting and designing an implementation arrangement. By examining the characteristics of the transaction, the level of service required and the institutional environment, a short list of the implementation arrangements expected to be the most effective can be produced. Guided by key questions and worldwide best practices, proponents can choose from a wide range of project delivery and financing options, ranging from pure public governance options to the creation of regulated markets for private initiatives and innovative business models. This process enables the iterative development of evidence for the five cases.

Designing an implementation arrangement involves four key steps and decisions:

Step 1. Defining a governance mode: Define the main services the project will create and categorize them into types of economic goods. Identify the main services the project will generate and categorize those services according by type of economic good (public, club or private goods or common-pool resources), which will lead to the selection of the most suitable governance mode. The economic good types are shown in diagram 9.

Diagram 9
Types of economic goods and modes of governance



Source: Prepared by the authors, on the basis of Altamirano, M. A. (2019). *Hybrid (green-grey) water security strategies: a blended finance approach for implementation at scale* [Background paper]. Roundtable on Financing Water; and Musgrave, R. A. and Peacock, A. T. (1958). *Classics in the Theory of Public Finance*. Springer.

In economics, a good is anything (an asset, object or service) that can be consumed or that increases utility and can therefore be sold on the market. It can be understood as a visible physical object, as a tangible object or as an intangible service. Their classification into private, club, common-pool and public goods responds to considerations of market failures and externalities. Two attributes underlie this classification:

(i) Rivalry: whether there is competition to obtain a given good or, in other words, whether that good is finite or infinite, or whether the marginal cost of providing a good to an additional consumer is zero or not.

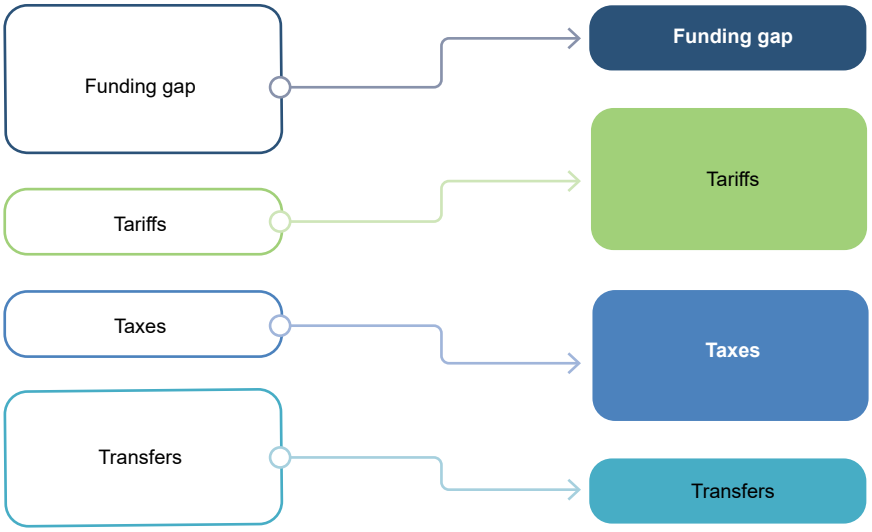
(ii) Exclusion: whether it is possible to exclude someone from consuming a given good and how costly it is to do so.

It should be noted that this step in the WSFF classifies the services provided by the asset that the project creates, and not necessarily the asset itself. For example, a freshwater ecosystem such as a wetland may provide services that are considered private goods, but the wetland itself may be a public good and remain under public ownership. This category helps define appropriate funding sources to ensure cost recovery. The modes of governance or families of implementation arrangements include:

- Publicly awarded projects or contracts: different options are still possible here, ranging from direct implementation by the public sector with its own staff to public-private partnership (PPP) contracts.
- Direct investments in water security driven by the private sector (water stewardship).
- Collective investment vehicles, such as the 26 water funds created in the region with support from IDB, the FEMSA Foundation, The Nature Conservancy (TNC) and other partners.
- Environmental and ecosystem service markets, such as the carbon credit market, the environmental mitigation market or storm water markets, which are highly developed in the United States and, more recently, in countries of the region such as Colombia.

Step 2. Defining the funding strategy: A project's sources of funding or income may be public or private. The main sources of funding, according to OECD, are the three Ts: taxes, tariffs and transfers. The funding strategy addresses the question of who will ultimately pay for the investments made: taxpayers or users. Once the sources of funding —indicating who will ultimately pay for the project— have been determined and secured, the mechanisms for raising upfront capital (financing) and the best way to contract for or purchase the project can be selected. As shown in diagram 10, the aim is to increase the sources of funds through tariffs or taxes and to reduce both the funding gap and the dependence on transfers or subsidies from external sources.

Diagram 10
Funding sources



Source: Prepared by the authors, on the basis of the 3T's model (tariffs, taxes and transfers); and Organisation for Economic Co-operation and Development. (2011). Meeting the challenge of financing water and sanitation: tools and approaches. *OECD Studies on Water*. OECD Publishing. https://doi.org/10.1787/9789264120525-en.

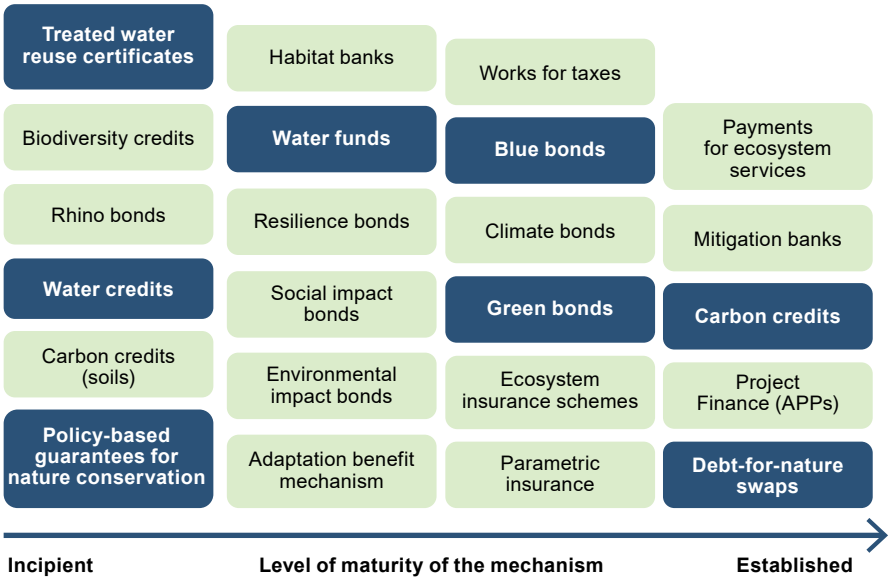
In selecting the implementation arrangements and funding sources, consideration should be given to the typology of economic goods and to the fact that, in general:

- Private goods can generate funding sources through the collection of fees or tariffs (e.g. residential drinking water services).
- Club assets may generate contributions from a defined group (e.g. an irrigation association).
- Common-pool goods or resources need tight regulation to avoid overexploitation (e.g. aquifers).
- And purely public goods are likely to be more dependent on taxes or subsidies (e.g. flood control).

In addition, in many contexts, mosaic projects —projects that fulfil several functions and generate multiple benefits— are advisable, in order to access multiple sources of financing. This portfolio logic increases bankability and attracts investors with different profiles.

Step 3. Defining a financing strategy: Depending on the type of project and whether the project sponsor is public or private —as defined in the governance mode step— various financial instruments can be used to raise the necessary initial resources, to be repaid through financing over time. On account of the trends explained in previous chapters, the past decade has seen an accelerated development of innovative financing mechanisms that could be used to finance water security projects. Diagram 11 shows an updated inventory of the different financing mechanisms that can be used for different types of water security and adaptation projects. Although most of them are only for financing, there are some —such as carbon credits, biodiversity credits and wastewater reuse certificates— that, if selected and applied in the financing strategy, could at the same time strengthen the project's funding or revenue sources.

Diagram 11
Financing mechanisms



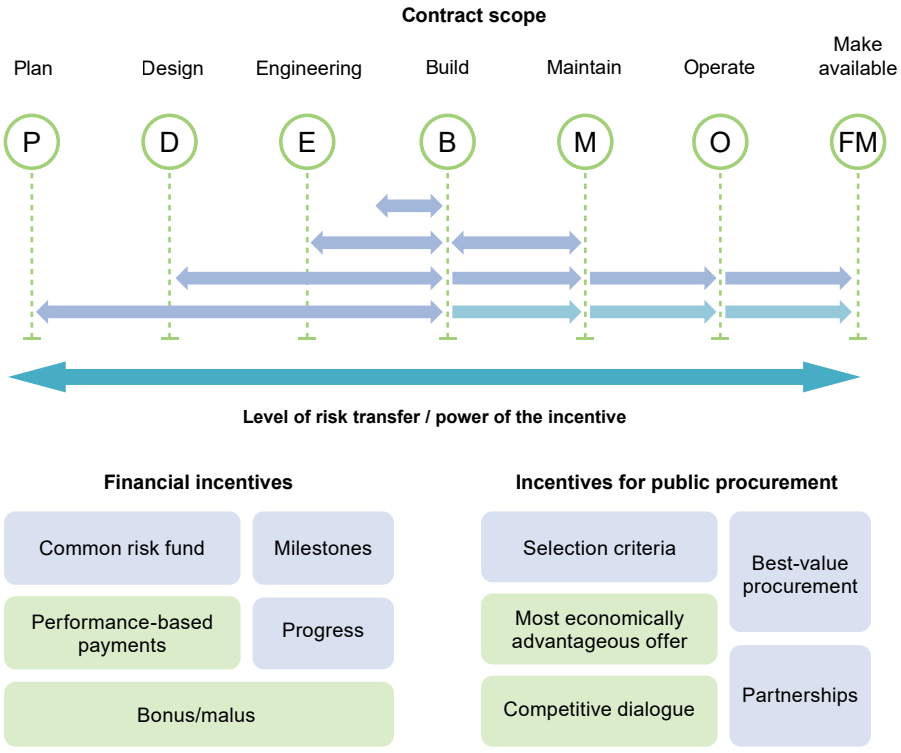
Source: Prepared by the authors, on the basis of Altamirano, M. A. (2021). *Leveraging Private Sector Investments in Adaptation: The Evolving Role of Climate Finance in Enabling a Paradigm Shift.* Climate Markets and Investors Association.

Step 4. Defining a contracting or procurement strategy: This step covers the way in which the project sponsor —often a national or local government agency responsible for project implementation— decides to carry out procurement. This decision is particularly relevant in large-scale, capital-intensive infrastructure projects that create assets with lengthy life cycles.

The process, shown in diagram 12, applies mainly to infrastructure projects that are acquired by governments through public procurement (number 1 in the implementation arrangement families identified in the first step on types of goods and governance modes), by private companies (number 2) or jointly through collective investment vehicles (number 3). The structuring of environmental markets (number 4) follows another design logic, as it does not involve the direct acquisition of specific projects but rather the introduction of regulations so that a new market mechanism can emerge.

In public infrastructure procurements, the government can opt for a fully integrated contract —involving the private sector from planning to operation and maintenance— or for more traditional schemes in which the different phases are tendered separately. In this way, the sponsor can decide whether to award a comprehensive contract covering the entire life cycle (design, construction, operation and maintenance) or to assign specific phases and activities to different entities.

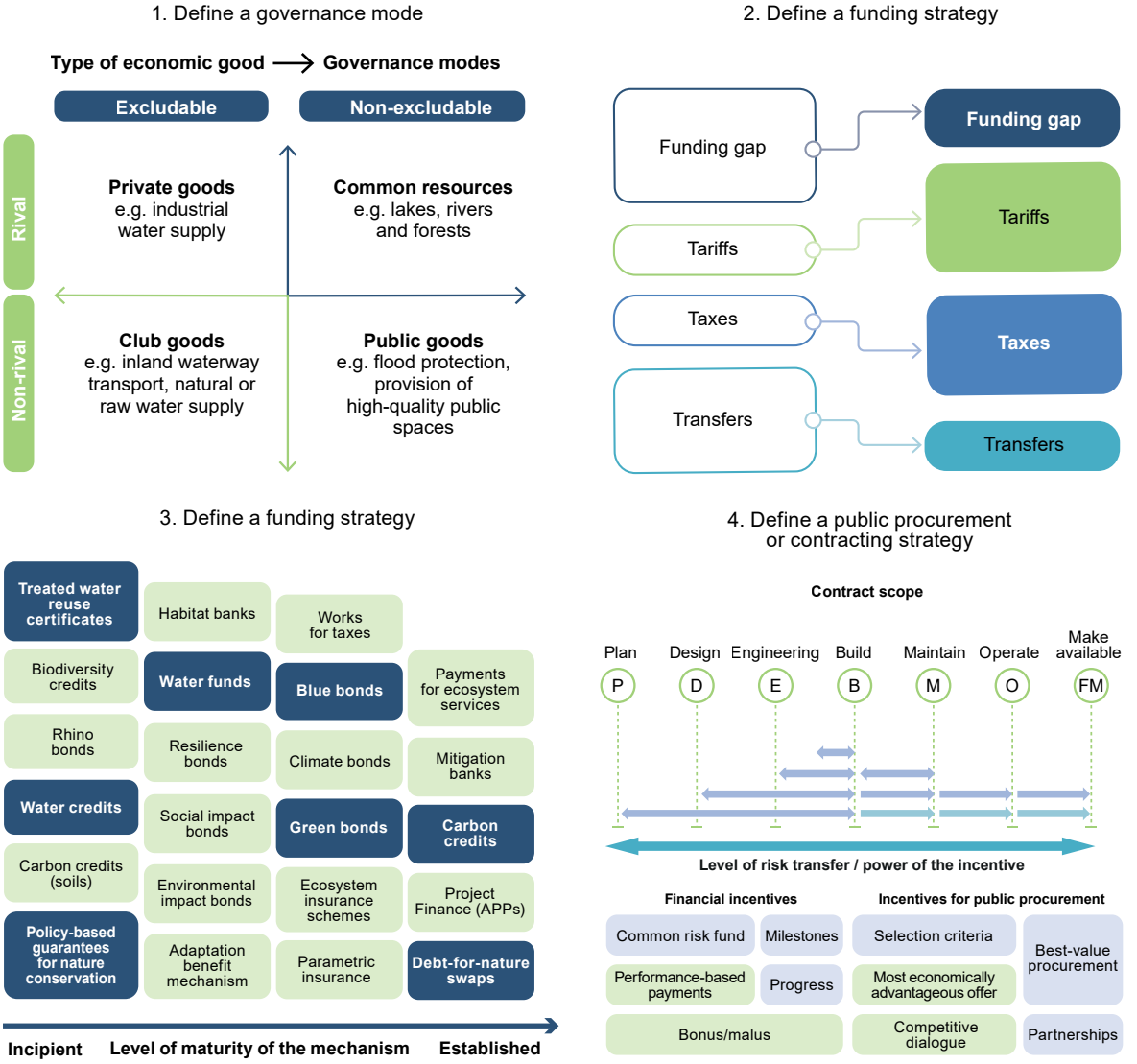
Diagram 12
Types of contracts for infrastructure project implementation



Source: Prepared by the authors, on the basis of Altamirano, M. A. (2019). *Hybrid (green-grey) water security strategies: a blended finance approach for implementation at scale* [Background paper]. Roundtable on Financing Water.

