

MULTISTAKEHOLDER GOVERNANCE FOR FINANCING RIVER BASIN MANAGEMENT IN BRAZIL

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Introdução

Water challenges are intensifying globally due to growing demand and limited supply, emphasizing the need to diversify Water Resources Management (WRM) financing. Traditional mechanisms—tariffs and public budgets—often fall short (Grafton et al., 2020) and are inconsistently applied. Complementary funding mechanisms such as Payments for Ecosystem Services (PES) and donations are increasingly recognized, involving governments, companies, users, and civil society organizations (CSOs). Foundations, CSOs, and PES schemes increasingly fund WRM, enhancing water quality and quantity.

Problema de Pesquisa e Objetivo

In Brazil, multistakeholder WRM is well established at the basin level, involving agencies, councils, and committees. Financing remains heavily dependent on public budgets, supplemented by tariffs. Federal investment needs of BRL 7.6 billion contrast with BRL 2.0 billion in 2022 revenues, with similar mismatches at state and basin levels. PES and donations could complement budgets, broaden responsibility among governments, CSOs, and private actors, and help advance SDG 6 while strengthening WRM. This research explores scenarios for PES and donations as alternatives to strengthen WRM in Brazil.

Fundamentação Teórica

Water governance underpins effective WRM and water security (Libanio, 2020). Multistakeholder approaches diversify financing while requiring participation and coordination. Public managers using PES or donations must engage companies, CSOs, and other actors, reflecting a governance framework that integrates functions, attributes, and outcomes (Jiménez et al., 2020). Globally, tariffs and budgets often fall short, and in Brazil, public funding dominates while user participation is limited. These complementary sources can strengthen financing, and promote multistakeholder governance.

Metodologia

The scenario formulation used official data to estimate complementary WRM financing, prioritizing PES and donations. PES used government data on native vegetation, legal reserves, and preservation areas; CSO donations used the Map of Civil Society Organizations (MapCSO). Values were set within reasonable ranges as percentages of each source. Three scenarios were defined for each source: PES - 20% (weak), 30% (medium), and 40% (strong) of the eligible area were allocated to WRM; donations - 10% (weak), 20% (medium), and 30% (strong) of CSO-raised funds were directed to WRM.

Análise e Discussão dos Resultados

Scenarios show PES programs and CSO donations in Brazil could mobilize resources comparable to or exceeding public budgets and tariffs. PES and donations exceed tariff revenues by up to 678% and account for nearly half of the public budget. Complementary financing supports multistakeholder governance, expands participation, and redistributes risks, but requires transparency, accountability, and ethical safeguards. PES linked to carbon markets and donations offer opportunities, though challenges include ethical concerns and potential environmental misconduct.

Considerações Finais

This study shows that complementary sources (PES programs and CSO donations) can strengthen WRM financing in Brazil. While budgets and tariffs remain essential, they face limits, especially without charges. Scenarios indicate these sources can mobilize significant resources, sometimes matching or exceeding budgets, expanding debate beyond conventional tools. Risks include double counting, requiring case-based studies. Future research should assess practical, financial, and governance outcomes, as well as opportunity costs.

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Palavras Chave

Water financing, Payments for ecosystem services, Donations

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1 INTRODUCTION

Water-related challenges are intensifying worldwide due to growing demand and limited supply (Grison et al., 2023). This setting underscores the need for a strategic shift toward a broader array of alternative or complementary water sources (Amos et al. 2020; Ribeiro et al. 2022; Stec 2023). Besides diversifying water sources, it is also critical to diversify funding for water resources management (WRM). In this context, exploring alternative funding sources is an essential policy strategy for developing water resources.

This challenge becomes even more pronounced when traditional funding sources are limited. Traditional funding mechanisms, namely tariffs and public budgets, have proven insufficient. Tariffs often fail to cover infrastructure and management costs (Berbel et al. 2019; de Brito & de Azevedo 2020; Grafton et al., 2020), are inconsistently applied (Berbel et al. 2019; Ribeiro et al., 2021), and remain absent in many regions. Public budgets, although central, are similarly constrained (Alaerts, 2019).

