World Water Policy

WILEY

RESEARCH ARTICLE OPEN ACCESS

The Role of Public Finance to Address the Global Finance Gap for Drinking Water Services

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Received: 11 April 2025 | **Revised:** 11 September 2025 | **Accepted:** 19 October 2025

Keywords: drinking water | financial sustainability | financial viability status | global finance gap | life-cycle costs | public finance | sustainable development goals (SDGs)

ABSTRACT

Meeting SDG target 6.1 for drinking water requires addressing the finance gap between the funds available from tariffs, taxes and transfers, and the life-cycle costs of sustaining these services. While there are li-mitations to applying repayable finance to address this gap, governments can be well suited to support both drinking water infrastructure and operational needs. Roles for public finance supporting infrastructure construction have been well documented, however public finance tactics to support the ongoing operational needs of services have been less systematically explored. Building on existing literature about this finance gap, this paper analyzes examples of public finance from around the world to offer a framework for (1) understanding and comparing strategies by which public finance can bridge, shrink, and fill finance gaps for drinking water services, and (2) analyzing the tactics through which public finance can address gaps related to operational needs. This framework expands on and codifies how the finance gap for drinking water services can be—and is being—addressed. The paper also discusses the effectiveness and efficiency of public finance allocations, and how these may interact with the financial viability status of particular services. This can contribute to increasing the investment amounts, efficiency, and effectiveness that are all needed to address the finance gap and accelerate progress towards drinking water services for all.

1 | Introduction

The world is off-track to meet the SDG target 6.1 for drinking water services (WHO and UNICEF 2021; Joseph et al. 2024). In many countries, and globally, there is a finance gap for water services: a difference between the costs of these services, and the revenues available for them (UNICEF 2022). While current levels of investment in the sector could cover the infrastructure costs to achieve basic services for all, they are not sufficient for the goal of safely managed services, or for the ongoing costs of operating and maintaining services (Hutton and Varughese 2016). To continue global progress on safe drinking water services, there is a need to address this finance gap, increasing investment amounts, efficiency, and effectiveness (Kingdom et al. 2018; Alaerts 2019; Pories et al. 2019; Rozenberg and Fay 2019; SWA 2020; USAID 2021; Joseph et al. 2024). Currently, there is no standard framework for understanding or comparing options to address the finance gap for drinking water services. Building on existing literature about this finance gap, and from analysis of documented examples of public finance for water services around the world, this work aims to provide a framework for (1) understanding strategies by which public finance can bridge, shrink, and fill finance gaps for drinking water services, and (2) analyzing the tactics by which public finance can address gaps related to operational finance.

Summary

- Drinking water services globally face a mismatch between the available revenues from tariffs, taxes, and transfers, and the life-cycle costs of these services: this constitutes the global finance gap for drinking water services. The gap includes funds needed for infrastructure construction, and for ongoing operations and maintenance of services, with operational needs becoming the larger component.
- Different strategies are needed to address different components of the global finance gap for drinking water services: gap bridging strategies can help address infrastructure needs, and gap shrinking and/or filling strategies can help address operational needs. The financial viability status of services may affect which strategies are most efficient.
- Many drinking water services lack adequate tariff revenue to support ongoing operating costs. Around the world, a range of tactics are available and used by governments to shrink and/or fill this finance gap, applying policy, technical assistance, and financial instruments, at a range of cost levels. Governments should assess which tactical investments can most efficiently and effectively address the finance gaps they face and accelerate progress towards drinking water services for all.

The need to bridge or fill the finance gap (OECD 2010) for drinking water services has been discussed in a range of existing literature. This has included quantitative analysis of the scales of investments allocated (Joseph et al. 2024) and needed (Hutton and Varughese 2016) to reach the SDG target. It has also included qualitative analysis of the life-cycle costs of services (Fonseca et al. 2011), the available revenues from tariffs, taxes, and transfers (OECD 2009), the gap between these (OECD 2010; Norman et al. 2015; Kolker et al. 2016; Goksu et al. 2017; World Bank Group and UNICEF 2017a; USAID 2021; UNICEF 2022), and the potential for efficiency gains (Kolker et al. 2016; Goksu et al. 2017; World Bank Group and UNICEF 2017a; Soppe et al. 2018; SWA 2020; UNICEF 2022; International High-Level Panel on Water Investments for Africa 2023). However, literature has not systematically addressed that this finance gap has multiple contributing elements, which need to be addressed in different ways.

Efforts to address the finance gap for drinking water services need to consider the balance of costs contributing to the gap, and the associated implications. Studies have identified an increasing need for operational finance (World Water Council and OECD 2015; Hutton and Varughese 2016; Rozenberg and Fay 2019), which is expected to surpass infrastructure finance needs before 2030 (SWA 2020). This means there are limitations on the role of repayable finance in addressing the gap: repayable finance is only suitable for infrastructure costs (World Water Council and OECD 2015) and the relatively few services which would be able to make the required repayments (Fonseca 2015; World Water Council and OECD 2015; Leigland et al. 2016). On the other hand, public finance can be well suited to addressing these needs. Studies have highlighted the important role public finance should (Kolker et al. 2016), has, and is likely to continue to play in drinking water services (Hall and Lobina 2012; Norman et al. 2015; Humphreys et al. 2018; Joseph et al. 2024) – including supporting infrastructure (Joseph et al. 2024), operational (Van Den Berg and Danilenko 2017; Andres et al. 2019; WHO and UN Water 2019; Joseph et al. 2024), and policy and regulation costs (Rozenberg and Fay 2019). Public finance, however, is not a bottomless well (Whittington and Pattanayak 2015; Andres et al. 2019): allocations of public funds entail trade-offs, and the amounts governments allocate to the water sector may not increase in the near future (Joseph et al. 2024). Maximizing continued progress on drinking water service levels and sustainability requires investments which are efficient, adaptive, well-targeted, and equitable (Nilsson et al. 2021; WHO, UNICEF, and World Bank 2022; Joseph et al. 2024), and which are compatible with the identified characteristics of the finance gap.

This paper offers a framework for understanding and comparing strategies for bridging, shrinking, and filling the finance gap for drinking water services, focusing on the roles for public finance. By considering the attributes of infrastructure versus operational costs, the potential and limitations of repayable finance, and the broad range of water services, across income levels, urban and rural areas, and piped and non-piped services, this framework can be applicable across all geographies and service types. In this way, it can guide efforts to address the finance gap and accelerate progress towards drinking water services for all.

2 | Background

2.1 | Public Finance for Drinking Water Services

Governments need to play a leading role in water sector finance (Kolker et al. 2016). Public finance is suited to purposes of public good which improve equity, decrease poverty, support access to essential goods and services, and lead public policy (Mulgan 2009; United Nations 2014). Public finance, by its nature, represents a funding stream which can be directed by governments, without the consultations, negotiations, or restrictions (Pories et al. 2019) which can constrain private sector investments, donor projects, or overseas development assistance. It also underpins the institutions, policies, and regulations that govern the delivery of water services (Rozenberg and Fay 2019). The societal, economic, and public health benefits of water are well suited for public finance investments (Alaerts 2019; Joseph et al. 2024).

Globally, public finance allocations for drinking water services have been stable or increasing (WHO and UN Water 2022), and are likely to continue to play an important role in developing water services (Norman et al. 2015; Humphreys et al. 2018; Joseph et al. 2024). This includes supporting services which, due to high costs and/or low revenues from lower income populations, may never be financially viable and so are not suited to commercial investment (Humphreys et al. 2018). Due to higher per-capita investment needs (Ndaw 2016) and more difficult conditions for maintaining services (Briceño-Garmendia et al. 2008) including lower income levels (Andres et al. 2019; Pories et al. 2019), many rural water services can

fall into this category of services suitable for public finance investment.