All these decisions regarding the design of the implementation arrangements for the project or project cluster guide the process of structuring and preparing the investment project and enable the five business cases to be developed by project cluster. The complete process is shown in diagram 13.

Diagram 13
Steps in designing the implementation arrangement



Source: Prepared by the authors, on the basis of Altamirano, M. A. (2019). *Hybrid (green-grey) water security strategies: a blended finance approach for implementation at scale* [Background paper]. Roundtable on Financing Water.

C. Designing the road map for project preparation

Moving from an overview of the process to the practical implementation of the WSFF requires defining a preparations road map that allows the activities to be ordered, sequenced and adapted according to the proponent's level of institutional maturity and starting point. The following section sets out this road map and describes how to structure a collaborative process to strengthen each of the five cases.

Rigorous project preparation is one of the main bottlenecks in closing water security investment gaps. As highlighted by the Global Infrastructure Hub (2019), inadequate support at this stage can result in critical projects being scrapped or implementation costs increasing prohibitively. Robust preparation —from conceptualization and feasibility analysis to financial and contractual structuring— is essential to create bankable investment proposals that can mobilize public and private financing.

The design of the WSFF road map starts with identifying the proponent's starting point. If a water security strategy or plan already exists, the process begins by strengthening the strategic case through a comparison of the preferred solution against a business-as-usual scenario. When no such strategy exists, a simplified version of strategic planning —for example, through a collaborative theory of change— should be developed to define the scope of the solution, the expected impacts and the desired service levels.

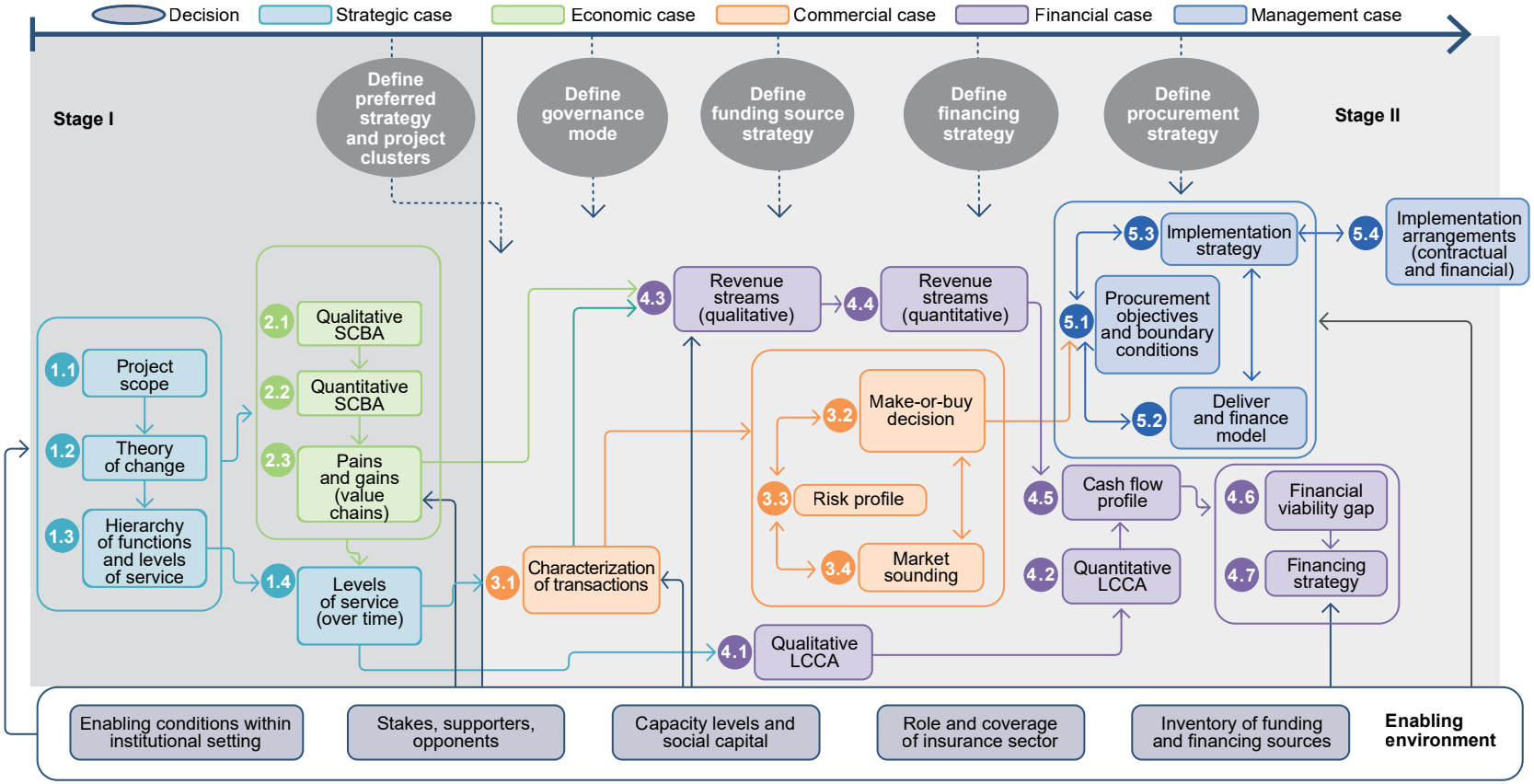
A second key component is the design of the collaborative process. The recommendations to that end are to establish an independent facilitation team, conduct an initial diagnosis to clarify what would constitute a successful outcome from the sponsor's perspective, and map out the institutional positioning, including concerns, capacities and relevant stakeholders. The WSFF promotes structured workshops that can focus on a specific phase of the process: zooming out to refine the strategic and economic cases, or zooming in to gather evidence related to the commercial, financial and management cases. Ex-post validation through interviews with key stakeholders enables the findings to be fine-tuned and the next steps to be specified.

As previously stated —and reiterated here in the interests of clarity— the process consists of two stages. The first —the broad "zoomed out" view— places water investments within an economic development and resilience agenda and defines the theory of change and social cost-benefit analysis underpinning the strategic case and the economic case. The second —"zoomed in"— moves towards more concrete implementation arrangements and analyses governance options, funding sources, contractual incentives and risk sharing.

This progressive project structuring process is shown in diagram 14, which summarizes the complete road map and how the analysis progresses, from the strategic definition to the contractual and financial structuring necessary to produce bankable and investable projects.

Once the road map has been established and the process sequence understood, the systematic analysis of each of the five WSFF cases can proceed. The following sections address the criteria, guiding questions and evidence required to strengthen the strategic, economic, commercial, financial and management cases.

Diagram 14
Road map for preparing water security investment programmes and projects

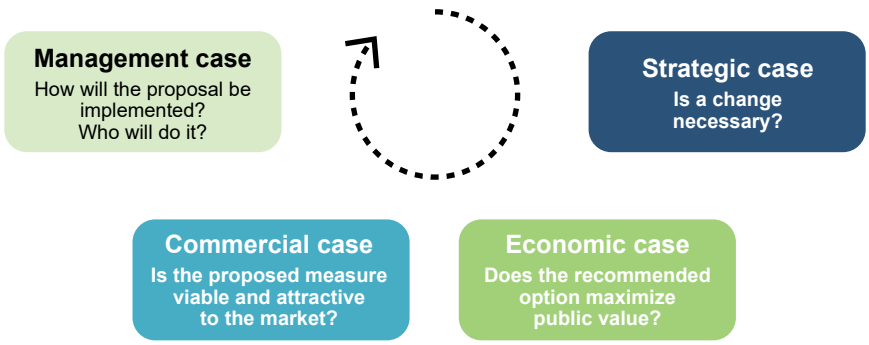


Source: Prepared by the authors, on the basis of Altamirano, M. A., de Rijke, H., Basco, L. and Arellano, B. (2021). *Handbook for the Implementation of Nature-based Solutions for Water Security: Guidelines for Designing an Implementation and Financing Arrangement*.

D. The five business cases

As explained above, the WSFF uses the five-case model to structure how the results of the investment preparation process are presented, as shown in diagram 15. This model assumes that an investment case has five key dimensions: strategic, economic, commercial, financial and management. The specific steps that the WSFF recommends for structuring each of these cases are presented in greater detail below.

Diagram 15
Five business cases



Source: Prepared by the authors, on the basis of the five cases of the United Kingdom HM Treasury. (2018).

1. Strategic case

The strategic case begins with the assessment of the "strategic fit" of the proposed water security strategy: in other words, the extent to which the proposed strategy aligns with strategic drivers, policy priorities and enabling conditions at the institutional level. One necessary step is therefore to work on clarifying the scope of the preferred solution(s) in terms of the type of measures, and to continue with the quantification of the expected level of service (**HM Treasury, 2011**) compared to a project in which the strategy has already been implemented.

In the context of the water and climate crisis, with the realization that traditional economic development paradigms have led to an exponential growth in environmental vulnerability and impact, the strategic case requires an assessment of the project's transformative potential. In other words, one key element of the strategic case is the project or programme's "theory of change".

In the context of water security programmes and within the WSFF, this step requires not only a demonstration of how and why a desired change in a given context will be achieved through the proposed investment programme, but also how it is expected to contribute to and drive an authentic paradigm shift. A paradigm shift in the world's economic models towards low-carbon and climate-resilient development can be achieved by transforming the way in which cities, infrastructure networks, food systems and economies in general expand. In cases where this new paradigm is already in place, the investment programme must demonstrate how it reinforces it over the long term. Table 9 presents all the key criteria for making an initial diagnosis or analysis of the water security project or programme, the questions that can be used to conduct a self-assessment of those criteria and the steps that can be followed in the event that an answer is not yet available. Each of the five cases and some of the steps will be illustrated through the different cases documented as part of the research conducted for this guide.

Table 9
Initial diagnosis and assessment of the strategic case for water security investments

1. Strategic case: alignment of the preferred solution with priorities and enabling conditions		
Criteria	**Self-assessment questions**	**Module**
Clarity of the solution's scope	**Scope of the preferred strategy's solution** Does the preferred strategy have a clear solution scope? Are the measures and their typology included in the preferred strategy clear enough to be explained to everyone? Stakeholders? (yes/no)	1.1
Potential for a paradigm shift	**Theory of change** Is there a clear theory of change that explains the difference in system dynamics between the business-as-usual situation and the situation after implementation of the preferred water security strategy? (yes/no)	1.2
Impact of the solution vs. business as usual	**Hierarchy of functions and levels of service** Have the **service levels** for business as usual and for the solution been defined, prioritized and quantified? (yes/no)	1.3
	Levels of service (over time) Have **these service level**s been mapped and characterized over time? (yes/no)	1.4
Strategic fit: alignment with government priorities, strategic drivers, the overall policy context and the institutional enabling environment	**Enabling conditions** Do cultural values, norms, regulations and political priorities encourage or hinder the preferred solution? Has the application of the preferred solution been identified and analysed? (yes/no)	0.1
	Stakes, supporters, opponents Is there an overall analysis of stakeholders, supporters and opponents? (yes/no)	0.2
	Levels of capacity and social capital and goodwill among public, private and community stakeholders Is it clear that private-, public- and third-sector involvement in the provision of water security and related services (e.g. water supply, protection, quality) is seen as desirable? (yes/no)	0.3
	Role of the insurance sector Is there a clear role for the insurance industry in (driving) the implementation of the water security programme, project or strategy? (yes/no)	0.4
	Inventory of funding and financing sources Has an inventory of possible public and private sources of funding been made? Have financing facilities and instruments been identified? (yes/no)	0.5

Source: Prepared by the authors, on the basis of Altamirano, M. A., de Rijke, H., Basco, L. and Arellano, B. (2021). *Handbook for the Implementation of Nature-based Solutions for Water Security: Guidelines for Designing an Implementation and Financing Arrangement*.