Given these limitations, complementary funding mechanisms are gaining relevance. Payments for Ecosystem Services (PES) (den Heijer & Coopens, 2023; OECD 2022, 2021; Salzman et al. 2018; Vidaurre et al. 2017) and donations (Kauffman 2014; OECD 2022; Wang et al. 2023) are increasingly recognized as innovative tools to support WRM (Salzman et al., 2018). Unlike dichotomous approaches – state versus market (Ostrom 2010) or make versus buy (Williamson, 2002) – financing water management requires joint responsibility among governments, companies, users, and civil society organizations (CSOs). Foundations and voluntary organizations are already playing growing roles, mobilizing donations from diverse stakeholders to fund projects and water plans (Ibones et al., 2024). PES schemes, whether government- or user-funded, have become relatively mature in certain basins, improving water quality and quantity (Salzman et al., 2018).

In Brazil, public budgets are the main source of funding for WRM, with tariff charges playing a secondary role. This highlights that the government and users are responsible for most of the WRM funding in the country. As a result, there is a growing need to develop and implement alternative financing mechanisms, whether through new approaches or reimagining existing ones. Alternative funding has been a significant focus in various studies on water, with applications in both gray infrastructure (Kolker et al. 2016; OECD 2022) and nature-based solutions (den Heijer and Coopens 2023).

Brazilian multistakeholder participation in WRM is well established at the basin level, involving agencies, councils, and committees (Libanio, 2020). However, financing remains heavily dependent on public budgets, complemented by user tariffs where charges are implemented. The gap is striking: federal investment needs are estimated at BRL 7.63 billion annually, at the same time revenues from budgets and tariffs amounted to only BRL 2.00 billion in 2022 (Brazil, 2024). At state and basin levels, similar mismatches occur (ANA, 2024b). These figures highlight the urgency of complementary funding sources.

This research explores scenarios for PES and donations as alternatives to strengthen WRM financing in Brazil. Although not exhaustive, these mechanisms could build a more robust funding portfolio, helping bridge the gap between available resources and investment needs. Importantly, they are not intended to replace public budgets or tariffs but to complement them, broadening the responsibility for WRM and enhancing progress toward Sustainable Development Goal (SDG) 6. Complementary financing reflects a shift toward multistakeholder governance, where governments, CSOs, and private actors collectively assume responsibility

for public goods (Jiménez et al., 2020). By diversifying funding sources and governance arrangements, countries like Brazil can better address the financing challenges for WRM.

2 THEORETICAL BACKGROUND

2.1 WATER GOVERNANCE

Water governance is the foundation for effective WRM and for achieving water security (Libanio, 2020). Multistakeholder governance can diversify financing sources but requires less centralization and greater participation in decision-making. Public managers adopting mechanisms such as PES or donations must therefore engage more closely with companies, CSOs, and other actors. Scholars have highlighted both the opportunities and challenges of such governance (Ibones et al., 2024; Jiménez et al., 2020). Engagement outcomes depend on internal factors (e.g., incentives, resource balance), external contexts (e.g., politics, culture, technology), and individual characteristics (Whitley et al., 2024).

Despite this complexity, multistakeholder partnerships have expanded in the past two decades, increasingly seen as essential for advancing the SDGs (Higham et al., 2024). In WRM specifically, such partnerships are also on the rise (Whitley et al., 2024). However, reviews reveal that academic literature seldom addresses the role of non-state actors in financing. Most attention has been given to capacity building and knowledge sharing, while service provision and funding remain less explored. As a result, government funding is still the norm, whereas corporate, individual, or CSO contributions are considered innovative but still emerging.