2.2 | The Finance Gap for Drinking Water Services

Estimated annual capital investments between $6.9 billion, for basic water services, and $37.6 billion, for the SDG target of safely managed services, are needed per year to achieve drinking water services for all by 2030. While current sector funding may be able to cover the capital costs of basic water services for all, it is not sufficient for the standard of safely managed water services, or for the ongoing costs of operating and maintaining services (Hutton and Varughese 2016). Less than a third of countries report having sufficient funding to implement their plans for water services. Operating costs contribute to this shortfall, with water tariffs insufficient to cover the main operating costs for about 60% of urban services and more than 70% of rural services (WHO and UN Water 2022), including in many low and middle income countries (Andres et al. 2019). Globally, these mismatches between the available revenues from tariffs, taxes, and transfers (OECD 2009), and the life-cycle costs (Fonseca et al. 2011) of these services, constitutes the global finance gap facing drinking water services.

Local gaps in the financial viability of particular services (Bender 2017; Alaerts 2019; International High-Level Panel on Water Investments for Africa 2023) contribute to the global finance gap for water services. Some services operate profitably (WHO and UN Water 2022), and may be able to attract private finance to further extend services or increase service quality. However, in developing countries, 85% of water utilities are not financially viable (Alaerts 2019). While everyone needs drinking water, rural and lower income households (Whittington and Pattanayak 2015; Andres et al. 2019), and those in areas with higher income disparities (Van Houtven et al. 2017), may have less ability or willingness to pay for services (Hope et al. 2020; WHO and UN Water 2022). Also affecting the financial viability are factors including the scale and density of services (Rouse 2013), water consumption levels (Van Den Berg and Danilenko 2017), operational efficiencies (Alaerts 2019), and infrastructure and service qualities and standards (Rozenberg and Fay 2019). The expansion of services to remote, rural, and lower income areas still lacking water services means this group of less financially viable services will continue to grow (Pories et al. 2019).

2.3 | Addressing the Finance Gap for Drinking Water Services

Strategies for addressing the finance gap can be summarized as aiming to either bridge, fill (OECD 2010), or shrink finance gaps for water service delivery, by adjusting the balance of cost types needed (Fonseca et al. 2011) and revenue sources available (OECD 2009):

- Finance to **bridge gaps** targets initial funds needed to invest in infrastructure, and can include repayable finance (OECD 2010). Finance can be used directly or indirectly to support infrastructure construction, by increasing the funds available for capital expenditures (CapEx), or to reduce the costs of capital (CoC) for repayable finance.
- Finance to **fill gaps** targets persistent differences between ongoing operating costs and available revenues (OECD 2010). Finance can be used to directly or indirectly support paying operating expenditures (OpEx).
- Between these, finance can also be used to **shrink gaps** between ongoing operating costs and available revenues. Finance can be used to increase the funds available from water tariffs to support operational costs, or to decrease the funds needed for operating expenditures (OpEx).

Documentation within water sector literature exists that relates to all of these strategies, though to varying extents. In particular, documentation on the roles for public finance towards each of these strategies also varies.

Most of the literature on the finance gaps for water has focused on bridging the finance gap for infrastructure construction. Several publications have highlighted the need for attracting more capital finance (SWA 2020; International High-Level Panel on Water Investments for Africa 2023), possible sources for capital investments (United Nations 2014; World Water Council and OECD 2015; Leigland et al. 2016; Fonseca et al. 2021; International High-Level Panel on Water Investments for Africa 2023; REAL-Water 2023), and repayable finance instruments that can enable these capital investments (OECD 2010; United Nations 2014; World Water Council and OECD 2015; World Bank Group 2016; Bender 2017; Goksu et al. 2017; World Bank Group and UNICEF 2017a, 2017b; Alaerts 2019; UNICEF 2022; REAL-Water 2023). A few of these have further clarified that any repayable finance likely needs to be repaid from water tariffs (OECD 2010; Kolker et al. 2016; Bender 2017; SWA 2020; USAID 2021). Some have further discussed how different finance instruments are suited to different degrees of risk (International High-Level Panel on Water Investments for Africa 2023), and how different characteristics affect access to capital investments (OECD 2010). These can all be described as strategies and tactics for gap bridging.

The roles of the public sector in gap bridging, by supporting and enabling infrastructure investment, have also been well documented. Governments may directly spend money to support the construction and rehabilitation of water infrastructure (Hutton and Varughese 2016). This spending may be with existing government money as grants (Bender 2017; Goksu et al. 2017), or through taking loans, usually at better interest rates than available to private entities, and shifting the cost of water infrastructure to future taxpayers (Hall and Lobina 2012). Public finance can also be used by governments to unlock investments from other sources (World Bank Group and UNICEF 2017b; WHO, UNICEF, and World Bank 2022). This can include leading the prioritization (Pories et al. 2019; UNICEF 2022) and sequencing (Hutton and Varughese 2016) of new services, and project preparation (OECD 2010; World Water Council and OECD 2015; Winpenny et al. 2016; International High-Level Panel on Water Investments for Africa 2023). Governments may also make investments in policies that support enabling environments (United Nations 2014; World Water Council and OECD 2015;

Kolker et al. 2016; Alaerts 2019; Pories et al. 2019; Fonseca et al. 2021; WHO, UNICEF, and World Bank 2022; Joseph et al. 2024), including enabling private sector participation (Kirkpatrick et al. 2005b; Norman et al. 2015; World Water Council and OECD 2015; Kolker et al. 2016; Ndaw 2016; Soppe et al. 2018; Pories et al. 2019; IDEV Independent Evaluation African Development Bank 2020; WHO, UNICEF, and World Bank 2022; Joseph et al. 2024), as well as to attract (Leigland et al. 2016; Bender 2017; Goksu et al. 2017; WHO, UNICEF, and World Bank 2022) and reduce the costs of capital financing (OECD 2010; Goksu et al. 2017), and to support readiness in the sector to use these investments (Briceño-Garmendia et al. 2008; Pories et al. 2019; International High-Level Panel on Water Investments for Africa 2023; Joseph et al. 2024). They can also make investments to attract aid needed for infrastructure that is not appealing to private sector actors seeking financial returns (Fonseca et al. 2021). Additionally, publications have highlighted that the public sector can support gap bridging by using funds more efficiently for maximum value (Kingdom et al. 2018; SWA 2020; UNICEF 2022; International High-Level Panel on Water Investments for Africa 2023). This literature provides useful references for governments considering how to bridge gaps in infrastructure investments for water services.

Tactics for addressing finance gaps for the ongoing operational needs of water services, and how these can be filled, or shrunk, have been less documented. Literature has discussed the increasing need for operational finance (World Water Council and OECD 2015; Hutton and Varughese 2016; Rozenberg and Fay 2019; SWA 2020), that ongoing costs for some services can be financed by tariffs (Goksu et al. 2017; REACH and RWSN 2023), and the importance of governments in supporting and enabling water tariffs to support operating costs (Ndaw 2016). Studies suggest improvements to operational efficiency may enable more services to reach this point of financial viability based on tariffs as well, reducing the finance gap for operational needs (Kolker et al. 2016; Goksu et al. 2017; Kingdom et al. 2018; UNICEF 2022), though this may not be soon achieved in low and middle income countries (Goksu et al. 2017). Still, there is agreement that many existing water services struggle to cover O&M costs (Goksu et al. 2017; Alaerts 2019; Andres et al. 2019; SWA 2020; WHO and UN Water 2022; Fabre and Straub 2023; Joseph et al. 2024), with consequences for services, infrastructure built, and the sector's ability to attract investment (World Bank Group and UNICEF 2017b). These recurrent finance needs cannot be met with loans, bonds, or equity (World Water Council and OECD 2015), and so these services require support—often subsidies—for ongoing operating costs (REACH and RWSN 2023). To this end, there is documentation outlining the range of different subsidy models that can support OpEx (Andres et al. 2019). Overall, this set of literature discusses gap shrinking and filling, but is relatively low in quantity and sparse on details compared to the literature on gap bridging for infrastructure costs.