The methodology is based on a central principle: driving this change requires rethinking how investments are made and how infrastructure is planned. This implies:

- Recognizing the catalytic role of water. Water interconnects energy, food and health and, as such, represents both a risk and an opportunity and can serve as a leverage point towards a new development paradigm.
- Planning at the basin scale to manage climate risk. As recommended by the Task Force on Climate-related Financial Disclosures (TCFD)[1] and the High-Level Expert Group on Sustainable Finance (HLEG),[2] environmental externalities and climate risks should be incorporated into investment decisions. Given that most of the impacts of climate change are manifested through the water cycle (World Bank, 2016), project origination should be based on planning that considers hydrological dynamics, the watershed as the unit of analysis and the role of healthy ecosystems as buffers.
- Updating project origination and preparation processes. Traditional approaches and weak institutional frameworks tend to generate portfolios focused on resolving past urgent needs, with little integration and often without a long-term strategic vision.
- Recognizing freshwater ecosystems as critical infrastructures. Their role in reducing climate variability and extreme events, along with the importance of green water, must be explicitly incorporated into planning (Global Commission on the Economics of Water, 2023).

Represented graphically, the theory of change shows how the preferred strategy alters existing vicious circles that compromise the region's water security and sustainable development and creates

[1] More information about TCFD is available at https://www.fsb-tcfd.org/.
[2] More information about HLEG is available at https://ec.europa.eu/info/publications/sustainable-financehigh-level-expert-group_en.

virtuous circles or reinforces existing ones. Theory of change is the main pillar for structuring a compelling narrative of change that triggers commitment among all the stakeholders benefitted by the solution and that increases their willingness to support the intervention financially.

The strategic case —and, more specifically, the strategic fit— are further strengthened by an institutional analysis. The Water Security Financing Framework's institutional analysis is centred on a comprehensive review of the enabling environment for the successful implementation and financial sustainability of the proposed water security strategy. The elements involved in this analysis include an evaluation of:

- **Enabling conditions and incentive gaps:** An analysis of all the incentives and disincentives created by formal and informal institutions for water security investments and their long-term sustainability. The four-layer institutional model (Williamson, 1998, 2000) is particularly useful in this regard.
- **Stakes, supporters, opponents:** Analysis of the stakeholders and identification of their interests and positions with respect to a change in the business-as-usual (BAU) scenario and vis-à-vis the alternative solutions proposed.
- **Levels of capacity, social capital and goodwill among public, private and community stakeholders:** Identification of all actors with a stake in implementation over the infrastructure asset's life cycle, be it traditional or natural; analysis of the strengths of public, private and community stakeholders and the levels of trust and linkages between them.
- **Role of the insurance sector (optional):** Analysis of the role and coverage of insurance schemes, and the incentives that national insurance and reinsurance regimes create for the active participation of the insurance community and private infrastructure asset owners in the mitigation of water-related catastrophic risks and thus in water security investments.
- **Inventory of instruments for generating funding and financing:** An inventory is drawn up of the economic instruments and other mechanisms that exist to generate sources of income (funding) and financing for programme or project implementation, from both public and private sources and including both concessional and commercials funds.

Box 1 presents the strategic case of the Metapán WWTP in El Salvador to illustrate and summarize the outcomes of three of the Water Security Financing Framework's steps:

1.1 Solution scope

1.2 Theory of change

1.3 Hierarchy of functions and levels of service

The case documentation was produced through a mixed research process that combined field work, participatory sessions and virtual consultations with local authorities and representatives of the municipality of Metapán, the National Water Supply and Sewerage Administration (ANDA), ministries involved with the water and environmental sectors and private sector actors associated with the project, including the Holcim cement company and representatives of the Lempa River Hydroelectric Executive Commission (CEL).

Box 1
Strategic case of the Metapán WWTP, El Salvador

Project description

The Metapán Wastewater Treatment Plant (WWTP) is a pioneering project in El Salvador intended to reverse the contamination of the San José River and the Metapán Lagoon, an ecosystem of high ecological and social value located northwest of Lake Güija within the Güija Complex, which was declared a Ramsar site in 2010 for its international biodiversity importance and for its hosting of critical Central American tropical dry forest ecosystems. The lagoon, one of the municipality of Metapán's main natural resources, supports artisanal fishing, agriculture, livestock grazing and tourism, but for decades it received the city's wastewater through the San José River, a 6.4 km torrential waterway that discharges directly into the wetland.

The total investment exceeded US$ 3.6 million, financed mainly by the municipality but supplemented with significant contributions from strategic partners: US$ 800,000 from the Special Fund for ANTEL Resources (FANTEL), some US$ 250,000 from Holcim for network separation and technical assistance, and funds and technical support from the National Water Supply and Sewerage Administration (ANDA), the Ministry of Environment and Natural Resources (MARN), the Social Investment Fund for Local Development (FISDL), GIZ and the Trifinio Plan.

Solution scope (1.1)

The diagnosis identified the discharge of untreated wastewater as the main source of environmental pressure on the Metapán Lagoon, affecting water quality and public health. The selected solution was a WWTP with secondary treatment. The project involves the construction and operation of an anaerobic treatment plant designed to remove the organic load from urban wastewater.

The project also includes complementary infrastructure, such as the acquisition of 25 plots of land for easements —with an estimated cost of US$ 1 million— and the planned construction of a reservoir to store treated water (not yet completed). These measures constitute a coherent intervention package that is technically feasible and in alignment with local environmental and health priorities.

In its current phase, the municipality is exploring options for financial sustainability, including the reuse of 1,000–1,500 m³/day of treated water, sludge recovery and the exploitation of biogas, in coordination with the Lempa River Hydroelectric Executive Commission and the Acelhuate biogas plant project, on account of the technological synergy and strategic relevance of both projects for the national water and energy transition.

Theory of change (1.2)

The investment in the Metapán WWTP is a strategic response to decades of accumulated deterioration in the San José River and the Metapán Lagoon, bodies of water that are part of the Güija Complex Ramsar Site and that support such essential economic activities as artisanal fishing, agriculture, tourism and the local water supply. The proliferation of water lilies (*Nymphaeaceae*) —which can cover up to 90% of the lagoon's surface— emerged as a visible symptom of the ongoing ecological collapse, causing the asphyxiation of the aquatic ecosystem, an accelerated loss of biodiversity and direct effects on the surrounding communities' livelihoods. That situation, together with growing social pressures and the national commitments arising from the Ramsar designation, underscored the urgency and legitimacy of a structural intervention based on sanitation.

The theory of change presented in diagram 16 —the result of a collaborative modelling process with technical, community and institutional stakeholders— shows how investments in the WWTP and its expanded design (treated water reuse, sludge recovery and methane energy recovery) act on critical leverage points within the system. Capital investments (shown in orange in the diagram) trigger direct transformations in structural factors (shown in green), such as the reduction of untreated discharges and the reduction of nutrients that feed the proliferation of water lilies. In turn, those changes enable improvements in economic activities (in turquoise), particularly fishing, tourism and local production chains linked to the efficient use of water.

According to this systemic logic, the WWTP operates as a catalyst to halt the reinforcing negative dynamics that for decades degraded the lagoon ecosystem. The sustained reduction of organic and nutrient loads from domestic wastewater and agricultural runoff —nutrients that could be replaced by the use of stabilized sludge to improve soils— will lead, in the medium term, to a decrease in the area covered by water lilies and a simultaneous improvement of key ecological parameters: increased water oxygenation, recovery of fish populations and increased navigability, with a direct impact on community well-being and local economic activity.

The diagram also shows that these environmental benefits will produce indirect positive effects downstream in the upper Lempa River basin, since the lagoon is part of its water system. Although the Metapán lagoon is not directly connected to hydroelectric reservoirs of the Lempa River Hydroelectric Executive Commission, its recovery improves water regulation and water quality in the upper basin, which has an impact on the availability and stability of the flow to strategic infrastructure such as the Cerrón Grande reservoir. In addition, sludge recovery and the potential for generating biogas position the intervention within a circular economy framework with direct energy benefits.

The methane recovery potential of the Metapán WWTP has been noted in recent ECLAC studies. Based on information provided by the National Water Supply and Sewerage Administration, and taking into account the treatment plant's anaerobic technology (UASB type reactor), it produces about around 311,847 m³ of methane a year, of which some 278,148 m³ could be recovered, for an energy yield of 2,773 MWh/year. However, given the efficiencies of the cogeneration systems, only 971 MWh of electrical energy and 1,109 MWh of heat energy would be usable per year. A financial evaluation, using a discount rate of 10% and a 20-year term, shows that the investments for methane use at the WWTP (estimated at about US$ 400,000), report an estimated income of US$ 1.23 million: a benefit of about 23.1 times the investment and a return rate of 37%, which would allow the investment to be recovered in 3.4 years (the benefits are expressed primarily in terms of savings in the WWTP's electricity supply and without considering the co-benefits of reduced methane emissions), as shown in table 1.

Table 1
Potential for methane use at the Metapán WWTP

Name	Installed capacity (l/s)	Treated flow (l/s)	Inlet concentration (COD, mg/l)	Population served	Treatment technology	Methane		Recoverable methane litre of CH4 /m³ treated water	Energy content (MWh/year)	Energy cogeneration	
						Generated (m^3/year)	Recoverable (m^3/year)			Electricity (MWh/year)	Caloric (MWh/year)
El Salvador											
Metapán	60	50	700	19 830	UASB reactor + percolator filter	311 847	278 148	176,4	2 773	971	1 109

Source: Saravia Matus, S., Fernández, D., Chavarro, P., Montañez, A. y Sarmanto, N. (2025). Energy recovery from methane in wastewater treatment: case studies in El Salvador, Mexico and Panama. *Natural Resources and Development Series* (226) (LC/TS.2024/143). Economic Commission for Latin America and the Caribbean.

Finally, the theory of change illustrates the structural difference between the BAU scenario —ongoing degradation, loss of ecosystem services and reduction of economic opportunities— and the future offered by the preferred strategy, which consolidates environmental, social and economic virtuous circles, aligning the intervention with the pursuit of SDG 6, SDG 13, SDG 14 and SDG 8, as well as El Salvador's commitments under the three Rio Conventions. This clear and robust theory of change allows the construction of a strategic narrative that can mobilize the stakeholders involved and substantiate the need to ensure the treatment plant's financial sustainability, which are prerequisites for consolidating the long-term benefits of this essential public investment.

Hierarchy of functions and levels of service (1.3)

The WWTP investment has the following hierarchy of functions, where the primary function is to provide wastewater treatment, and the possible secondary functions being considered are energy generation and sludge recovery. Related to these three main functions are a series of services that could create sources of income or funding for the project, depending on the type of economic good generated and the target group. They can be seen in table 2.

Table 2
Hierarchy of functions and economic goods, Metapán WWTP

Function	Service	Type of good	Target group	Fund generation mechanism
Wastewater treatment	Sanitation and sewage management	Club good	Inhabitants of Metapán	Tariffs
	Reduced pollution in the lagoon	Public good (environmental)	Groups whose incomes depend on the lagoon's health	Taxes or transfers (e.g. GEF funds)
	Supply of treated water	Private good	Farmers and industrial groups	Tariffs
Power generation	Biogas and methane production	Private good	National energy suppliers (grid feed-in)	Tariffs
			Self-consumption	Reduced operating costs
	Reduced emissions	Global public (environmental) good		Carbon credits or transfers (e.g. from climate funds)
Sludge recovery	Biofertilizers	Private good	Farmers	Tariffs

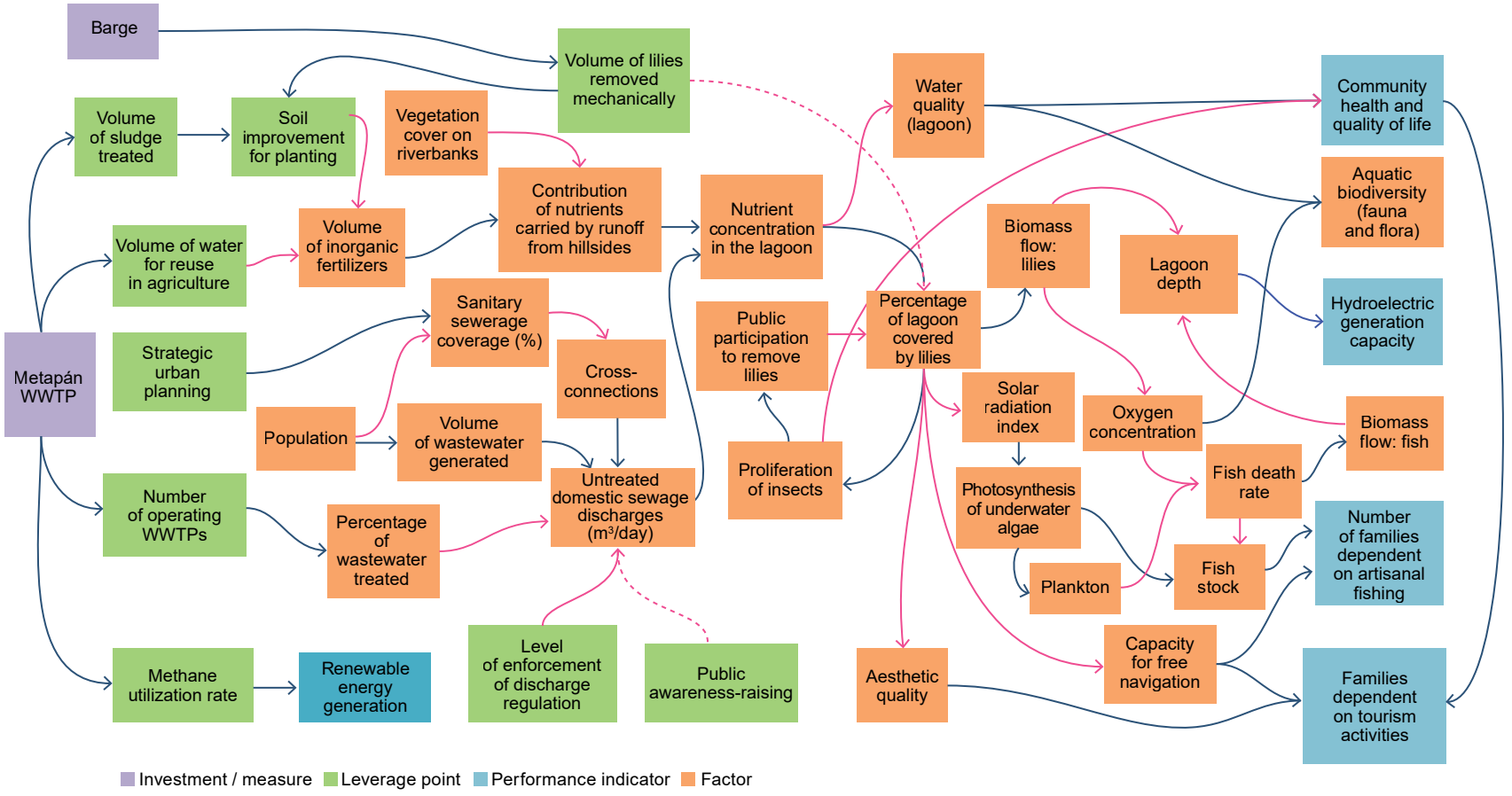
Source: Prepared by the authors.