According to Jiménez et al. (2020), multistakeholder involvement in WRM financing, including PES and donations, reflects a governance approach that strategically integrates functions, attributes, and outcomes. Financing through PES, identified as an innovative mechanism, is part of this governance framework, which also emphasizes multilevel coordination, participation, and adaptability – qualities equally applicable to donation schemes. The discourse on funding influences governance design, legitimizing engagement. Multistakeholder participation fosters cognitive shifts, knowledge exchange, and understanding of diverse interests, highlighting its value for WRM (Heikkila & Gerlak, 2019).

2.2 FUNDING FOR WATER RESOURCE MANAGEMENT

Funding sources for water infrastructure across the globe can be categorized into three general groups known as the 3Ts: tariffs, taxes, and transfers (OECD 2022). Tariffs are payments made by water users, typically linked to consumption, extraction of groundwater, discharge of effluents, water rights grant (de Brito and de Azevedo 2020; Rey et al. 2019). While tariffs are well-established in some regions, they are emerging in others and absent in many parts of the world.

Taxes, which are reflected in public budgets, are intended to ensure funding for WRM (OECD 2022; Rey et al. 2019). Financing through mechanisms based on public budgets suggests that the funds come from the entire population, regardless of whether individuals are direct users of water resources in a given river basin. Thus, water users indirectly contribute to public funding for WRM.

Non-reimbursable transfers can be seen as public transfers from central governments to other governmental entities (Lago et al. 2015). These transfers may also take the form of aid or donations from governments, water users, companies, and CSOs, including non-governmental organizations (NGOs), with the aim of promoting development and sustainability (Kauffman 2014; OECD 2022). Reimbursable transfers might involve support from multilateral

development banks and agencies, or even national institutions (OECD 2022). All these types of transfers can play a crucial role in funding WRM, especially in developing countries or regions with significant investment needs.

Global estimates for investment in water infrastructure amount to hundreds of billions of dollars (Borgomeo et al. 2023; McDonald et al. 2021; OECD 2022). Nonetheless, the water sector receives only a minor portion – less than 10% – of the total funding allocated to infrastructure across all sectors (OECD 2022). This discrepancy exists despite the considerable value water resources contribute to ecosystem services worldwide (Balasubramanian 2019).

From a global perspective, disparities in country performance create major challenges for WRM, underscoring the need for sustainable funding strategies (Grison et al., 2023). Brazil exemplifies this complexity: as a developing, continental-scale nation, it relies heavily on public budgets for WRM, mirroring fiscal strains faced worldwide (Rey et al., 2019). User participation in financing remains limited. Although the 1997 Water Law established a framework for tariff collection, implementation is uneven. By 2022, charges were applied in only 6 of 27 state basins and 6 of 12 federal basins (ANA, 2024a). Recent progress has expanded approval of charging mechanisms, particularly in state basins (seven new states with charges) – expected to start in 2024-2025.

Even where implemented, tariffs have proven insufficient to cover WRM costs. This problem, observed globally (Grafton et al., 2020), reflects the difficulty governments face in sustaining infrastructure while financing new projects. In Brazil, reliance on constrained public budgets intensifies the challenge. In 2022, tariff revenues reached BRL 599 million (USD 116 million), with state basins generating 77%. However, these revenues represented only a small share compared to tax-derived public resources. Consequently, WRM financing depends predominantly on budgets: states contributed 55% of total funding, the federal government 42%, and municipalities the remainder. This distribution aligns with basin-scale management, as state basins involve multiple municipalities, while federal basins cross state boundaries.

3 METHODOLOGY

The scenario formulation began with official data collection to estimate complementary financing sources for WRM. Two mechanisms were prioritized: PES and donations. Given the unpredictability of scenario construction, values were estimated within broad but reasonable ranges, expressed as percentages of parameters associated with each source. Three scenarios were developed – weak (low), medium, and strong (high).