Based on this, a research gap exists in understanding the roles for public finance in addressing the overall finance gap for drinking water services, and, particularly, how public finance can be applied to support the operational elements within the finance gap.

3 | Methods

This study draws on published examples of public finance for drinking water services to examine strategies and tactics to support these services. The study followed a realist epistemology focused on explicit semantics for describing, summarizing, and interpreting all examples, using documentary analysis of archival texts to achieve thematic saturation (Braun and Clarke 2006; Robson and McCartan 2016; Silverman 2019). This provided an existing and available basis for the breadth of data sought, using material (Silverman 2019) and analytical approaches (Braun and Clarke 2006; Robson and McCartan 2016) more familiar and accessible to decision makers considering the issue of water sector finance gaps.

Examples were collected from published material about water sector finance, including gray literature and academic publications. These source materials are presented in Appendix A. In total, 213 examples covering 68 countries were identified from 54 publications, including reports from development agencies about water finance (41 reports published by AMCOW, IRC, OECD, RWSN, SWA, UNICEF, USAID, Water.org, WHO, World Bank, World Water Council, and WSUP), and journal and conference publications (13 articles). While 19 publications were framed around a single specific example, most of these publications described multiple countries and examples of public finance, often as illustrations or recommendations within a broader narrative report or discussion.

The 213 examples identified were assembled in a table, noting the country, country income group (World Bank 2024), and a brief description summarizing how public finance was being used to support water service delivery. Examples included direct expenditure allocations for drinking water infrastructure and operations, as well as government policy and regulation related to the finance of these services, from national or subnational levels. Examples that were described as planned or anticipated rather than past or ongoing, as unsuccessful or having major issues and presented as negative examples, or as led by donors or non-governmental organizations without descriptions of the involvement of government funding, were excluded.

This table was used as the dataset for theoretical thematic analysis (Braun and Clarke 2006) to support the development of an analytical framework of public finance tactics supporting drinking water service delivery. Each example was coded, and assigned as many codes as were relevant (Ritchie et al. 2003) to capture how public finance was being used: many examples were multifaceted and involved several elements. There were also instances where different publications described examples which seemed identical, similar, or related, within one country. In all cases, each example was coded separately: the results examine the presence or absence of codes at a country level, thus avoiding potential noise in results due to duplication of examples sourced from different texts. Coding of this dataset of examples was conducted recursively, with code coherence and distinctions rechecked and a sample of examples recoded for rigor. Data collection from archival material continued beyond thematic saturation (Braun and Clarke 2006), with additional examples returning no additional codes for the analytic objectives of the study (Guest et al. 2006), and the identification of

novel country examples also decreasing (Silverman 2019). Codes were assigned at two levels.

The first level of codes sought theory-related codes (Robson and McCartan 2016) connected to existing frameworks widely used for understanding finance for drinking water services. These included frameworks describing the sources of revenue for water services, classified as taxes (public finance), tariffs paid by users, and aid transfers (OECD 2009), and describing the life-cycle cost types (Fonseca et al. 2011) of drinking water services. The final themes are conceptualized as a set of five strategies of how public finance can seek to change the balance of funds available versus needed for service provision, and how these may seek to either bridge, fill (OECD 2010), or shrink finance gaps for water service delivery. These strategy theme codes are presented in Results (Section 4).

The second level codes were applied to examples which included descriptions of public finance allocations towards ongoing operational needs of drinking water services. This set of codes sought to characterize the types of tactics (Robson and McCartan 2016) by which public finance was used towards the identified strategy. These codes were developed inductively, with initial codes reviewed and refined. These codes were reflexively informed, but not driven, by other frameworks and concepts (Braun and Clarke 2006) used in the drinking water sector, including categories of drinking water management approaches (Lockwood and Smits 2011). To improve clarity, the codes were further structured using a typology (Silverman 2019) of instruments describing how funds were spent. Government allocations for direct spending and transfer payments (Mulgan 2009; Acemoglu et al. 2022) were labeled as financial instruments. Spending through government operating costs was subdivided between technical assistance instruments, where government provides information, education, and advice (Mulgan 2009), and policy instruments, where government invests in enacting policy actions, including surveillance, oversight, and enforcement (Boyne 1998; Ostrom 2015; Rozenberg and Fay 2019). The resulting codes for these tactics are presented in the Results (Section 4).

4 | Results

4.1 | Public Finance Strategies Supporting Drinking Water Services

This paper proposes a framework of five strategies by which public finance is used to address finance gaps for drinking water services, identified within the examples analyzed. The following paragraphs describe these five strategies, the number of countries each was identified in, and how the strategies relate to bridging, shrinking, and filling finance gaps.

The first two strategies relate to bridging drinking water sector finance gaps, by supporting and enabling infrastructure investment. As outlined in the Background (Section 2), gap bridging strategies have been well documented. This framework proposes distinguishing between two gap bridging strategies using public finance. One seeks to **increase funds available for capital expenditures**. This includes various forms of investment by governments, and initiatives to attract investment from other repayable and non-repayable sources, which were identified in 41 country examples. Another gap bridging strategy aims to **decrease the funds needed by reducing the costs of capital** for infrastructure, by investing public finance towards obtaining more favorable conditions on repayable funds. This strategy was identified in 8 country examples. Both gap bridging strategies support progress on drinking water services by increasing the reach or coverage of infrastructure, through new infrastructure in areas without services, as well as infrastructure expansion and replacement.

The other three strategies proposed relate to addressing operational finance gaps. One gap shrinking strategy seeks to **increase funds available from tariffs**. While water tariffs are often insufficient to cover the main operational costs of water services (Whittington and Pattanayak 2015; Alaerts 2019; Andres et al. 2019; Fonseca et al. 2021; WHO and UN Water 2022; Fabre and Straub 2023), due in part to the need to keep tariffs at affordable levels (Hutton and Varughese 2016), they are still the largest and most predictable source of funding for ongoing water services (SWA 2020). Increasing the revenue from tariffs can bring some water services to, or closer towards, a point of financial viability. This strategy was identified across 45 country examples. A second gap shrinking strategy aims to **decrease funds needed for operating expenditures**. This includes various efforts to control the operating costs of services and provide services which are both more affordable and financially sustainable (Van Den Berg and Danilenko 2017). This was identified in 34 country examples. The final strategy aims to **increase funds available for operating expenditures**, with public finance allocations for filling the operational finance gap. This was identified in 33 country examples. These three strategies can enable progress on drinking water services by reducing the amount of infrastructure that falls into disrepair and disuse, and thereby, people who lose access to services.

Across all five strategies, more country examples (60) were related to one or more strategies for increasing funds available, than related to strategies for decreasing funds needed (34). This was similar across all country income groups, except lower-middle income country examples, which were about evenly divided (17 country examples related to increasing funds available, 16 related to decreasing funds needed).

Within the literature examined, examples of public finance being used to support drinking water services through these strategies were identified from 68 countries 161 times. The distribution of these country examples across the five strategies is described in Figure 1.

This research demonstrates widespread documented examples of public finance supporting drinking water services which can be understood through the lenses of these five strategies. By expanding on already widely used framing concepts—related to service revenue sources and life-cycle costs—the resulting framework can usefully contribute to efforts to understand and address the finance gaps for these services.

	Strategies	*Country examples*
Infrastructure		
Gap bridging	**Increase** funds available **for Capital Expenditures** (CapEx)	*41*
	Decrease funds needed **for Costs of Capital** (CoC)	*8*
Operational		
Gap shrinking	**Increase** funds available **from tariffs**	*45*
	Decrease funds needed **for Operating Expenditures** (OpEx)	*34*
Gap filling	**Increase** funds available **for Operating Expenditures** (OpEx)	*33*

FIGURE 1 | Five public finance strategies to support drinking water services.

4.2 | Public Finance Tactics Supporting Ongoing Operations of Drinking Water Services

This paper also proposes a framework of tactics, developed based on the examples analyzed, by which public finance supports finance gap shrinking and filling for the ongoing operations of drinking water services. The tactics are further categorized by whether they apply financial, technical assistance, or policy instruments, as outlined in the Methods (Section 3), and labeled with a relative level of cost, compared with other tactics.