Lessons learned and methodological implications for the WSFF

- The enabling environment defines, from the outset, which governance arrangements are feasible and which are not. At Tenorio, multilevel coordination and a stable regulatory framework facilitated structuring.
- Developing a robust strategic investment case requires structural analysis, not just a justifying narrative. Defining a clear technical scope and a sound theory of change is critical to guide the rest of the project structuring process.
- The theory of change facilitates subsequent institutional and financial decisions. By explicitly portraying how the intervention alters the system's dynamics, it enables informed conversations between public, private and community entities and opens up options for the explicit selection and identification of new funding sources.
- The hierarchy of functions sets the stage for the economic, commercial and financial case. Identifying which function benefits whom enables value streams —and, potentially, revenue streams— to be anticipated. Analytical clarity in this phase reduces the risk of rework in subsequent phases.
- Incomplete strategic cases tend to generate inconsistencies in the design of the economic governance mechanisms, the contracting model and even risk allocation. Early stakeholder involvement is essential to validate strategic assumptions.
- The Metapán experience demonstrates that validating the theory of change and functions with local stakeholders improves the preferred solution's legitimacy and feasibility.

Source: Prepared by the authors.

Diagram 16
Effects of the investment on the Metapán Lagoon's environmental problems (theory of change)



Source: Prepared by the authors.

Box 2 presents, for illustrative purposes, the enabling environment for the Tenorio WWTP in Mexico, along with a brief summary of the outcomes of three of the WSFF steps:

0.1 Enabling conditions in the institutional framework

0.2 Stakes, supporters, opponents

0.3 Institutional capacities and social capital

0.4 Role of the insurance sector

Box 2
Enabling environment for investment at the Tenorio WWTP, San Luis Potosí, Mexico

Project description

The Tenorio WWTP, located in San Luis Potosí, was designed to supply treated water to local industries, reduce pressure on overexploited aquifers and improve environmental quality. The project entailed major World Bank participation and a multistakeholder governance model involving the federal National Water Commission (CONAGUA), state authorities and industrial users. This makes it a particularly robust example to illustrate the Water Security Financing Framework's institutional enablers.

The plant has the capacity to treat 90,720 m³ of urban wastewater a day (equal to just over 1,050 litres a second) and uses advanced processes that include biological treatment, clarification and disinfection with chlorine and ultraviolet rays. The treated water is distributed along an approximately 40-km pipeline to the Villa de Reyes Combined Cycle Power Plant, as well as to industrial and agricultural users under specific contractual arrangements. The concession was granted by the State Water Commission (CEA) of San Luis Potosí to the company Aguas del Reúso de Tenorio (ARTE), made up by Degrémont (41%), Sumitomo (39%) and Prodin (20%) (Equihua and Rojas, 2013; De la Peña, Larrea, Sasaki and Smith, 2022).

The plant, inaugurated in 2006 under a 20-year BOT scheme, treats 45% of the city's urban wastewater and reuses 100% of the treated water.

Enabling conditions in the institutional framework (Step 0.1)

- The Tenorio WWTP was developed in an environment where the federal regulatory framework for industrial reuse was clear, with technical standards governing discharges and treated water quality.
- CONAGUA and state authorities provided a stable legal and administrative framework, which facilitated permits and oversight.
- World Bank support strengthened governance through transparency requirements, risk analyses and environmental standards.

Stakes, supporters, opponents (Step 0.2)

- Local industries had a keen interest in securing sustainable sources of water, which generated a strong incentive for them to cooperate with the project.
- State authorities saw Tenorio as a solution to aquifer overexploitation and as an effective way to meet environmental goals.
- There was no significant opposition from any particular group, but general concern did exist at the beginning, related to possible fees and the availability and reliability of supply.

Institutional capacities and social capital (Step 0.3)

- The state and municipal technical teams had the operational capacity to integrate the project with the existing infrastructure.
- The World Bank supported the technical, economic and contractual structuring, thus strengthening local capacities.
- Public-private cooperation benefited from pre-existing relationships of trust between industry and the state government.

Role of the insurance sector: risk management regimes (Step 0.4)

Although this case was not designed with an explicit role for the insurance sector, it does incorporate several elements that are typically analysed at this step:

- Compliance with environmental and risk mitigation standards.
- Reduction of operating risks through World Bank guarantees and financial mechanisms.
- Strengthening industrial water resilience, a matter of importance to corporate risk management.

Lessons learned and methodological implications for the WSFF

- The enabling environment defines, from the outset, which governance arrangements are feasible and which are not. At Tenorio, multilevel coordination and a stable regulatory framework facilitated structuring.
- The interests and needs of the productive actors determine the political arena for the generation of funding sources. High levels of industrial demand created a natural pull towards reuse solutions.
- Institutional capacities shape the complexity of the contractual model. In this case, thanks to the support of the World Bank, the project was able to incorporate advanced risk management tools.
- Institutional enablers make it possible for future risks and costs to be anticipated. Early evaluation avoids the design of transactions that cannot be implemented due to regulatory or capacity constraints.
- Enablers must be evaluated prior to any decision on the contractual structure or funding model. The Tenorio case shows that a solid institutional base reduces uncertainty in the financial, commercial and management cases.

Source: Prepared by the authors, on the basis of WaterWorld. (2004, 1 June). *Degrémont wins water reuse contract in Mexico*. https://www.waterworld.com/wastewater-treatment/article/16200790/degremont-wins-water-reuse-contract-in-mexico; Equihua, L. and Rojas, A. (2013). Tenorio project: a case of sustainable development in Mexico. *Desalination and Water Treatment, 51*(1–3). https://doi.org/10.1080/19443994.2012.714649; World Bank. (2018). *Wastewater: from waste to resource. The case of Atotonilco de Tula, Mexico*. http://documents.worldbank.org/curated/en/922441521175520658; Delgado, A., Rodríguez, D. J., Amadei, C. A. and Makino, M. (2021). *Water in circular economy and resilience (WICER)*. World Bank. https://www.worldbank.org/en/topic/water/publication/wicer; De la Peña, M. E., Larrea, C., Sasaki, K. and Smith, D. (2022). El reúso de agua residual tratada en América Latina y el Caribe: 10 estudios de caso. Inter-American Development Bank. http://dx.doi.org/10.18235/0004515.

2. Economic case

The economic case aims to define whether, from a societal perspective, it is worth investing in the preferred strategy for the proposed water security programme or project. In addition to the cost-benefit analysis, the WSFF economic case aims to identify the specific economic sectors and stakeholders within the value chains that are affected by both the BAU scenario and the scenario in which the preferred strategy has been implemented. Table 10 details the criteria and specific questions to be addressed in the economic case.

Table 10
Initial diagnosis and assessment of the economic case

2. Economic **Societal value of investing in the preferred strategy or the preferred option**		**Module**
Criteria	**Self-assessment questions**	
Benefits versus costs Job creation potential of the programme or project versus BAU	**Qualitative social cost-benefit analysis** Is there a qualitative analysis of the avoided damage, social benefits and opportunity costs of the BAU scenario versus the implementation of the preferred strategy? (yes/no)	2.1
	Quantitative social cost-benefit analysis Is there a quantitative analysis of the avoided damage, social benefits and opportunity costs of the BAU scenario versus the implementation of the preferred water security strategy, programme or project? (yes/no)	2.2
Distributive effects	**Distributional costs and benefits ("pains and gains")** Have the basin's value chains and their dependence on water resources been analysed? Have specific winners and losers been identified under the BAU scenario compared to the implementation of the programme or project? (yes/no)	2.3

Source: Prepared by the authors, on the basis of Altamirano, M., de Rijke, H., Basco, L. and Arellano, B. (2021). *Handbook for the Implementation of Nature-based Solutions for Water Security: Guidelines for Designing an Implementation and Financing Arrangement.*

This allows for a more granular economic analysis in order to determine the winners and the losers, given that both scenarios impact the basin's productive value chains. The "winners and losers" analysis provides a first step towards identifying the stakeholders who might be willing to pay for the services created by the water infrastructure asset. At the same time, it serves to identify the stakeholders who may need to be compensated if the programme or project is implemented.

Box 3
Economic case: La Farfana Biofactory, Santiago, Chile

Project description

The La Farfana Biofactory, located in the metropolitan area of Santiago, Chile, and operated by Aguas Andinas, is one of the largest wastewater treatment facilities in Latin America. Since its inauguration in 2003, it has treated the wastewater of approximately 50% of the Greater Santiago sanitation system, which serves nearly 6 million people, contributing decisively to the reversal of decades of environmental deterioration in the Mapocho River.

Subsequently, through investments in anaerobic digestion, biogas generation, thermal drying, production of agrocompost biosolids and improvements in energy efficiency, La Farfana evolved towards a biofactory model, maximizing resource recovery and slashing final waste disposal to almost zero. That transformation made the plant an international reference point for the circular economy and sanitation infrastructure.

La Farfana was developed under a build-operate-transfer (BOT) scheme between Aguas Andinas and EDAM (a subsidiary of SUEZ, at the time Degrémont S.A). It was inaugurated in 2003 and, at the time, was the largest WWTP in Latin America and a key element in achieving 100% treatment coverage in Chile's urban areas.

Qualitative and quantitative cost and benefit analysis (2.1 and 2.2)

La Farfana demonstrates how investment in a WWTP and the provision of sanitation services generates multiple socioenvironmental benefits beyond regulatory compliance. Those benefits are shown in qualitative and quantitative terms in the following table.

Table 1
Benefits generated by La Farfana Biofactory, Chile

Benefit category	Qualitative description	Quantitative evidence
Environmental recovery and water security	Drastic reduction in pollutants discharge into the Mapocho River; ecological recovery.	607,000–766,000 m³ treated a day; 50% of the sanitation of Greater Santiago; ecological improvements recorded.
Improved quality of urban life	Elimination of odours and vectors; sanitary and urban improvements.	Compliance with sanitary standards; elimination of raw discharge.
Energy security	Energy self-production; reduced vulnerability to electricity prices.	41,620 MWh generated in 2023; 74.4% of energy consumption covered; estimated savings of US$ 7.07 million a year.
Climate mitigation	Reduced emissions; methane capture; substitution of fossil fuels.	90,000 Nm³ of biogas a day; reduction of 138,516 tCO_2e (2011–2018); 2023 credits: 4,426 tCO_2e = US$ 277,240.
Waste recovery (biosolids)	Transformation of sludge into certified agricultural biosolids.	11,752 m³ of sludge a month; 45,080 tons in cumulative sales; 16,310 tons sold in 2024; 100% recovery.
Energy benefits (biogas)	In-house use of biogas and its sale as biofuel.	Gross income: US$ 3 million a year; Operating expenditure: US$ 2 million a year; net income: US$ 1 million a year; Metrogas savings: US$ 1.6 million a year.
Financial benefits enhanced by additional investments	Stability through regulated tariffs; accelerated recovery of investments through additional sources of revenue and avoided costs.	Sanitary tariff US$ 0.72/m³; treatment tariff US$ 0.126/m³; biogas upgrading investment US$ 6 million; payback 2.7 years.

Source: Prepared by the authors.

The table below shows all the capital and operating costs involved in the implementation of the Farfana plant since its initial construction.

- Initial construction costs of the WWTP, as part of the Greater Santiago sanitation programme.
- Energy recovery infrastructure costs (biogas upgrading, gas pipeline).
- Annual operating costs of the biogas system.
- Technological modernization costs to improve biomethane quality.