For PES, government data on native vegetation, legal reserves (LR), and permanent preservation areas (APP) were used. Data came from 6,472,624 Rural Environmental Registry (CAR) entries (Serviço Florestal Brasileiro, 2020). Potential credits were calculated as: area (ha) × carbon sequestration rate × conversion factor. A carbon rate of 2.50 t.C.ha⁻¹ (Heinrich et al., 2021) and the IPCC conversion factor of 44/12 (C to CO_{2e}) were applied. Projections assumed 10% of potential credits in the first year at USD 5.00/t.CO_{2e}. PES scenarios considered carbon credit programs for preserving or restoring riparian forests or springs.

For donations, data came from IPEA (2024). Funds raised by 567 projects from 462 CSOs in 2022 were identified, with averages calculated per year. While Brazil had about 855,000 CSOs in 2020, only 660 focused on environmental issues, and only a fraction operated projects. Data on funding for water-related programs and projects are unavailable, with only general funding values being reported.

Since PES addresses broader socio-environmental issues, a wider percentage range was applied. Donations, supporting diverse causes, were assigned lower percentages. Though subjective, the ranges were deemed plausible. The defined scenarios are:

- PES: 20% (weak), 30% (medium), 40% (strong) of the total eligible area allocated to WRM financing.
- Donations: 10% (weak), 20% (medium), 30% (strong) of funds raised by CSOs directed to WRM.

These scenarios provide plausible estimates of how PES and donations could complement traditional funding sources for WRM.

4 RESULTS AND DISCUSSION

4.1 FINANCING STATUS IN BRAZIL

The total revenue generated from water tariffs in Brazil amounted to approximately BRL (Brazilian Real) 4.12 billion over nearly three decades since the first implementation in the state of Ceará. State river basins accounted for a significant portion of tariff revenue, contributing 78.4% of the accumulated total by 2020 and 77.9% of the annual total for that year. Furthermore, state river basins consistently displayed a higher average annual value of tariff revenue. The states of Ceará and São Paulo were particularly notable, together accounting for more than 73% of the state-level tariff revenue in 2020. Individually, Ceará and São Paulo each collected substantially more than all the federal basins combined, whether considering the annual revenue for 2020, the historical accumulated total, or the average annual revenue. These disparities highlight the significant role that state-level initiatives play in generating funding for WRM in Brazil. Based on the ANA (2023), The Table 1 provides an overview of the charging in Brazil.

Table 1 - Charging tariffs for use of water resources in the Brazilian river basins, cumulative and for the year 2020 (BRL million)

Domain river basins	2020	Until 2020	Annual average
State domain			
Ceará	159.00	1,378.00	55.12
São Paulo	150.00	929.00	66.36
Rio de Janeiro	64.00	505.00	29.71
Minas Gerais	41.00	378.00	34.36
Paraná	4.00	24.00	3.00
Paraíba	4.00	19.00	3.17
Total	422.00	3,233.00	-
Federal domain			
São Francisco	43.69	278.33	25.30
Piracicaba, Capivari and Jundiá	24.98	273.48	18.23
Paraíba do Sul	23.43	206.07	11.45
Doce	14.70	103.09	10.31
Paranaíba	12.57	27.46	6.88
Verde Grande	0.15	0.46	0.13
Total	119.52	888.89	-

Source: authors based on ANA (2023).

Given that tariffs are insufficient to address the challenges of WRM, the funding structure relies heavily on public budget resources. A review of the budget reveals the amounts that each level of government – federal, state, and municipal – allocates for WRM. Notably, municipal governments have lesser responsibilities, while state and federal governments account for 55% and 42%, respectively, of the total WRM budget for 2022. This distribution is logical, as planning and management occur at the river basin level. Some basins span many municipalities within the same state – case of state basins – or cross state boundaries – case of federal basins.

Additionally, the federal budget shows that WRM receives more than twice the resources allocated to water and wastewater services (WWS). Conversely, at the state level, WRM receives less than half the WWS budget. At the municipal level, WRM represents an insignificant fraction compared to WWS, which aligns with the municipal governments' responsibility for WWS, while the state and federal governments play a supporting role in WWS-related policy.