While the instrument categories clarify the tactics, the relative cost labels provide an initial rough guide to the financial implications of each tactic in addressing the operational finance gap. For this framework, relatively low costs were assumed when the amounts paid by the public finance involved were mainly related to government staff time (Joseph et al. 2024). Moderate costs were assumed when public finance was involved in the issuing of funds or loans to support services, with others contributing towards costs at various ratios. Relatively high costs were assumed when governments were more directly responsible for ongoing services and public finance was a main element determining the scale of total funds available.

Costs were assessed qualitatively, rather than quantitatively, for three reasons. First, most of the source material from which these examples were identified did not describe cost amounts. Second, there have been relatively few quantitative analyses of water utility finances in low income countries, and some of those have had questions raised around reliability (Libey et al. 2020). Third, public investments in the sector can be difficult to track (Fonseca 2024), as they are often spread across different levels and departments of government (Pories et al. 2019; Joseph et al. 2024) and use different ways of deriving numerical figures.

The following sections describe, on a strategy-by-strategy basis, each of the tactics proposed in the framework. For each tactic, there is a description of how it uses public finance, the number of countries in which it was identified, and the mechanism by which the tactic could contribute to the strategy.

4.2.1 | Tactics for Gap Shrinking by Increasing Funds Available From Tariffs

Four tactics were identified by which public finance was applied towards a strategy to increase the funds available from tariffs. All applied policy or technical assistance instruments, and involved relatively low levels of public finance investment.

4.2.1.1 | Policies for Increasing Tariffs. One tactic involved government investment in **policies for increasing tariffs**. Described among 29 country examples, these include decisions about setting and enforcing water tariffs (Fonseca et al. 2021), and preventing underpricing of water (Briceño-Garmendia et al. 2008).

Public finance related to these instances would include analysis to determine affordable tariff levels, considering ability and willingness to pay for services (Hope et al. 2020; SWA 2020; WHO and UN Water 2022), how this might vary between and within populations (Hutton and Varughese 2016; World Bank 2017), and establishment of price levels, caps or scales (Kirkpatrick et al. 2005a). It could also include analysis of what tariff revenues are needed for cost-recovery where this forms the basis of tariff setting, as well as funding of tariff policy enforcement mechanisms (World Bank 2017). The amount of public finance involved would be expected to be relatively low, focused on use of government staff time.

Water tariffs in low and middle income countries are usually not at levels sufficient for cost-recovery (Andres et al. 2019), and many tariff structures have most customers paying lowest rates, even when some of them could afford to pay more (SWA 2020). Increasing tariffs could lead to greater revenues from water users, reducing the operational finance gap. However, increasing water tariffs is often unpopular and so politically challenging for governments to do (OECD 2010; Rouse 2013; World Water Council and OECD 2015), and tends to happen slowly (Joseph et al. 2024). Any increase also needs to consider that water is a human right, and must be affordable—though affordability is difficult to determine (Hope et al. 2020; Mitlin and Walnycki 2020; WHO and UN Water 2022), and not uniform within countries and groups (Hutton and Varughese 2016). Even adopting a technical framing, such as having tariffs target full cost-recovery, still requires clarity about what types of costs are expected to be covered (World Bank 2017), and is challenging to calculate (Kingdom et al. 2018).

4.2.1.2 | Technical Assistance to Improve Tariff Collection. Governments also invest in **technical assistance to improve tariff collection**. Described among examples from 4 countries, this tactic includes initiatives for enhancing demand for safe water services (Ndaw 2016), for addressing under-collection of billed tariffs, and for reducing instances

of non-billed water usage efforts to addressing under-collection of billed tariffs, and for reducing instances of non-billed water usage (Briceño-Garmendia et al. 2008; World Water Council and OECD 2015; UNICEF 2022).

Public finance in these instances could include costs for behavior change (Fonseca 2015; Ndaw 2016), building capacity of service providers, and clarifying the legal and regulatory environment (Ndaw 2016) and mechanisms (World Bank 2017) for tariff enforcement. The amount of public finance involved would be expected to be relatively low, focused on use of government staff time.

Poor tariff collection can seriously hamper the cash flow of service providers and limit their operations (Van Den Berg and Danilenko 2017), particularly when operating margins are already tight, and so improved tariff collection can help reduce the operational finance gap. However, there may be limitations in tariff enforcement mechanisms, as well as a need to allow some flexibility and variations in actual tariffs collected to account for local contexts and needs (World Bank 2017).

4.2.1.3 | Policies Regulating Water Service Quality. Examples from 20 countries were classified as governments enacting **policies regulating water service quality**. These could be targeting quantitative or qualitative improvements in services (Parker and Kirkpatrick 2002) related to water quality, safety, quantity, reliability, continuity (hours per day), or access (distance) (World Bank 2017). These standards or improvements can support water users willingness to pay tariffs for water services (World Water Council and OECD 2015; Goksu et al. 2017; Van Houtven et al. 2017; World Bank Group and UNICEF 2017b; Kingdom et al. 2018; Soppe et al. 2018; REACH and RWSN 2023).

Public finance in these instances would include costs related to responsibilities for water service outcomes (Boyne 1998) and policy enforcement (Rouse 2013), including monitoring and supervision to identify issues and ensure compliance with the local relevant plans, policies, and legislation (Huston and Moriarty 2018). The amount of public finance involved for operational needs would usually be relatively low, involving primarily allocations of government staff time, though may increase substantially in cases of regulation targeting water quality if new laboratory infrastructure is required, and for operational costs of laboratories.

Improved water service quality can improve the operational confidence of service providers (Ndaw 2016) and may support water user tariffs which reduce the operational finance gap. However, there may be challenges in defining what good quality services mean, within and between different groups (Boyne 1998): different priorities can influence the tariffs water users are able or willing to pay (Van Houtven et al. 2017). Regulating water quality may also be challenging, as less than half of countries have a regulator who can enforce sector policies or recommendations, and even lower oversight in rural areas (WHO and UN Water 2022), including due to insufficient human and financial resources to provide the required surveillance and enforcement (WHO and UN Water 2019).

4.2.1.4 | Policies for Private Service Delivery Contracts. Governments may also seek to increase water user contributions to services by enacting **policies for private service delivery contracts**. Described within examples from 29 countries, these include management contracts, *affermages*, leases, concessions, and Build-Operate-Transfer (BOT) concessions (World Bank Group 2014), as well as variations on BOT contract models with private operators involved in various combinations of the Design, Rehabilitation, and Finance of services, in addition to or instead of any of the BOT elements (Ameyaw et al. 2017).

Public finance related to these instances would include costs for identifying suitable operators and tendering (Boyne 1998), contracting, managing contract performance, enforcing contract terms (Kirkpatrick et al. 2004; Rouse 2013), and governance more broadly (Ndaw 2016). Some instances may also involve more direct spending related to service infrastructure through involvement in public-private partnerships (PPPs) (World Bank Group 2014; World Water Council and OECD 2015; Fabre and Straub 2023). The amount of public finance involved for operational needs would usually be relatively low, involving primarily allocations of government staff time.

These contracts can support higher available funds for ongoing operational costs through higher tariffs charged by private operators (Kirkpatrick et al. 2004; Banerjee and Morella 2011), as well as larger scales of operations (Kirkpatrick et al. 2004; Fabre and Straub 2023) enabling pooling of risks and revenues across more services (Hope et al. 2019). Additional benefits could include providing regulation through the contract terms (Van Den Berg and Danilenko 2017), improving operation of some water services (Boyne 1998; World Bank Group 2014; International High-Level Panel on Water Investments for Africa 2023), and improvements to water quality and safety (Joseph et al. 2024). However, PPPs are not widespread in the sector (Joseph et al. 2024): relatively few have been studied, and research has largely focused on larger operators (International High-Level Panel on Water Investments for Africa 2023). There are also suggestions that they may not improve operational efficiencies (Hall and Lobina 2012; Fabre and Straub 2023; Joseph et al. 2024), and have mixed effects on service access (Parker and Kirkpatrick 2002; Banerjee and Morella 2011; Joseph et al. 2024) and tariff revenues (Joseph et al. 2024).