Table 2
Capital costs and operating costs of La Farfana Biofactory

Category	Qualitative	Quantitative
Main capital expenditure for construction	Construction of the La Farfana WWTP as part of the Greater Santiago sanitation programme.	US$ 315 million
Total capital expenditure of the sanitation programme	Total investments to enable 100% treatment for Greater Santiago (La Farfana + Mapocho-Trebal).	US$ 900 million
Capital expenditure for biogas upgrading	Investment for biogas purification system and gas pipeline (13.5 km).	US$ 6 million
Capital expenditure for additional biogas modernization	Technological modernization of the biogas system.	US$ 2.7 million
Operating expenditure for the biogas system	Annual operating and maintenance costs of the biogas system.	US$ 2 million/year
Operating expenditure for the WWTP (implicit in tariff)	Operating cost taken into account in the regulated sanitation tariff.	US$ 0.126/m³ for treatment (15% of the US$ 0.72/m³ tariff)

Source: Prepared by the authors, on the basis of World Bank. (2019). *Wastewater: from waste to resource. The case of Santiago, Chile*. http://documents.worldbank.org/curated/en/284951573498126244; Ybarra Moreno, J. and Chinga Dolarea, P. (2020, 17 June). *Un día en las biofactorías del Gran Santiago de Chile* [Webinar]. Asociación Latinoamericana de Desalación y Reúso de Agua; Aguas Andinas. (2022). *Strategic partner*. https://www.aguasandinasinversionistas.cl/en/grupo-controlador; Aguas Andinas. (2025). *Reporte integrado 2024*; De la Peña, M. E., Larrea, C., Sasaki, K. and Smith, D. (2022). *El reúso de agua residual tratada en América Latina y el Caribe: 10 estudios de caso*. Inter-American Development Bank. http://dx.doi.org/10.18235/0004515.

Box 3 and table 11 show the economic case for the La Farfana Biofactory in Santiago, Chile, and the Tenorio WWTP in San Luis Potosí, Mexico, and, more specifically, the result of three WSFF modules:

2.1 Qualitative cost-benefit analysis

2.2 Quantitative cost-benefit analysis (if applicable)

2.3 Distributional costs and benefits, winners and losers ("pains and gains")

The private sector has the capacity and interest to assume services or tasks that the contracting entity might be willing to delegate, or could even be willing to execute these activities on its own initiative: i.e. unsolicited proposals.

Within this analysis, the outline of the contracting strategy is defined and the first evaluation of the main contractual issues is conducted. Consequently, the first step in the commercial case is to propose a mode of governance that is best suited to service delivery and to the management of the infrastructure asset, whether traditional or natural.

Table 11
Winners and losers: pains and gains experienced by different groups if the proposed investment is made (2.3). Example: Tenorio WWTP, Mexico

Sector	Target group	Winner / Loser	BAU – Pains	BAU – Benefits	Solution – Pain or gain?	Solution – Benefits
Industry	Industrial companies in San Luis Potosí	Winner	Yes. Supply uncertainties due to overexploitation; risk of interrupted operations.	No	Not significant. Initial adjustments to treated water quality and consistency.	Yes. Safer water source; reduced operating risks; productive continuity.
State government / operating agencies	San Luis Potosí State Government and system operator	Winner	Yes. Pressure on aquifers; rising costs; reputational risk.	No	Yes (moderate). Monitoring and institutional strengthening requirements.	Yes. Reduced pressure on aquifers; regulatory compliance; environmental improvements.
Local community	Inhabitants of San Luis Potosí	Neutral-Winner	Yes. Long-term risks due to source depletion; potential conflicts due to industrial use.	No	Not significant.	Yes. Indirect benefits through greater water stability.

Sector	Target group	Winner / Loser	BAU – Pains	BAU – Benefits	Solution – Pain or gain?	Solution – Benefits
Agricultural sector	Local farmers	Neutral	Yes. Increasing competition for water with the industrial sector.	No	Not significant.	Yes (indirect). Reduced pressure on aquifers; stable availability.
Environmental authorities	Secretariat of the Environment and Natural Resources (SEMARNAT), National Water Commission (CONAGUA)	Winner	Yes. Difficulty in meeting environmental goals due to discharges and overexploitation.	No	No.	Yes. Improved indicators and strengthened regulatory compliance.

Source: Prepared by the authors.

3. Commercial case

The commercial case seeks to answer three main questions:

(i) Is the preferred strategy or proposed investment project viable?

(ii) Is there a supplier or private market agent capable of meeting the defined needs and expected service levels?

(iii) Can the programme or project be implemented in such a way as to produce an arrangement that guarantees value for money?

At this point, one key element is the make-or-buy decision, which requires assessing the expected role of the public and private sectors in the provision of the investment programme or project and associated services. At this stage, it must be determined whether the private sector has the capacity and interest to assume services or tasks that the procuring entity might be willing to delegate, or whether it could even be willing to execute these activities on its own initiative: i.e. unsolicited proposals. Within this analysis, the outline of the contracting strategy is defined and the first evaluation of the main contractual issues is conducted. Consequently, the first step in the commercial case is to propose a mode of governance that is best suited to service delivery and to the management of the infrastructure asset, whether traditional or natural.

More specifically, investments in water security —including water and sanitation projects as well as watershed conservation projects— can take any of the following four forms:

(i) Publicly awarded projects or contracts.

(ii) Direct investments in water security driven by the private sector (water stewardship).

(iii) Collective investment vehicles, such as water funds.

(iv) Environmental and ecosystem service markets.

In most cases, the provision of water services and water security projects will involve some degree of public participation, through either public procurement or market regulation.

Consequently, the remainder of the commercial case is oriented towards identifying which tasks and risks should be assumed by the authorities and which can be delegated to market agents. The risks identified in the commercial case are those that compromise successful implementation, financial sustainability and key performance indicators over the asset's entire life. Those performance indicators usually represent the attainment of the level of service required for the services to be provided by the water infrastructure assets.

The final element in the commercial case requires a comprehensive inventory of private organizations and other non-public entities with the capacity to take on specific tasks or activities throughout the entire public investment cycle or capital project life cycle, as well as the associated risks. The specific criteria and questions to be addressed in the commercial case, as well as links to the corresponding forms, are shown in table 12.

Table 12
Initial diagnosis and assessment of the commercial case for water security investments

3. Commercial **Does the private sector have the capacity to assume the activities or services involved in carrying out the project or any interest in doing so?**		**Module**
Criteria	**Self-assessment questions**	
Dependence on regulation of the commercial activity involved in providing the services	**Characterization of the transaction** Is there a clear understanding of the transaction in question? Have the capital-intensive elements of the water security strategy been identified? Have the services to be provided or enhanced by the investment been classified according to the type of economic good (e.g. public good, tariffed (or club) good or private good)? (yes/no)	3.1
Quality of the contracting strategy	**Outsourcing decision** Is there a clear understanding of the tasks involved in the provision of water services (water security) and of who (public sector, private sector or community stakeholders) is best placed to take on each of those tasks and the associated risks? (yes/no)	3.2
Technical and construction risks ESG risks[a]	**Risk profile** Have the risks involved in implementing the measures that make up the water security strategy, throughout its entire life cycle, been characterized? Is there a plan to manage those different risks? (yes/no)	3.3
Private sector interest in implementing and/or investing[b]	**Market sounding** Have the private organizations and other non-public entities (e.g. third sector or communities) with the capacity and willingness to take on the required activities/tasks and associated risks been identified? (yes/no)	3.4

Source: Prepared by the authors, on the basis of Altamirano, M. A., de Rijke, H., Basco, L. and Arellano, B. (2021). *Handbook for the Implementation of Nature-based Solutions for Water Security: Guidelines for Designing an Implementation and Financing Arrangement*.

[a] ESG risks.

[b] This is largely related to: (a) the dependence of the business activity on regulation and enforcement (enabling environment), and (b) the potential for generating income (financial case).

Box 4 illustrates the commercial case for the Tenorio WWTP in Mexico and the Aquapolo WWTP in Brazil using the following steps of the WSFF:

3.1 Characterization of the transaction (Aquapolo)

3.2 Make-or-buy decision (Aquapolo)

3.3 Risk profile and preliminary allocation (both cases)

3.4 Market sounding (Aquapolo)

Box 4
Commercial case: Aquapolo WWTP, Brazil and elements of Tenorio WWTP, Mexico

Project description

Aquapolo, one of the world's largest industrial water reuse projects, was developed to supply treated water to the Capuava petrochemical plant, operated by Braskem. The project was promoted by the public sanitation company of the State of São Paulo (SABESP) in partnership with the private company Foz do Brasil (Odebrecht Group). Aquapolo treats effluents from SABESP's ABC plant, processes them using ultrafiltration and reverse osmosis and conveys them along a 17 km pipeline to the industrial facilities. It has a capacity of 650 l/s, equal to 56,000 m³/day, for an output of approximately 20 million m³ a year.

The contractual model provides for guaranteed industrial offtake, a 41-year contract, availability payments and an indexed tariff scheme, making Aquapolo an excellent example of commercial structuring under the WSFF.

Characterization of the transaction (3.1)

The Aquapolo transaction can be characterized according to the parameters of the Water Security Financing Framework:

(i) **Nature of the good/service:** Industrial treated water is a club good: restricted access, identifiable users, payment by contract. It is not considered a public good, as the benefit is limited to specific industrial customers.

(ii) **Level of specificity of the asset:** Very high, as the 17 km pipeline and the advanced treatment plant only serve the petrochemical complex. This high specificity of the asset justifies the existence of long-term contracts (41 years).

(iii) **Frequency and continuity of transaction**: Daily frequency, constant volumes at established quality levels. At the same time, high industrial dependence creates incentives to guarantee service continuity.

(iv) **Technological complexity**: Relatively high, with ultrafiltration and reverse osmosis processes, and with quality requirements equivalent to industrial process water. This demands stringent performance requirements and specialized maintenance.

Make-or-buy decision (3.2)

SABESP decided to outsource the construction, operation and commercial management through Aquapolo S.A. for the following reasons:

(i) **Reasons for outsourcing** or delegating to a private entity:

- Need for private capital to finance highly specific infrastructure (pipelines, advanced filtration systems).
- Need for specialized expertise in advanced industrial processes.
- Desire to transfer performance risks to the operator.

(ii) **Contractual arrangement:** SABESP supplies the pretreated effluent, Aquapolo (the concessionaire) invests, operates and markets the treated water and Braskem undertakes to receive a guaranteed volume and quality of offtake.

(iii) **Lessons learned and methodological implications for the WSFF**

The case shows how outsourcing is justified when there is an anchor client (Braskem) with a high willingness to pay; when there are specific technical requirements; and when operating risks are better managed by a private operator.

Risk profile and preliminary allocation (Step 3.3)

The cases of both Aquapolo and Tenorio are examined below. The following table identifies the main risks at Aquapolo and how they were assigned to various stakeholders or the ways in which they were mitigated.

Table 1
Risk profile and allocation at Aquapolo WWTP

Type of risk	Description	Assumed by
Operating	Failures in advanced filtration processes; quality required by Braskem	Concessionaire
Demand	Dependence on a single large industrial customer	Mitigated by long-term contract
Financial	Debt service for highly specific infrastructure	Concessionaire
Influent quality	Variation in the quality of effluent supplied by SABESP	Shared (SABESP guarantees pre-treatment)

Source: Prepared by the authors.

The best illustrated structural risks at the Tenorio WWTP include the following: (a) future industrial demand, (b) tariff instability, (c) credit risks derived from industrial payments, and (d) regulatory compliance.

In a BOT scheme, the public sector usually assumes the political and regulatory risks, while the concessionaire assumes the risks associated with design, construction, operation, maintenance and financing; risks of force majeure and environmental risks are usually shared. While in traditional BOTs the demand risk would normally be borne by the concessionaire, at WWTPs it is shared through contractual clauses such as take-or-pay clauses, minimum volume guarantees or availability payments.

When an anchor user exists —such as the Federal Electricity Commission (CFE) at Tenorio or Braskem at Aquapolo— long-term purchase contracts are signed that transfer part or all of the demand risk to the buyer. At Tenorio, the contract with CFE includes a fixed tariff and a guaranteed volume, which significantly reduces the concessionaire's commercial exposure.

Market sounding (3.4)

The Aquapolo case showcases the private sector's growing interest:

(i) **Anchor customer:** Braskem guarantees a significant volume of purchases.

(ii) **Private operator with capacity:** Foz do Brasil (Odebrecht Group) has shown interest in participating in the industrial reuse business.

(iii) **Economic incentives:** Treated water is cheaper and safer than deep sources, and also reduces petrochemical operating risks.

(iv) **Conditions that made private participation possible:** Guarantee of good effluent quality provided by SABESP; constant demand, guaranteed by a long-term contract; and adoption of modern infrastructure with high levels of efficiency and cost recovery.

Lessons learned and methodological implications for the WSFF

- Characterizing the transaction assists greatly in defining the possible contractual structure.
- The level of asset specificity determines the duration of the contract and the distribution of risks.
- A strong anchor customer reduces demand risk and facilitates access to financing.
- The make-or-buy decision is technical and financial, not merely organizational.
- Timely market sounding conducted early in the process avoids transactions that later fail due to lack of private interest.
- Clarity regarding the risks facilitates future blended finance structures.

Source: Prepared by the authors, on the basis of World Bank. (2019). *Wastewater: from waste to resource. The case of Santiago, Chile*. http://documents.worldbank.org/curated/en/284951573498126244; Aquapolo. (2020). *Relatório de sustentabilidade 2023*; *Revista Técnica de Medio Ambiente*. (2021, 20 April). Aquapolo: valorización de efluentes frente a desafíos del cambio climático. https://www.retema.es/actualidad/aquapolo-valorizacion-efluentes-frente-desafios-del-cambio-climatico; De la Peña, M. E., Larrea, C., Sasaki, K. and Smith, D. (2022). *El reúso de agua residual tratada en América Latina y el Caribe: 10 estudios de caso*. Inter-American Development Bank. http://dx.doi.org/10.18235/0004515; 2030 Water Resources Group. (2022). *Industrial reuse of water from WWTPs: The Aquapolo project in Brazil*. https://2030wrg.org/wp-content/uploads/2022/01/Article-2030-WRG-Brazil_Industrial-reuse-of-water-from-WWTPs.pdf.