4.2.2 | Tactics for Gap Shrinking by Decreasing Funds Needed for Operating Expenditure

Five tactics were identified by which public finance was applied towards a strategy to decrease the funds needed for operational expenditure. These included a range of instruments and public finance investment levels.

4.2.2.1 | Loans and Guarantees. Governments may provide **loans and guarantees** targeted to shrink ongoing operational costs. Identified in examples from 4 countries, these financial instruments (OECD 2010; REAL-Water 2023) support service providers in paying particular ongoing or recurring costs, such as for supplies or routine services.

Public finance in these instances would include government staff time to implement and manage the loans and guarantees (REAL-Water 2023), as well as the financial allocations themselves. The relative amount of public finance involved would be moderate, involving government staff time as well as outgoing funds, which may not always be repaid.

This tactic could help to reduce ongoing costs charged by suppliers by lowering the risk of non-payment by water service providers, and by helping to catalyze other spending (WHO, UNICEF, and World Bank 2022; REAL-Water 2023). Like other repayable finance, however, its application would be limited to contexts where repayments could be managed from water tariffs (OECD 2010; Bender 2017; SWA 2020; USAID 2021).

4.2.2.2 | Policies Regulating Service and Support Structures. Governments may also enact **policies regulating service and support structures**. Identified in 18 country examples, such policies include different types of decentralization, centralization or re-centralization, of responsibilities (OECD 2010; REACH and RWSN 2023), according to levels deemed suited and efficient for various roles (Ndaw 2016), grouping smaller service providers under or into larger professional management entities to try to improve service delivery (REACH and RWSN 2023) or increase operational efficiencies (UNICEF 2022), and strengthening policy frameworks supporting private sector engagement in service provision (Ndaw 2016).

Public finance in these instances would include the monetary costs of operating (Boyne 1998) or overseeing (Huston and Moriarty 2018) these structures, and policy enforcement (Rouse 2013). The amount of public finance involved would usually be relatively low, involving the organization of government staff, and the allocations of staff time to policy development.

Well-designed sector structures can support lower ongoing operational costs by working at efficient operational scales (Rouse 2013; Van Den Berg and Danilenko 2017; Leflaive et al. 2022). They may also support private service providers to operate in the sector (Kirkpatrick et al. 2005b; IDEV Independent Evaluation African Development Bank 2020), and to engage in longer-term initiatives to improve operational efficiency (Banerjee and Morella 2011; Kolker et al. 2016; Ndaw 2016; Van Den Berg and Danilenko 2017; Joseph et al. 2024). However, the design of appropriate structures and policies is not straightforward, and can bring mixed results (Parker and Kirkpatrick 2002). In some cases, decentralization can result in less effective services, and small-scale services may entail higher costs (Rouse 2013) and struggle to access finance (OECD 2010). Decentralized regulatory entities may also have less capacity to support service providers (World Bank 2017). Concerns about private sector involvement, as described above, may also apply to some of these policy tactics.

4.2.2.3 | Policies for Service Delivery Models With Low Operational Costs. Governments may also promote **policies for service delivery models with low operational costs**. Described among 7 country examples, these include self-supply service delivery, wherein households, alone or in small clusters, provide their own water services, sometimes with government involvement and support (World Bank 2017), and community-based management (CBM), where operational costs are managed locally by water users (Carter 2021; REACH and RWSN 2023).

Public finance allocations in these instances relate to government responsibilities for water service outcomes (Boyne 1998), and could include structured support for theses service delivery models, aggregation of communities, local government involvement (World Bank 2017), and monitoring and supervision (Huston and Moriarty 2018; Danert et al. 2022). The amount of public finance involved would usually be relatively low, involving primarily allocations of government staff time.

These tactics offer low-cost models for maintaining services (Foster and Hope 2016; Carter 2021; Danert et al. 2022) because, unlike professionalized service delivery models, these are voluntary-based (Lockwood and Smits 2011), removing most or all local remuneration costs. They may also be helpful for providing services to dispersed populations, and where other services are not yet available or sufficient (World Bank 2017; Carter 2021). However, there is wide documentation of shortcomings in community-based management in sustaining services over time, concerns that it places too much burden on communities (Chowns 2015) and allocates too much financial risk to communities (Hope 2015) where financial backstopping is required (Hutchings et al. 2015). Similarly, there are concerns that these tactics are not always adequately supported (Carter 2021) and can become a way for governments to escape responsibility for services (World Bank 2017).

4.2.2.4 | Policies for Infrastructure With Low Operational Costs. Governments may also promote **policies for infrastructure with low operational costs**. Identified in 11 country examples, this tactic includes investments in solar power where this is done to reduce ongoing energy expenditures (UNICEF 2022; REACH and RWSN 2023), as well as initiatives targeting water infrastructure quality to reduce early failure and excessive or premature maintenance needs (Bonsor et al. 2015; UNICEF and Skat Foundation 2016; Danert 2022a). These include a range of initiatives, including use of longer-lasting non-corroding materials (Danert 2022b), improving drilling practices (RWSN 2010; UNICEF and Skat Foundation 2016), and licensing of those involved in construction to support quality installations (RWSN 2010).

Public finance in these instances would include costs related to monitoring, supervision (Huston and Moriarty 2018), and enforcement (Rouse 2013). The amount of public finance involved would usually be relatively low, involving primarily allocations of government staff time.

While all water infrastructure requires maintenance, the standards to which infrastructure is designed, and the standards it must meet, are major determinants of service costs (Van Den Berg and Danilenko 2017). Some infrastructure can be cheaper to maintain and operate, have a longer life-span, or require less maintenance (Rozenberg and Fay 2019), lowering ongoing operational costs. Still, the affordability of infrastructure (Van Den Berg and Danilenko 2017) and of ongoing operations (Rozenberg and Fay 2019) are both issues, particularly in serving low income

areas (Hutton and Varughese 2016): the investments required for higher quality or more expensive infrastructure may hinder the suitability of this approach, particularly where many still lack access to even basic services (Hutton and Varughese 2016; Danert 2022a). Policy adherence may also prove challenging, with many countries struggling with surveillance, oversight, and enforcement capabilities (WHO and UN Water 2019, 2022).

4.2.2.5 | Technical Assistance for Service Efficiency. Examples from 10 countries were classified as governments investing in **technical assistance for service efficiency**. This includes support linked to overall financial ratios like operating cost coverage (Van Den Berg and Danilenko 2017), efficiency indicators related to labour, energy, or operating costs (Banerjee and Morella 2011), or rates of non-revenue water (WHO, UNICEF, and World Bank 2022), as well as measures of achievement of service standards (Goksu et al. 2017). Assistance might also include demand reduction (Goksu et al. 2017; Kingdom et al. 2018; Joseph et al. 2024) to maximize populations served.

Public finance in these instances could include costs for monitoring and supervision of service providers to identify issues, building capacity of service providers (Ndaw 2016; REACH and RWSN 2023), and behavior change (World Water Council and OECD 2015) or incentives (Goksu et al. 2017; Pories et al. 2019) for service providers or water users. The amount of public finance involved would be expected to be relatively low, focused on use of government staff time.