4. Financial case

The purpose of the financial case is to assess the extent to which the project is affordable, fundable, investable and bankable. To show that the project is affordable from the perspective of the public or private sponsor, the case must provide evidence that the implementation costs or life-cycle costs are realistic and affordable, and that the required financing sources are available and supported. Table 13 sets out the specific questions to be addressed in the financial case and includes links to the corresponding form and methodology.

Table 13
Initial diagnosis and assessment of the financial case for water security investments

4. Finance **Is the project affordable, fundable, investable and bankable?**		**Module**
Criteria	**Self-assessment questions**	
Affordability of the solution Effect on local/regional tax base	**Qualitative life-cycle cost analysis (LCCA)** Is there a qualitative analysis of the costs of implementing the water security strategy/measure? (e.g. life-cycle costs, capital expenditure versus operating expenditure) (yes/no)	4.1
	Quantitative life-cycle cost analysis (LCCA) Have the implementation costs and capital and operating expenditures been quantified according to the characteristics of the proposed investment project over time? (yes/no)	4.2
Income generation potential (funding)	**Revenue streams (qualitative)** Have possible sources of income and funding that could be generated been identified? Is there a qualitative analysis of those flows that considers a wide range of taxes, tariffs and transfers? (yes/no)	4.3
	Revenue streams (qualitative) Have the revenue streams over time been quantified? (yes/no)	4.4
Available or secured financing	**Project cash flow profile** Has the project's cash flow profile been estimated? (yes/no)	4.5
	Financial viability gap Has the revenue gap and the need to use viability gap funding been calculated)? (yes/no)	4.6

4. Finance Is the project affordable, fundable, investable and bankable?		Module
Criteria	**Self-assessment questions**	
	Financing strategy Have high-potential financing sources and mechanisms been identified? Has the potential of existing financing facilities and instruments for water security projects been analysed? Has the project secured government funding or concessional funds to leverage private sector participation? (yes/no)	4.7

Source: Prepared by the authors, on the basis of Altamirano, M. A., de Rijke, H., Basco, L. and Arellano, B. (2021). *Handbook for the Implementation of Nature-based Solutions for Water Security: Guidelines for Designing an Implementation and Financing Arrangement*.

Consequently, the case development process begins with a more detailed identification of the value drivers linked to the specified service levels that, if guaranteed, can generate revenue. In general terms, revenue streams or sources of project funding may come from taxpayers or from beneficiaries through a wide range of taxes (general or earmarked), tariffs and transfers (subsidies). At this step, the identified revenue sources are compared with the implementation costs: i.e. life-cycle cost or total cost of ownership (TCO). Both positive and negative cash flow projections define the basis of the project's cash profile.

Investors often evaluate different opportunities by using a risk/return ratio, through which they can compare an investment's expected returns with the level of risk they must assume to secure them. The risk-adjusted cash flow profile forms the basis for the investment return analysis, which is the key criterion for both equity and debt investors. The financial case emphasizes how the cash flow profile must be adjusted to the project's risk profile, which implies that the future risks that could affect the project (as previously identified in the commercial case) are internalized as an additional cost —during the construction or operation phases— or as lower revenues. Ultimately, equity or debt investors will calculate their return on investment (RoI) based on the risk-adjusted cash profile and the opportunity cost, represented by the discounted cash flow at a market interest rate.

Finally, the financial case identifies the financial gaps (in funding and in financing) and the financing and funding instruments that can be effective in closing them. Since a significant financial viability gap can be expected in the implementation of many water security investment projects, one crucial step within the WSFF is the design of blended finance strategies.

Blended finance strategies for implementing water infrastructure projects at the necessary scale make strategic use of concessional and philanthropic sources of finance (e.g. grants) to leverage greater private sector participation and to mobilize additional resources towards emerging markets. As noted by IFC (2018), blended finance is a critical tool for mitigating early entry costs or project risks, in that it helps realign the risk-return ratio of pioneering investments and enables them to crystallize.

One example of this is viability gap funding (VGF): a financial mechanism used by some governments around the world to successfully complete projects that are economically justified but not financially viable. VGF consists of a transfer in the form of an upfront subsidy or grant to the private developer of a project, normally upon completion of construction and the infrastructure asset's entry into operation.

Box 5 describes the financial case for the Tenorio WWTP in Mexico and the Aquapolo WWTP in Brazil as an illustration of the following steps in the WSFF:

4.1 Capital expenditure, operating expenditure and life-cycle costs (Tenorio)

4.2 Funding and financing sources (Tenorio)

4.3 Qualitative revenue streams (Aquapolo)

4.6 Financial viability gap and 4.7 Financing strategy (Tenorio)

Box 5
Financial case: Aquapolo WWTP, Brazil, and Tenorio WWTP, Mexico

Capital expenditure, operating expenditure and life-cycle costs, Tenorio (4.1)

Total investment for this WWTP amounted to US$ 64.7 million, including infrastructure for treatment, distribution and supply to the Villa de Reyes Combined Cycle Thermoelectric Power Plant operated by the Federal Electricity Commission (CFE). This capital expenditure was necessary to offer two differentiated treatment lines: for industrial reuse and for agriculture. Meanwhile, the operating costs include:

- Operation and maintenance of the biological system.
- Pumping for the 40-km distribution system.
- Chemical supplies and energy costs.

Through the build-operate-transfer (BOT) contract signed in 2002 and concluded in February 2024, the private concessionaire company assumed management and the operating and maintenance costs for 18 years following the start of operations (2006).

Funding and financing sources, Tenorio (4.2)

The most important funding source for the project launch was FONADIN, which contributed 40% of the total capital expenditure through a trust fund comprising public concessional capital from taxes. At the same time, 60% of the initial financing required for implementation was provided to the private concessionaire company by Banobras, and the private partners ARTE-SUEZ (41%), Sumitomo (39%) and Prodin (20%) contributed the remaining equity capital in proportion to their participation in the consortium. In Mexico, BOT water projects typically require partners to contribute between 15% to 25% of the total equity, which in this case was estimated at between US$ 6 million and US$ 10 million.

The contracting scheme and financing strategy reduce the project risk profile by means of the following:

- Public-private participation.
- The debt obtained is project finance and was acquired with a specialized public institution; implicit guarantees of the BOT contract.

Qualitative revenue streams, Aquapolo and Tenorio (4.3)

The revenues of the Aquapolo WWTP are divided into two types: income from the sale of water to industrial customers, using a negotiated rate that is indexed to inflation and changes in macroeconomic conditions; and the availability payment received by the operator from the governmental authority.

At present, the industries adhering to the treated wastewater reuse contract are: Braskem (four industries that consume about 80% of the water), White Martins Capuava, White Martins Mauá, Oxicap, Oxiteno Petroquímica e Química, Cabot and, recently, Paranapanema and Bridgestone, located along the aqueduct in the municipality of Santo André (IDB, 2017).

In contrast, at Tenorio, the investment is recovered through fees charged to industrial and agricultural users and payments from the Villa de Reyes Combined Cycle Power Plant. As will be discussed in more detail in the next section in connection with the Tenorio WWTP, both cases achieve financial viability and sustainability over time through stable revenue sources combined with initial public contributions.

Financial viability gap (4.6) and financing strategy (4.7), Tenorio

The Aquapolo transaction can be characterized according to the parameters of the Water Security Financing Framework:

(i) **Nature of the good/service**: Industrial treated water is a club good: restricted access, identifiable users, payment by contract. It is not considered a public good, as the benefit is limited to specific industrial customers.

(ii) **Level of specificity of the asset**: Very high, as the 17-km pipeline and the advanced treatment plant only serve the petrochemical complex. This high specificity of the asset justifies the use of long-term contracts (41 years).

(iii) **Frequency and continuity of transaction**: Daily frequency, constant volumes at established quality levels. At the same time, a high industrial dependence creates incentives to guarantee service continuity.

(iv) **Technological complexity**: Relatively high, with ultrafiltration and reverse osmosis processes, and with quality requirements equivalent to industrial process water. This demands stringent performance requirements and specialized maintenance.

Financial viability gap (4.6) and financing strategy (4.7), Tenorio versus Aquapolo

Although the Tenorio WWTP case documents do not explicitly use the financial viability gap concept, the project's financing structure and potential revenue streams show a clear gap between the total investment costs and the ability to repay them through industrial and agricultural tariffs. Based on the literature on the case, it can be concluded that industrial demand —mainly through the payments made by the Villa de Reyes Power Plant— were not enough to sustain a total repayment of the investment, since part of the treated water output was also directed to agricultural uses where lower tariffs applied. The combination of agricultural users with limited capacity to pay, a single industrial anchor customer, differentiated processes and high transportation costs (40 km), create a financial scenario where the tariff flows cannot offset the initial investment and much less the project's total lifetime costs.

The funding and financing strategy adopted for the WWTP was able to close this gap by means of the following:

- The National Infrastructure Fund (FONADIN) financed 40% of the project on a concessional basis, in the form of a subsidy or transfer (*fondeo*). The fact that this public source of funding had to be used indicates expectations that future revenues would be insufficient to recover the capital expenditure. Had fully private financing and funding been chosen, the tariffs required to recover the investment would have been too high to ensure affordability.
- The contribution from Banobras, which participated in the structuring of the project finance as a long-term lender. In the Mexican context, the participation of Banobras indicates that commercial banks were not willing to finance the project or were expected to do so at rates or terms incompatible with the project's projected cash flows.

In contrast to the situation at Tenorio, where the financial scheme had a viability gap that required concessional contributions from FONADIN and long-term debt from Banobras, the case of the Aquapolo WWTP in Brazil involves an industrial reuse project without significant viability gaps. That was because of the presence of a robust anchor user (Braskem) with a high and stable willingness to pay, backed by a long-term supply contract with characteristics close to a take-or-pay, which guarantees sufficient volumes and tariffs to recover capital expenditure and finance the operation without the need for public subsidies. At Aquapolo, the strength of the revenue stream, the specificity of the industrial client and the contractual certainty enable the project to be fully financed under a commercial logic, without requiring blended finance instruments, which is in direct contrast to the mixed structure required to achieve project bankability at Tenorio.

Source: Prepared by the authors, on the basis of World Bank. (2018). *Wastewater: from waste to resource: The case of Atotonilco de Tula, Mexico*; WaterWorld. (2004, 1 June). *Degrémont wins water reuse contract in Mexico*. https://www.waterworld.com/wastewater-treatment/article/16200790/degremont-wins-water-reuse-contract-in-mexico; Equihua, L. and Rojas, A. (2013). Tenorio project: A case of sustainable development in Mexico. *Desalination and Water Treatment, 51*(1–3); Aquapolo. (2020). *Relatório de sustentabilidade 2023*; Aquatech, 2023; Koh et al, 2025; World Bank. (2013); Braskem. (2012, 2020); Christoph Kullman, Darren Lawrence, and Emyr Costa. (2011); AIDIS. (2016).

5. Management case

The purpose of the management case is to assess whether the implementation of the proposed investment programme or project is feasible. This assessment involves demonstrating that the project sponsor or proponent can execute the project successfully and professionally, and that it has a sound system and processes in place for managing the project and its risks. Both the project's public procuring entity and its private or community developer must have sufficient capacity and experience. Table 14 details the specific questions to be addressed by the management case and includes links to the corresponding form and methodology.

In this regard, the Water Security Financing Framework aims to support the development of sound contractual arrangements that will enable the successful execution of the transaction (i.e. a project or set of projects). This step within the WSFF focuses on the project or set of projects that are part of a water security strategy and that could be awarded or outsourced to third parties. This stage considers a broad series of contractual arrangements, referred to in the infrastructure field as project delivery and finance methods. These arrangements can be between an authority and a private contractor, between a private company investing in the basin and a third party to whom the project is subcontracted, or even between multiple stakeholders in the basin.

Table 14
Initial diagnosis and assessment of the management case for water security investments

5. Management **Are there robust contractual and organizational arrangements in place to bring the project to fruition?**		**Module**
Criteria	**Self-assessment questions**	
Capacity of the (public) entity to contract and successfully implement the project	Contracting objectives and boundary conditions (aspirations, concerns and key stakeholders for implementation) Have the aspirations and contributions of the various stakeholders for the sustainable implementation of the water security strategy, programme or projects been identified? (yes/no)	5.1
	Project implementation and financing model: scope of the contract, financial and bidding incentives Has a contracting strategy been designed or defined, including the scope of the contract(s), payment mechanisms and contracting incentives, for the water security strategy, programme or projects? (yes/no)	5.2
Monitoring and evaluation systems considered	Project or project cluster implementation strategy Have responsibilities been assigned for the implementation of the programme or project, considering all phases of the life cycle of the infrastructure asset that is to be created? (yes/no)	5.3
	Implementation arrangements by project or project cluster Have the interdependencies between the key players for successful implementation been mapped? Have the formal (e.g. contractual) arrangements required between them been designed and analysed to ensure successful and sustainable service delivery? (yes/no)	5.4

Source: Prepared by the authors, on the basis of Altamirano, M. A., de Rijke, H., Basco, L. and Arellano, B. (2021). *Handbook for the Implementation of Nature-based Solutions for Water Security: Guidelines for Designing an Implementation and Financing Arrangement.*

The first step is therefore to define the strategic objectives and framework conditions of the procurement strategy. These include the main aspirations and concerns of the project sponsor or proponent, considering the stakeholders already identified who play a crucial role or can provide essential resources —money ($), authority (A), expertise (E) and networks (N)— for successful implementation and sustained service delivery.

The management case clearly sets out how risks, benefits and responsibilities are allocated in the execution of the investment programme or project. This allocation explicitly considers all phases in the life cycle of the infrastructure asset to be created by the investment: planning, design, construction, maintenance, operation, monitoring and, if applicable, even dismantling. In some cases, financing may also be part of the contractual scope.

One essential aspect of the management case is to define the implementation strategy and arrangement for the project or set of projects, specifying who is to contribute to implementation, with what resources and at what point in the overall life cycle. Note that those resources also include expertise, authority and networks/trust, not only financial resources (for funding or financing). From that overview, the management case defines the potential procurement strategy, which includes the contractual scope, payment mechanisms (e.g. financial incentives) and other bidding incentives such as award criteria. This phase is intended to determine the parties responsible for each phase of the project's life cycle.

Once completed, the management case provides a comprehensive perspective of the contractual relationships between the various stakeholders involved in the implementation of water security strategies, programmes or specific investment projects. The questions to be answered at the level of the entire strategy and investment plan, especially those that are to be implemented jointly, are how do the actors relate to each other, and what agreements are necessary for everything to work and achieve the expected impact.

Box 6 illustrates the management case for the La Farfana Biofactory in Chile, which is the result of the following steps of the WSFF: 5.1 Objectives of the contracting process and boundary conditions; 5.2 Contracting strategy: delivery and finance model; 5.3 Implementation strategy; and 5.4 Implementation arrangements.

Box 6
Management case: Farfana WWTP, Chile

Objectives of the contracting process and boundary conditions (5.1)

As explained above, before defining the implementation arrangements and contracting strategy, the strategic, economic, commercial and financial ambitions sought through the investment must be made explicit. These ambitions serve as boundary conditions for designing the project's procurement and contracting process (the fourth or final step in designing an implementation arrangement), as they provide the basis for the capacities, incentives and implementation modalities that will be needed. The following table presents the strategic ambitions for the case of La Farfana Biofactory, and the resources that the different public and private actors provided for its implementation.

Table 1
Ambitions and strategic objectives of the La Farfana Biofactory investment

Ambition category (La Farfana)	Specific description of the La Farfana case
Service quality and continuity	Maintenance of treatment parameters in compliance with DS 90/2000 and DS 609/1998, guaranteeing continuity of service for 6 million inhabitants.
Operating efficiencies and cost savings	Reduced costs through cogeneration with biogas (41,620 MWh/year), total elimination of landfill disposal and optimization of operating expenditure.
Incorporation of circular functionalities	Integration of anaerobic digestion, biomethane production, recovery of biosolids (Huechún) and reduced emissions (CDM credits).
Innovations in technology and energy	Expanded biogas/biomethane production, improved upgrading efficiency and strengthened energy autonomy (74.4% in 2023).
Financial robustness and sustainability of tariffs	Ensuring sustainability through regulated tariffs, income diversification (biogas, biosolids, carbon) and investment recovery in the shortest possible time.

Source: Prepared by the authors.

Table 2
Role and resources contributed by different public and private actors at the La Farfana Biofactory

Actor type	Actor	Main role	Resources contributed ($, A, E, N)
Public	Sanitation Services Superintendency (SISS)	Tariff regulation, monitoring of sanitary performance and authorization of investments recognized in tariffs.	A, N
Public	Ministry of the Environment / Superintendency of the Environment (SMA)	Environmental regulation, compliance with DS 90/2000, DS 609/1998 and DS 4/2009; monitoring of emissions and sludge.	A, E, N
Public	Municipalities and regional government	Territorial alignment, permits and coordination with urban planning.	A, N
Private	Aguas Andinas (operator of La Farfana)	Operation, maintenance, biosolid recovery, biogas/biomethane production and cogeneration.	$$–$$$, E, N
Private	Technology suppliers (Veolia, SUEZ, Degremont)	Provision of advanced technology, technical support and specialized maintenance.	E, N
Private	Industrial and agricultural customers of reuse programmes	Potential demand for treated water, social legitimacy and territorial validation.	$, N
Private	Metrogas (buyer of biogas/ biomethane)	Purchase of biogas/biomethane, investment in network interconnection and expansion.	$$, N, E

Source: Prepared by the authors.

Implementation arrangement: contractual and financial (5.2 to 5.4)

The La Farfana WWTP was developed and is operated by Aguas Andinas, the drinking water and sanitation services concessionaire in Greater Santiago, under the sanitary concession system regulated by the Sanitation Services Superintendency (SISS). In this model, which is typical of Chile's urban water systems, the concessionaire is responsible for planning, designing, financing, constructing, maintaining and operating all the infrastructure necessary to meet the required sanitary and environmental standards, including major investments such as La Farfana. Project financing is structured through capital expenditure financed by the company itself and gradually recovered through the regulated tariff, whereby SISS recognizes efficient investments in the tariff base in accordance with sectoral regulations (DS 90/2000; DS 609/1998; current tariff frameworks). The plant is part of a comprehensive urban sanitation programme with a total investment of US$ 900 million, of which US$ 315 million was earmarked for La Farfana, all financed under the regulated tariff model.

One particularly interesting element —almost unique in the world— is that the La Farfana WWTP operates within Aguas Andinas's indefinite sanitary concession, a permanent regime with no expiration date, overseen by SISS through five-yearly tariff reviews and strict environmental standards. This means that La Farfana does not have a fixed contractual duration, as is the case in BOT models, but rather that its operation is based on a stable and continuous regulatory framework that guarantees efficient investment recovery and long-term operational sustainability.

This combination of an indefinite concession with robust regulation has enabled the concessionaire to access financing for major resilience projects, such as the Pirque Mega Tanks, built in 2020 with an investment of 64.22 billion Chilean pesos. These mega-tanks significantly increased the autonomy of Santiago's water supply system, raising the capacity of service continuity from 9 hours before the project to 34 hours after it was launched. The following table shows the scope of the contract in terms of the phases of the asset's life cycle and the entity responsible for each phase. As can be seen, under the regulated sanitary concession regime operating in Chile, Aguas Andinas is responsible for practically the entire life cycle of the La Farfana WWTP: planning, design, engineering, construction, operation and maintenance.

Although the concessionaire has a central role in investment planning, that phase is carried out in close coordination with SISS, which defines sanitation standards and efficiency criteria and recognizes investments in the tariff base. Unlike a BOT contract, where the life cycle is managed within a finite contractual term, the concession in this case is indefinite, and the assignment of responsibilities follows a permanent regulatory model and not a build-operate-transfer scheme.

Table 3
Scope and allocation of responsibilities under the BOT contract, La Farfana

Life cycle stage	Entity responsible	Included in contract?	Description of scope
Planning (P)	Aguas Andinas + SISS	Yes	Investment planning, sanitary and environmental justification, alignment with regulatory standards.
Design (D)	Aguas Andinas	Yes	Process design and regulatory compliance (DS 90/2000; DS 609/1998).
Engineering (E)	Aguas Andinas + specialized suppliers	Yes	Detailed engineering, technology selection, advanced process integration.
Building (B)	Aguas Andinas (contracts builders)	Yes	Civil construction and equipment assembly under concessionaire's supervision.
Maintenance (M)	Aguas Andinas	Yes	Preventive and corrective maintenance of infrastructure and equipment.
Operation (O)	Aguas Andinas	Yes	Complete operation: treatment, anaerobic digestion, biogas, biomethane and biosolids.
Make available, finance and maintain	Aguas Andinas + SISS	Yes	Continuity of service, compliance with standards and regulatory oversight.

Source: Prepared by the authors.

Table 4 shows how the different types of risk associated with La Farfana's operation are allocated. As in the regulated sanitary concession regime, most of the relevant risks —design, construction, and operational, technological and financial performance— fall directly on the concessionaire, which is responsible for ensuring compliance with the sanitary and environmental standards established by the authorities. Other risks, such as environmental risk, which depend both on operational performance and on regulatory standards and oversight, are managed jointly by Aguas Andinas and the regulatory agencies (SISS and SMA). This distribution reflects the structural principle of the Chilean model: the concessionaire assumes full responsibility for the service, while the authority maintains a supervisory and oversight role to ensure environmental protection and the continuity of the public service.

Table 4
Allocation of risks between the public sector and the concessionaire company, La Farfana

Type of risk	Aguas Andinas (Concessionaire)	SISS / Authority	Description
Political/regulatory risk		SISS, SMA, MOP	The authority defines tariffs, standards and oversight; critical regulatory stability.
Design risk	High		Responsibility for selecting appropriate processes and technologies.
Construction risk	High		Supervision and compliance with deadlines and costs of works.

Type of risk	Aguas Andinas (Concessionaire)	SISS / Authority	Description
Operational performance risk	High		Compliance with DS 90/2000, digester management, biogas and biosolids upgrading.
Financial risk	High		Capital expenditure and operating expenditure financed by the concessionaire under the tariff regime.
Demand risk	Very low		The service is provided as a regulated monopoly; there is no traditional demand risk.
Environmental risk	High–Shared		Operational impacts vs. oversight and environmental compliance.
Technological risk	High		Responsibility for technological upgrades and efficiency improvements.

Source: Prepared by the authors.

Source: Prepared by the authors.

E. Conclusions

This chapter has outlined the core elements of the Water Security Financing Framework (WSFF), highlighting its relevance as a progressive, collaborative and multidimensional approach to transforming water security priorities into robust and bankable investment projects. Based on the conceptual analysis developed in the sections above, the following key conclusions can be drawn:

- **Importance of flexible approaches to governance and provision:** Financing water security projects requires consideration of a full spectrum of governance modes: public provision, private management, public-private partnerships, collective mechanisms and environmental markets. No model is universally superior for all cases: their suitability depends on the type of investment or measure (characteristics of the transaction), on the institutional and regulatory context and on local capacities. The selection of an implementation arrangement should be based on an analysis of such factors as the functions to be provided and the risks and stakeholders involved, following the four-step process provided by the WSFF.
- **Water security projects often generate combinations or "packages" of economic goods:** Water security investments often produce private, club, public and common pool resources simultaneously. This classification has direct implications for identifying funding sources and for determining payment structures and the allocation of responsibilities. Recognizing the economic nature of the service allows for the design of more efficient cost recovery and incentive alignment mechanisms.
- **The characterization of the transaction is essential in preparing the commercial case:** The intensity or volume of the capital required, the level of asset specificity and the functional structure of the service must be fully understood. This characterization determines the feasibility of involving private actors, the appropriate contract type and the optimal distribution of risks. The WSFF provides self-diagnostic tools to assess commercial viability and market interest.
- **The analysis of the institutional environment restricts the options for implementation and public procurement arrangements:** The methodological basis of the new institutional economics on which the WSFF is built reveals how formal rules, informal norms and incentives shape possible solutions. Public sector capacity, regulatory maturity and interconnections among stakeholders determine the viability of provision and financing models. Similar projects may therefore require radically different arrangements depending on the context in which they are implemented.
- **A solid strategic case is the basis for all subsequent structuring:** Clearly defining the public need, expected impacts and intervention logic avoids later inconsistencies in the economic,

commercial and financial cases. The theory of change —expressed graphically as a causal map— is a key tool for aligning stakeholders, clarifying assumptions and interconnecting desired outcomes.

- **A project's hierarchy of functions is a fundamental bridge to the economic, commercial and financial cases:** Mapping functions clarifies who benefits and who should contribute, which allows: (i) potential sources of income to be identified, (ii) more accurate cost-benefit analyses to be calculated, and (iii) clearer risk allocation strategies to be defined.
- **Correctly identifying and allocating risks is essential for sustainability:** Technical, environmental, social, operational and financial risks must be mapped out at an early stage in project preparation. Risks must be allocated based on the actors who have the real capacity to manage them, thus optimizing the project's efficiency and bankability.
- **The financial case requires risk-adjusted analysis and the exploration of feasibility gaps:** Investments must be evaluated using risk-adjusted cash flows, taking different funding and financing schemes into account. The case studies also reveal that many water security interventions present financial viability gaps, which require blended finance instruments and the support of concessional capital. The chapter shows how those mechanisms can mobilize private capital and reduce structural risks.

The WSFF incorporates lessons learned from real-world cases. The region's experiences show that the methodology is adaptable, identifies limitations and facilitates improvements in the project planning and preparation processes. Lessons learned from advanced projects enabled the validation of the methodological framework, while cases still at the early stages —such as the Metapán WWTP— demonstrate its usefulness in designing future routes towards financial sustainability.

VI. Conclusions and recommendations

This Water Security Financing Framework for Latin America and the Caribbean is based on the recognition of one central fact: the region's water security challenge stems not only from the inadequacy of the financial resources available, but also from persistent difficulties in transforming needs into well-structured projects that can meet the standards demanded by development banks, climate funds and private investors. Recent changes in the global financial architecture, such as the expansion of green and blue bond markets, the rise of sustainable and impact investing and the evolution of climate finance, create an environment that offers unprecedented opportunities but also demands strengthened institutional capacities and suitable enabling frameworks to take advantage of them.

A. Conclusions

1. Structural gaps that the WSFF is intended to close

The Water Security Financing Framework (WSFF) works to close two structural gaps that have historically limited countries' ability to mobilize investments:

- Gap between policy decisions and technical analysis: Political cycles favour short-term interventions that have insufficient preparation and that fail to incorporate financial sustainability and the management of assets and risks from the earliest stages.
- Gap between investment needs and available financial mechanisms: Despite the growing availability of climate funds, impact investments and blended finance schemes, many projects cannot access them because they do not meet the requirements for structuring, economic governance or performance contracts.

The WSFF offers a structured, transdisciplinary process to convert water security strategies into structured investment portfolios, interconnecting the five cases (strategic, economic, commercial, financial and management) and creating a common language among stakeholders.

2. Challenges and opportunities in the global financial architecture

As noted in chapter II, changes in the global financial architecture —the expansion of thematic bond markets, the rise of sustainable investments and climate action, and the renewed role of multilateral development banks— have created an environment in which financial resources are available, but the region lacks the capacity to absorb them in the form of concrete projects.