Operational inefficiencies of water services contribute to higher costs, denting financial viability. Improving efficiency can help to reduce the financial gap (Banerjee and Morella 2011; Hukka and Katko 2015; Goksu et al. 2017; Soppe et al. 2018; Joseph et al. 2024), and may potentially bring some services to a point of financial viability (Kolker et al. 2016; Leigland et al. 2016; Alaerts 2019). However, it can be difficult to choose how to track service efficiency, with a wide range of possible indicators which may not be correlated (Van Den Berg and Danilenko 2017). More generally, efficiency improvement margins in governments are considered to be relatively small (Mulgan 2009). Even with maximal efficiency, many drinking water services, particularly in low income countries, may still face a finance gap (Banerjee and Morella 2011). Some estimates suggest that even with efficiency improvements combined with a 10% increase in revenues, nearly a quarter of water utilities studied would remain financially unviable (Kolker et al. 2016; Leigland et al. 2016).

4.2.3 | Tactics for Gap Filling by Increasing Funds Available for Operating Expenditure

Four tactics were identified by which public finance was applied to increase the funds available for operating expenditures. All but one applied financial instruments, and so involved moderate or higher levels of public finance investment, while the other describes a lower cost policy instrument.

4.2.3.1 | Subsidies. Governments may allocate funds for **subsidies** to fill finance gaps for drinking water services. Subsidies are widely used by governments worldwide (Van Den Berg and Danilenko 2017; Andres et al. 2019; WHO and UN Water 2019) to help meet the costs of sustaining water services when these costs are higher than what users pay (World Water Council and OECD 2015; Andres et al. 2019; Joseph et al. 2024), and were identified among examples from 17 countries. Subsidies are highest for services in urban areas, and using piped infrastructure. They can be applied universally, or targeted, either through administrative or self-selection, and may be explicit or implicit, direct or indirect, and planned to decrease over time or to remain permanently (Andres et al. 2019).

Public finance in these instances would include costs related to the design of subsidy structures and levels (Ndaw 2016; Andres et al. 2019), to try to ensure subsidies are targeted appropriately to those less able to pay (World Bank 2017; SWA 2020; Joseph et al. 2024), and minimize inefficiency, and over-use of water. It would also include the subsidy payments themselves, which may be to water users, to institutions such as schools or health facilities, or to service providers, or payments for inputs such as electricity costs (Andres et al. 2019). The relative amount of public finance involved would be moderate, involving government staff time in addition to the subsidy amounts themselves, with most subsidies being complemented with tariffs paid by water users.

Subsidies for water services can help fill the gap between incoming tariffs and outgoing costs, keeping water tariffs at levels considered affordable to water users (Andres et al. 2019; Pories et al. 2019; Libey et al. 2020; Fonseca et al. 2021) while services continue without falling into disrepair (Andres et al. 2019). It is normal for subsidies to have a roll in filling financial deficits in the provision of public goods (World Water Council and OECD 2015). However, subsidies do not benefit those who do not yet have access to services (Van Den Berg and Danilenko 2017; Andres et al. 2019), and so can be regressive (Briceño-Garmendia et al. 2008). They may also encourage user underpayment (Hukka and Katko 2015; SWA 2020), overconsumption, provider inefficiencies (Rouse 2013; Goksu et al. 2017; Kingdom et al. 2018; Andres et al. 2019), and prevent or limit private investment (Leigland et al. 2016; Goksu et al. 2017; Pezon 2017). Subsidies can also be poorly designed, not reaching lower income households (Hukka and Katko 2015; International High-Level Panel on Water Investments for Africa 2023; Joseph et al. 2024) and benefiting households and services which do not require these subsidies (SWA 2020). For these reasons, some subsidies may be best applied for temporary and phased-out usage while progressing towards financial viability (Andres et al. 2019). Long-term subsidies might best be treated as a last-resort option for supporting operating expenditures (Goksu et al. 2017), or may be replaced with targeted social supports (Leflaive et al. 2022). Still, subsidies remain common worldwide, and some form of subsidies may always be needed for some water services (Andres et al. 2019; SWA 2020).

4.2.3.2 | Performance-Based Subsidies. Examples from 8 countries related specifically to **performance-based subsidies**, where subsidies are conditional on proof of meeting certain service or operations criteria (United Nations 2014; World Water Council and OECD 2015). Various performance metrics and payment routes can be used as the basis for these subsidies.

Some performance-based subsidies are paid to water users, based on maintenance activities. Some are paid to local governments, based on the water service results achieved in their areas. Others are paid to service providers, based on metrics related to energy use, volumes of water, tariffs collected, and service quality, efficiency, reach, or expansion.

Public finance in these instances would be similar as for subsidies more generally, with additional spending for monitoring and supervision (World Bank 2017; Hope et al. 2020) to inform actual subsidy payments. The relative amount of public finance involved would remain moderate, involving government staff time in addition to the subsidy amounts themselves, with most subsidies being complemented with tariffs paid by water users.

Performance-based subsidies can help to fill the gap between incoming tariffs and outgoing costs, with additional advantages of incentivizing improvements (Pories et al. 2019), efficiency (World Water Council and OECD 2015), and accountability for services, with subsidies targeting particular criteria (OECD 2010). They can also improve sector data and help to justify subsidies (Hope et al. 2019). To have the desired effects, these require careful design and definition of the incentives and metrics (Howard and White 2020).

4.2.3.3 | Government-Operated Service Delivery Models. Another tactic involves **government-operated service delivery models**, with governments assuming direct responsibility for ongoing operations of services, including operational costs. Identified in 17 country examples, these include services fully run by governments, as well as government-owned services (Rouse 2013; Mitlin and Walnycki 2016).

Public finance in these instances would include government staff time in addition to the ongoing costs of operating the water services—usually supplemented by some level of tariffs paid by water users. The amount of public finance involved would be relatively high, involving government staff time in addition to the operational costs not covered by user-paid tariffs.

Government-operated services can directly assume responsibility for filling an operational finance gap remaining after any tariffs (OECD 2010; World Water Council and OECD 2015). Compared with private service providers, governments may be better able to take long-term views to maintaining services, and consider the interests of all (Clark et al. 2018), including vulnerable and underserved populations (Joseph et al. 2024). However, like other service models, some government-operated services struggle to fund operational expenses (OECD 2010). There are also concerns and debate about whether these services might be less effective or efficient than private services, and more subject to political influence (Rouse 2013; Soppe et al. 2018; Andres et al. 2019; Joseph et al. 2024). Public models may be more successful when structures such as government-owned companies provide some separation (Rouse 2013).

4.2.3.4 | Policies for Cross-Subsidies. **Policies for cross-subsidies** can also be applied to fill gaps in ongoing operational needs. These were identified in 7 country examples, and can include cross-subsidies between different geographic areas, including urban and rural, between water service providers, and with providers of entirely different services (Andres et al. 2019; SWA 2020).

Public finance in these instances would include spending for design of the cross-subsidy mechanism and levels (Andres et al. 2019), monitoring, supervision, and assurance of compliance (Huston and Moriarty 2018) with the policies, and funding of tariff policy enforcement mechanisms. The amount of public finance involved would usually be relatively low, involving primarily allocations of government staff time.

Cross-subsidies can help to provide funds for operations by using the facts that the levels of tariffs which are affordable vary within and between populations (SWA 2020), and that some water services operate profitably. Surplus revenues from one service or group can be used to subsidize services which are not financially viable. However, such policies risk being unpopular (Van Den Berg and Danilenko 2017; Andres et al. 2019), and, in the case of subsidies between water services, may also face limitations: as few developing country water utilities are financially viable (Alaerts 2019), subsidies between water providers may only be feasible in a very few situations.

4.2.4 | Overview of Tactics for Supporting Ongoing Operations of Drinking Water Services

Within the literature examined, examples of these 13 public finance tactics being used to support the operations of drinking water services were identified from 64 countries 178 times. These tactics, labeled by instrument and relative level of cost, are described in Figure 2, showing the distribution of these country examples.

Among these country examples, policy instruments were most widely exemplified, across 56 countries, while financial instruments were identified among 32 countries, and technical assistance instruments across 12 countries: this distribution was similar across all country income groups. The distribution of the relative level of costs was also not uniform: lower cost tactics were most widely described, among 57 countries, compared to moderate cost tactics in 24 countries, and relatively high cost tactics in 17 countries: this distribution was similar for both low and lower-middle income countries, and upper-middle and high income countries.