Chapter III explained how those trends present both challenges and opportunities.

Emerging instruments, such as thematic bonds, carbon credits, international climate funds, impact investments and blended finance, offer concrete alternatives for diversifying finance sources and attracting private capital to water, sanitation and adaptation projects. However, their effective use depends on enabling regulatory frameworks, as well as on:

- Investment structuring and preparation capabilities.
- Robust water governance.
- Effective implementation arrangements.

Those constitute the three key leverage points identified in chapter II, which are indispensable for closing the implementation gap. If countries are successful in adapting their regulatory and institutional frameworks and building the necessary investment structuring capacities, they will be able to channel new flows of green and climate finance into water, sanitation and adaptation projects. Otherwise, they run the risk of being left behind and losing access to the concessional capital and private investment that today favour projects with an environmental and social impact.

3. Access to climate finance by local governments: lessons learned

Chapter IV completed the journey by examining the local channelling of philanthropic and climate funds. The cases of the Indian city of Surat and the National Water Reuse Programme in South Africa show that climate finance can be channelled into medium or small municipalities when strong governance structures and institutional and technical capacities are in place.

The cases of Surat and South Africa demonstrate that it is possible to create specialized financial vehicles (trusts, partnership offices) that reduce risks and allow projects to be grouped into portfolios. In Surat, philanthropic capital played a catalytic role; in South Africa, the backing of the Green Climate Fund (GCF) enabled the leveraging of private and multilateral resources. The two cases demonstrate the importance of project pooling to build scale, reduce transaction costs and attract institutional investors.

Both cases illustrate that even in complex institutional contexts and when severe fiscal constraints exists, innovative institutional arrangements can be designed that build municipal capacities to prepare investments, consolidate stronger governance and enable scalable implementation schemes: the three leverage points identified as essential in closing the region's implementation gap.

In Surat, the creation of the Surat Climate Change Trust (SCCT) was an institutional turning point. This public-private vehicle, independent of the municipal government, enabled the municipal corporation, state agencies, the private sector and academia to be brought together around a neutral technical platform. Its structure gave the city an unprecedented capacity to coordinate investments, manage technical expertise and directly access international financing: something that, for most municipalities, remains constrained by the need for resources to be channelled through the national government. SCCT operated, in practice, as a project pooling mechanism, reducing dependence on national transfers, strengthening continuity beyond political cycles and building credibility with donors and investors.

In turn, the South African case offers an example of how programmatic design can transform the scale and financial viability of local water and adaptation investments. The National Water Reuse Programme, partially financed with concessional capital from the Green Climate Fund (GCF), structured

scalable portfolios under a blended finance approach rather than merely presenting individual projects. That architecture made it possible to reduce risks, attract private capital and create a new class of climate assets linked to water reuse. One key component in the model was the Water Partnerships Office, a neutral technical vehicle charged with coordinating public, private and community actors and ensuring institutional continuity beyond political cycles.

Both experiences offer a set of lessons that can be directly transferred to Latin America and the Caribbean. First, they show that fiscal autonomy and tax modernization are necessary for attracting and co-financing climate investments. Second, they confirm the value of creating neutral institutional vehicles —such as trusts or technical offices— to coordinate multiple actors and sustain investment processes over time. Third, they show that programmatic design and project pooling reduce transaction costs, create economies of scale and increase the probability of attracting international financing. Finally, both cases highlight that blended finance schemes, when backed by climate funds such as the GCF, can play a catalytic role in mobilizing private capital for investments in water security, the circular economy and climate change adaptation.

Taken together, these lessons provide a practical road map: strengthen investment preparation capacities, consolidate multilevel and collaborative governance, and move towards implementation schemes that are scalable, programmatic, and capable of attracting climate and green finance on a sustained basis.

4. The project structuring road map: findings of the Water Security Financing Framework

Chapter V shows that the Water Security Financing Framework (WSFF) can serve as a strategic tool for transforming water security priorities into bankable investment programmes that are consistent with current climate and development finance dynamics. By interconnecting strategic planning, investment preparation and institutional analysis, the WSFF makes it possible to align public needs with concrete routes for structuring an investment portfolio by defining the project's logic, essential functions, beneficiaries and expected results from the earliest stage. This methodological integration —which combines approaches from new institutional economics, asset management, transaction cost economics and international structuring models— strengthens governments' ability to generate robust, consistent project portfolios.

The WSFF enables water security priorities to be converted into bankable investment projects through coherent interconnections between the strategic, economic, commercial, financial and management cases. Its use requires analysing the diversity of provision methods —public, private, PPP, collective or based on environmental markets— and selecting the one most suitable according to the functions to be provided, the economic nature of the service, the risks involved and the institutional capacities available. Characterizing the transaction and analysing the institutional environment are essential steps in defining viable implementation arrangements, determining market interest and establishing governance structures that respond to the regulatory context and the public sector's actual capabilities.

The chapter also highlights the importance of building a solid strategic case based on a clear theory of change and a hierarchy of functions that identifies the beneficiaries, revenue sources, costs and risks. The correct allocation of risks, risk-adjusted financial analyses and the identification of feasibility gaps are key elements in structuring sustainable projects, which in many cases require blended finance instruments or concessional capital. Finally, lessons learned from real cases show that the WSFF is an adaptable framework that helps improve project planning and preparation processes, validating its capacity to guide early stage interventions —such as the Metapán WWTP— and strengthen routes to financial sustainability in the water sector.

B. Recommendations for Latin America and the Caribbean

The WSFF methodological framework, analyses, cases and mechanisms presented in this guide lead to a set of strategic recommendations for the region's countries and local governments to take advantage of the opportunities afforded by the changing global financial architecture. The recommendations simultaneously address the structural challenges identified —the gap between planning and financing, insufficient capacities for preparing investments and gaps in governance and implementation— and the conceptual and practical advances put forward by the Water Security Financing Framework (WSFF). Their aim is to guide governments towards more effective processes for mobilizing resources, structuring and preparing projects and coordinating with stakeholders.

The most important recommendations are classified into five categories: public policy and regulatory reforms, strengthening institutions and local capacities and priorities, capitalizing on the growing potential of alternative funding and financing instruments and sources, rethinking investment origination and planning, and practical guidelines to advance collaboration and synergy among the different entities involved in the implementation and financing of water security.

1. Public policy and regulatory reforms

The evolution of global financial and climate markets requires Latin American and Caribbean countries to have stable, predictable and results-oriented regulatory frameworks that can provide long-term certainty, encourage investment and align sectoral policies with national environmental and climate commitments. Accordingly, progress towards policies consistent with environmental, social, and governance (ESG) criteria and resilience objectives —explicitly integrated into public planning and budgeting instruments— is essential to mobilize transformative investments. NDC 3.0 offers a strategic opportunity to position water security investments within climate investment plans and ensure consistency with national mitigation and adaptation goals.

At the same time, the regulatory regimes that oversee water and sanitation services must be strengthened, ensuring robust environmental standards, fair tariff schemes and clear rules for private participation, without compromising the protection of the public interest. As the case studies show, regulatory clarity and stability build confidence, reduce risks and provide enabling conditions for attracting investments and ensuring long-term financial sustainability.

Predictable regulatory frameworks that provide long-term security should be created, as shown by the case of La Farfana in Chile, where the indefinite concession under state supervision attracted significant private investment without resorting to subsidies. Experiences such as this can guide other countries in the search for models that provide investors and operators with certainty.

Regulations should be adapted to allow the use of emerging financial instruments, such as thematic bonds or blended finance schemes, so they can be integrated into water and sanitation projects when the necessary financial and institutional conditions exist. As shown by the analysis of the global financial architecture, those instruments expand the possibilities for leverage and diversification of financing, provided they are backed by sound governance frameworks and clear performance metrics.

2. Institutional strengthening and local capacity building

The experiences at Surat and in South Africa indicate that the technical capacity to design, structure and implement projects is a determining factor in accessing climate finance. In Latin America and the Caribbean, this implies strengthening local and regional technical units for project preparation, institutionalizing structuring processes based on methodologies such as the WSFF and establishing multilevel coordination mechanisms that interconnect national and local priorities. The consolidation of neutral institutional vehicles, such as municipal trusts or technical offices, can improve continuity beyond political cycles, reduce transaction costs and facilitate cooperation between public, private and community actors.

It is therefore essential to:

- Develop subnational project structuring capacities: As the Metapán case demonstrates, municipalities and operators need tools such as the WSFF to translate needs into bankable proposals. The guide recommends creating technical structuring units within local governments and water agencies.
- Encourage project pooling and adopt a programmatic approach: Grouping several initiatives into portfolios reduces risk and facilitates access to financing. Surat and South Africa show that this strategy can simultaneously attract philanthropic capital, climate funds and funding from development banks.
- Create venues for multisectoral and public-private coordination: The proposed methodology facilitates the construction of a common language between the public sector, the private sector and civil society. Not only does this build trust, it also lays the foundations for solid contractual agreements, without which financing cannot flow.
- Establish specialized financial vehicles: Regional trusts or funds that channel blended finance, as in South Africa with the support of the GCF, can be replicated in the region.

3. Strategic use of emerging financial instruments

Today, the region has a wide range of financing mechanisms available —green and blue bonds, international climate funds, blended finance schemes, impact investments— that can strengthen water security if they are integrated coherently with each territory's institutional capacities and strategic priorities. This requires designing projects and programmes with appropriate risk profiles that can attract private capital through the use of concessional resources or guarantees from multilateral banks or the Green Climate Fund (GCF). The adoption of programmatic models and scalable portfolios, as seen in South Africa, enables those instruments to be deployed on a larger scale and with greater efficiency.

Authorities should therefore:

- Expand the use of blended finance: combine donations, concessional resources and philanthropic capital with private investment, as was proposed at Metapán. This approach helps cover initial costs and balance risks.
- Capitalize on the potential of thematic bonds: green bonds for WWTPs and reuse, blue bonds for watersheds and conservation projects. Aquapolo and La Farfana have the conditions to structure emissions to diversify their sources.
- Assess the potential of carbon and water credits: both La Farfana (through biogas and the circular economy) and Metapán (through the treatment and reduction of pollutants) could generate certified credits, with additional income to cover operating expenses.
- Mobilize philanthropy and patient capital: Surat shows that philanthropic capital can open doors and reduce start-up risks. In Latin America, regional and international foundations can play a similar role in pilot projects.
- Involve development banks as catalysts: Tenorio shows that public banks can attract private investment, but scaling up requires the accompaniment of contractual innovations.

4. Rethinking investment origination and planning

Our region's challenge is not only to mobilize more resources, but also to transform the way investments are conceived, structured and managed from a project-level approach to a programmatic one, and from a sectoral and silo approach to a mission-based one. This requires moving from a reactive and fragmented logic to a mission-driven and programmatic approach, where each public investment project responds to strategic water security and climate resilience objectives. The Water Security Financing Framework proposes just such a paradigm shift: evolving towards viable, performance-based investment portfolios that can

create environmental, social and economic value. Investments must take advantage of the potential of multipurpose projects, combine different sources of financing —public, private, philanthropic and climate— and be measured by their real capacity to produce an impact. In this new approach, water security projects are not an expense but a purposeful investment, interconnecting incentives and metrics that recognize water as the strategic asset that sustains economies, territorial resilience and people's well-being.

5. Leveraging the potential of collective action: promoting public-private-community partnerships

One cross-cutting element of this guide is the importance of building collaborative venues where governments, the private sector, civil society and community actors can align incentives and jointly create solutions. The methodologies based on the five cases of the WSFF facilitate this construction of a common language that enables strategic visions to be transformed into robust and functional contractual arrangements. Early involvement of the private sector during strategic planning could make a catalytic contribution to defining realistic business models and identifying opportunities for performance-based contracts or PPP schemes, while the participation of civil society reinforces projects' social legitimacy and sustainability.

In order to build on the synergies of different sectors and actors, stakeholders must step forward to leverage the potential of intelligence and collective action to mobilize water security investments.

For national governments and regulators, the priority is to create an enabling institutional framework or environment through fair tariffs, the regulation of carbon markets and clear rules for private sector participation in providing water services. In contrast, local governments and operators need to strengthen their structuring capabilities with methodologies such as the WSFF, in addition to grouping projects into portfolios to increase scale and attract investment.

For their part, multilateral and development banks play a catalytic role by providing guarantees, concessional financing and technical support, as well as by promoting innovative instruments such as blended finance and thematic bonds. The private sector must participate transparently and pre-competitively in project origination, thereby helping to structure more robust projects; it can also continue to favour the PPP and BOT models already proven in cases such as Aquapolo and Tenorio. Finally, philanthropists and civil society can provide patient capital and social legitimacy and act as catalysts of pilot projects and guarantors of citizen participation.

Not only do these actions distribute responsibilities in a balanced way; they also show how public-private-community collaboration is essential to design sound contractual arrangements and thus ensure that funding flows towards viable and transformative water security projects.

In short, this guide proposes a paradigm shift in which instead of asking "how much financing do we need?", the question becomes "how do we structure projects that can attract financing?" The key is to build local capacities for designing transformative projects that can mobilize capital from multiple sources. That requires rethinking investment origination towards mission-driven approaches that incorporate implementation, financing and governance from the outset.

Taken together, these recommendations constitute a road map with which Latin America and the Caribbean can translate their water security strategies into viable, scalable and financially sound investment portfolios. The region will make progress as it strengthens its investment readiness, consolidates governance models that can coordinate multiple actors and levels and adopts programmatic implementation models that enable the complementary mobilization of resources from climate funds, multilateral banks and private capital. The potential exists; the challenge is to close the gap between intent and implementation through strengthened institutions, appropriate instruments and strategic partnerships that support the transition towards a resilient water future.

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