5 | Discussion

5.1 | Framing Strategies and Tactics Addressing the Finance Gap for Drinking Water Services

Gap bridging, shrinking, and filling strategies are all needed to continue and accelerate progress on drinking water services, and can be actioned through various tactics. Building on existing literature about the finance gap, the proposed framework expands on and explicitly codifies (Mulgan 2009) how the finance gap can be—and is being—addressed.

	Strategies	Tactics	Instrument	Relative level of costs	*Country examples*
Infrastructure					
Gap bridging	**Increase** funds available **for Capital Expenditures** (CapEx)				
	Decrease funds needed **for Costs of Capital** (CoC)				
Operational					
Gap shrinking	**Increase** funds available **from tariffs**	**Policies for increasing tariffs**	Policy	Relatively low costs	*29*
		Technical assistance to improve tariff collection	Technical assistance	Relatively low costs	*4*
		Policies regulating water service quality	Policy	Relatively low costs	*20*
		Policies for private service delivery contracts	Policy	Relatively low costs	*26*
	Decrease funds needed **for Operating Expenditures** (OpEx)	**Loans and guarantees**	Financial	Moderate costs	*4*
		Policies regulating service and support structures	Policy	Relatively low costs	*18*
		Policies for service delivery models with low operational costs	Policy	Relatively low costs	*7*
		Policies for infrastructure with low operational costs	Policy	Relatively low costs	*11*
		Technical assistance for service efficiency	Technical assistance	Relatively low costs	*10*
Gap filling	**Increase** funds available **for Operating Expenditures** (OpEx)	**Subsidies**	Financial	Moderate costs	*17*
		Performance-based subsidies	Financial	Moderate costs	*8*
		Government-operated service delivery models	Financial	Relatively high costs	*17*
		Policies for cross-subsidies	Policy	Relatively low costs	*7*

FIGURE 2 | Public finance tactics to support operations of drinking water services.

The framework can be applied to a broad range of contexts. It was developed drawing upon a wide variety of examples of public finance being used to support drinking water services, which covered differing geographies, country income groups, urban and rural settings, infrastructure types, and scales of services—details which were clearly described for some examples, while not mentioned or unclear in the text presented for others. All examples were presented positively in the literature they were drawn from, and so the tactics listed are (or were, when that literature was published) considered as having been successfully applied in at least some cases, by at least those authors. As a result, the framework of strategies and tactics presented can be considered as potentially applicable across a wide range of contexts, while also considering how they may be adapted to particular situations.

This framework can be useful for understanding and making initial comparisons of options to address the finance gap for drinking water services, at several levels. At a strategy level, it can guide understanding of the financial viability of particular services and of the sector-level gap, and reflections on the envisioned financial future of drinking water services. This can then inform investments on infrastructure versus operational needs. The framework ideas can also be applied for considering how short-term project or programme investments can best support the long-term financial sustainability of drinking water

services. At the tactical level, the framework offers decision makers a menu of investment options for consideration—based on their strategic objectives, and their available instruments and financial resources—as the proportion of the finance gap related to operational needs increases. More broadly, the framework provides language to illuminate (Mulgan 2009) and track what strategies and tactics are being used across time and space. This can help to identify holes in what is being applied, or where innovation may be required to come up with new tactics. Finally, the framework ideas can be used to help strategize about possible routes of progress towards universal safely managed drinking water services—considering the finance gap for existing services, service functionality and sustainability issues, and the remaining gaps in coverage of drinking water services.

5.2 | Public Finance Effectiveness for Operational Finance Gaps

As the gap related to operational finance increases, decision makers should consider how to effectively invest public finance to shrink and fill it. While this framework is built from positively described examples, the Results (Section 4) includes controversies about the effectiveness of tactics, based on documented experience and theoretical concerns. While there is not yet sufficient evidence available in the sector to make definitive judgments about the effectiveness of most of these tactics, it is still possible to compare at a theoretical level how effective different tactics might be for shrinking or filling a finance gap, by considering a relative level of assurance of results, to describe the degree of control versus risk that governments might expect. Particular tactics may offer a relatively high, or relatively low, assurance of results.

When reflecting on risk and control, some tactics might be assumed to provide a lower assurance of results. **Policies for service delivery models with low operational costs** delegate responsibility for water services to non-professional entities. While there are positive examples where these non-professional entities have been successful, there are also many instances where they fail to achieve sustained services over time. The indirect tactics of **technical assistance to improve tariff collection**, which supports service providers' ability to collect tariffs from water users, and **technical assistance for service efficiency**, which supports them to lower operational costs, would both also likely only allow a relatively low assurance of the results sought, and may also take more time to achieve positive results. In total, these three tactics were identified across 16 country examples.

Other tactics might be expected to offer a higher assurance of results. **Government-operated service delivery models with direct responsibility for ongoing operations** place governments in a position to have a high level of control over services. **Policies for private service delivery contracts** involve professionalized service providers, which tend to show improved service and sustainability results. The legal contract mechanisms would also likely allow a relatively high level of control in working towards service delivery results. **Performance-based subsidies** use results-based finance to incentivize ongoing service delivery. This tactic, with payments based on the achievement of clear measured results, would provide a relatively high assurance of the service delivery results sought, incentivizing service providers to improve their performance on the subsidy-determining indicators. It would have a similar level of cost, but a higher assurance of results, than a subsidy which is not performance-based. In total, these three tactics were identified across 36 country examples.

These descriptions remain intentionally theoretical and provide only an indication of a likelihood of effectiveness, not of actual success or non-success of a tactic or of any of its examples. In reality, any tactic could be more or less effective in the particulars of its design and implementation. An attempt at global comparisons of tactics would have mixed results due to these variations, as well as being hindered by a lack of sufficiently granular data on water service coverage, functionality, and financial sustainability, in time and place. Instead, these relative levels of assurance of results offer a lens through which to consider potential public finance tactics and assess choices which could improve the likelihood of the desired gap shrinking or filling effect. They may also be useful, alongside the relative level of costs, to compare tactical options. These reflections can help to guide more effective investments in drinking water services.

5.3 | Public Finance Efficiency for Finance Gaps

With limits on the public finance which can be invested in supporting drinking water services, decision makers should also consider the efficiency of investments to shrink and fill operational finance gaps. While quantitative comparative measures of efficiency would require case-specific investigation into the detailed costing of, and attributable results delivered by, specific tactics, which is beyond the scope of this paper, it is possible to discuss efficiency more abstractly, by considering investment diversification and prioritization.

The examples identified show many countries using multiple strategies and tactics to address finance gaps for drinking water services. These may describe both sequenced and overlapping investments of public finance, as the analysis was not time-bound, as well as both patchwork and layered investments, from combinations of national and sub-national examples. Investing in multiple strategies could be expected to be helpful, by providing a range of ways to address the finance gap for services considering both costs and revenues. Investing in multiple tactics might be efficient—if representing targeting of particular opportunities or needs within service contexts, – or inefficient—if indicating fragmentation of efforts, projectization, or low confidence in tactics. Further case-based research could help to identify whether or how multiple tactics can be helpful for addressing operational finance gaps, and if there are particularly efficient combinations that might be recommended in specific contexts.

Efficiency can also be assessed by considering prioritization in the allocation of limited resources. One lens through which to consider this is how particular public finance strategies might be anticipated to support or undermine the financial viability of services.

First, consider gap filling strategies. For services which are financially viable or suitable for commercial credit, gap filling support is likely to be inefficient, or even detrimental. Public finance allocations in these cases risks contributing to underpayment and overconsumption by water users, and inefficient operations by service providers, undermining the financial viability of these services. For services with expected but delayed financial viability, or uncertain financial viability, gap filling support poses these same risks. Where gap filling is required to sustain services while revenues and service costs reach a balance, support should be carefully designed to mitigate against risks of undermining future financial viability, and consider conditions for phasing out support over time. In the case of services which are not financially viable, gap filling support will be necessary, as drinking water services are still essential. This can help avoid infrastructure falling into disrepair and disuse (World Water Council and OECD 2015; Banks and Furey 2016; Foster et al. 2020), and services stopping, wasting the full potential of those infrastructure investments made (Franceys and Pezon 2010; World Bank 2017; World Bank Group and UNICEF 2017b; Kingdom et al. 2018; Hope et al. 2019; Rozenberg and Fay 2019; WHO, UNICEF, and World Bank 2022; REAL-Water 2023).

Second, public finance allocations towards gap shrinking strategies have the potential to be particularly efficient in specific cases. For services which are not financially viable, gap shrinking investments may be able to minimize the ongoing gap filling support needed (Andres et al. 2019). Such investments could provide efficiency returns by reducing the support required for sustaining these essential services over the years to come. For services with expected but delayed financial viability, or uncertain financial viability, investments in gap shrinking might accelerate or increase the likelihood of future financial viability and limit the extent or duration of their reliance on gap filling support.

Finally, public finance investments in gap bridging strategies can also bring efficiencies, particularly when targeted towards services with delayed or uncertain financial viability. For example, funds to support capital expenditures can provide services to more people, which, in addition to increasing coverage, may also offer more efficient scales of operations. Or, gap bridging support which helps to lower costs of capital can mean that service revenues are able to repay these costs more quickly. For these services, gap bridging might accelerate or increase the likelihood of future financial viability.

At these theoretical levels, the efficiency implications of the relationships between public finance strategies and financial viability of services are summarized in Figure 3.

The discussion of potential efficiencies and targeting of different strategies or strategy combinations can best be considered as an additional layer of reflection to inform public finance allocations, and is not suitable as a standalone criterion. Progress towards safely managed drinking water services for all means

		Financial viability status			
	Strategies	**Financially viable & commercially creditworthy:** Revenues greater than service costs	**Delayed financial viability:** Revenues approaching service costs	**Uncertain financial viability:** Revenues currently below service costs	**Not financially viable:** Revenues remaining below service costs
Infrastructure					
Gap bridging	**Increase** funds available **for Capital Expenditures** (CapEx) **Decrease** funds needed **for Costs of Capital** (CoC)		**May accelerate progress towards financial viability**	**May increase likelihood of future financial viability**	
Operational					
Gap shrinking	**Increase** funds available **from tariffs** **Decrease** funds needed **for Operating Expenditures** (OpEx)				**May decrease future necessary gap filling**
Gap filling	**Increase** funds available **for Operating Expenditures** (OpEx)	*Likely to undermine financial viability & creditworthiness*	*Requires mitigation against risk of undermining future financial viability*	**Necessary to sustain services** & *Requires mitigation against risk of undermining future financial viability*	**Necessary to sustain services**

FIGURE 3 | Efficiency of interactions of financial viability status with public finance strategies to support drinking water services.

that no country is starting from a blank slate (or empty vessel). Instead, the finance gap exists in context, where substantial investments have been made, varying levels and qualities of services exist for different populations, and political and societal priorities require consideration alongside efficiency.

5.4 | Limitations

The framework proposed for understanding public finance strategies and tactics has at least three limitations: it may not yet be complete, does not consider interactions, and may benefit from further iterations and development. These limitations are outlined below.

First, the identification of tactics within the framework may not yet capture all tactics used by governments to shrink and fill operational finance gaps. The examples identified show a range of tactics, but there may be others achieving positive results which are not exemplified in the documentation reviewed. Government water sector work can be difficult to track, being spread across various levels and departments (Pories et al. 2019), and so some tactics used may not be widely known. A limitation of relying on secondary sources is that there may also be tactics used in particular contexts which are less well documented, for cultural, language, or access reasons, among others. The review conducted was extensive, but not systematic or exhaustive, and there is not currently data available to enable a country-by-country study to quantify the distribution of tactics. Beyond this, there may also be gaps in the existing tactics: areas where tactics still need to be developed to address operational finance gaps for drinking water services. These areas of un- or under-documented tactics, and tactics still needed, would be areas for further research.

The framework and analysis also do not consider potential interactions between tactics. The examples collected are often drawn from summaries or described incompletely in the sources used. In particular, the precise time and geographic boundaries of these examples are not possible to analyze from this material: the examples include initiatives both sequenced and overlapping in time, as well as patchworked and layered in coverage, all aggregated to country level. Case-based research could study the application and value of combinations of tactics in specific contexts.

Finally, further iterations in the framework may also be beneficial. The framework may be strengthened, as outlined above, based on case-based research and as data availability improves, particularly if sufficient data becomes available to enable a country-by-country study. Policy makers may find that other tactic labels better reflect their objectives and efforts in addressing the finance gaps for these services. Further research could also review how these concepts can most usefully be presented to decision makers, and what tactic labels may best represent their objectives and efforts in addressing the finance gap for these services. Research into the most useful presentation of these concepts for decision makers could improve the practical application of the framework. Finally, as sector evidence develops, it may become possible to make more refined recommendations about the suitability of tactics to particular contexts.

6 | Conclusions

This paper proposes a framework for understanding (1) strategies by which public finance is bridging, shrinking, and filling the finance gap that limits drinking water services, and (2) tactics by which public finance seeks to support the ongoing operational finance needs of these services. The framework builds on previous research characterizing the finance gap, describing the importance of public finance in supporting water services, and acknowledging that public finance available for this sector is limited.

Global progress for safe drinking water services requires new access to services, and ensuring services are sustained over time. Both requirements are constrained by the finance gap faced by the sector. Public finance can play important roles towards both needs, however each demands different strategies. Distinguishing between these strategies can support reflection on the aims of governments, and ensure strategies are appropriately targeted.

Governments also have a particular role in addressing the aspects of the finance gap related to the ongoing operational costs of drinking water services which are not (yet) financially viable. While opportunities for government to contribute to finance gap bridging were already well documented, this paper offers a framework for understanding and comparing the tactics by which public finance also contributes to gap shrinking and filling, supporting service sustainability. These tactics involve different instruments, require different levels of investment, and may also entail different likelihoods of success in achieving their strategic purposes. Analyzing these tactics can help assess the options available to governments and inspire consideration of new tactics.

This framework can support further analysis and assessment of different strategies and tactics. Studying patterns of what strategies and tactics are applied where could highlight areas where they are particularly effective, or spaces where these may be suitable but so far are missing. Examining how particular tactics can shift the allocations of risks and responsibilities for services could help to understand the implications of these tactics, and potential consequences. Analyzing the effectiveness of tactics can help inform their adoption and indicate how they can better achieve their objectives. There may also be tactics which are not yet captured, or still need to be developed, to help shrink and fill the finance gaps for sustaining services. This can all contribute to increasing the investment amounts, efficiency, and effectiveness that are all needed to address the finance gap and continue and accelerate progress on drinking water services.

Acknowledgments

The author is grateful to Rob Hope at the Smith School of Enterprise and the Environment who supervised and supported the research and

provided valuable comments for this article, and to Steph Ferguson who assisted with the graphic design.

Funding

KN has received philanthropic support from Bank of America through the Smith School of Enterprise and the Environment, and Uptime Global. Neither organization has influenced the approach or findings of the research undertaken.

Ethics Approval Statement - (IRB Statement)

This research project has been reviewed and approved by an Oxford University ethics committee. The ethics reference is SOGE C1A 23 82.

Conflicts of Interest

KN works for Uptime Global, a company which supports the provision of results-based funding to rural water service providers. This work is linked to the research topic, but has not influenced the approach or findings of the research undertaken.

Data Availability Statement

The data that supports the findings of this study are available in the supplementary material of this article.

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Appendix A

Examples of public finance allocations

The following material about water sector finance containing examples of public finance allocations to support drinking water services was examined to develop the analytical frameworks presented in this paper:

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Appendix B

Graphical abstract