Based on the Secretaria do Tesouro Nacional (2024), Table 2 provides a breakdown of the budget allocations for WWS and WRM across different levels of government, illustrating the significant variations in funding priorities and responsibilities. This structure reflects the broader approach to WRM funding in Brazil, where state and federal governments are primarily responsible for river basin management, while WWS is largely under municipal jurisdiction. This division underscores the need for a balanced approach to WRM funding, considering the varying roles and contributions at each government level.

Table 2 - Public budget for WRM and WWS in Brazil, year 2022 (BRL million)

Federated entity level	WRM	WWS	WRM/WWS ratio
Federal government	1,861.66	762.64	244.11%
State government	2,433.93	5,924.09	41.09%
Municipal government	114.92	26,563.57	0.43%
Total	4,410.51	33,250.30	13.26%

Source: authors based on Secretaria do Tesouro Nacional (2024).

Revenue from water tariffs for WRM accounts for only a small portion of tax-derived revenue, indicating a greater reliance on public budgets to finance these activities. An analysis of the public budgets of each state and its municipalities reveals a distinct variation in the allocation of resources for WRM across different regions of Brazil.

The state and municipal governments in the Northeast and Southeast regions were the ones that allocated the most budget for WRM in 2022, standing out both in absolute terms and in the ratio between the budgets for WRM and WWS. This allocation reflects a stronger commitment to sustainable WRM in these states. In contrast, in the Brazilian Amazon region, known for its abundant water, there was a notable absence of budgetary resources allocated for WRM. This suggests challenges in the implementation of WRM policies in areas where the abundance of water may lead to a lower perceived need for management. These regional disparities emphasize the importance of a WRM strategy tailored to local needs and contexts, with appropriate funding to ensure long-term sustainability. Based on the Secretaria do Tesouro Nacional (2024), Table 3 presents the public budget for WRM allocated by state governments, along with the budget from municipal governments, across each of Brazil's twenty-seven states (including one Federal District, DF). It also shows the ratio of the WRM budget to the budget for WWS.

Table 3 - Public budget for WRM in Brazilian states, by type of federated entity, and comparison with the budget for WWS, year 2022 (BRL million)

Regions/State ¹	State government	Municipal government	Total WRM (state + municipal)	Total WRM/Total WWS ratio ²
North region				
Acre	1.03	0.21	1.24	0.57%
Amapá	0.02	-	0.02	0.02%
Pará	2.54	3.75	6.28	0.28%
Roraima	0.77	-	0.77	4.32%
Tocantins	5.03	0.16	5.18	2.23%
Northeast region				
Alagoas	62.76	3.07	65.83	7.16%
Bahia	3.95	4.27	8.23	0.43%
Ceará	212.08	18.96	231.04	31.63%
Maranhão	1.21	0.48	1.69	0.13%
Paraíba	124.83	4.31	129.14	154.06%
Pernambuco	151.39	5.74	157.13	17.90%
Piauí	13.33	13.57	26.90	9.39%
Rio Grande do Norte	94.43	14.91	109.33	57.27%
Sergipe	1.62	0.01	1.63	0.77%
Central-West region				
Distrito Federal	0.55	-	0.55	4.90%
Goiás	1.47	0.95	2.43	0.34%
Mato Grosso	2.55	1.75	4.30	0.85%
Mato Grosso do Sul	0.01	-	0.01	0.01%
Southeast region				
Espírito Santo	59.68	0.66	60.35	8.79%
Minas Gerais	53.96	1.86	55.82	1.51%
Rio de Janeiro	83.11	0.78	83.89	3.32%
São Paulo	1,503.47	12.60	1,516.07	15.10%
South region				
Paraná	-	2.18	2.18	0.30%
Rio Grande do Sul	41.06	22.53	63.58	2.98%
Santa Catarina	13.09	2.17	15.26	1.09%
Total	2,433.93	114.92	2,548.85	7.85%

Source: authors based on Secretaria do Tesouro Nacional (2024).

Note: ¹ States of Amazonas and Rondônia (North region) did not have state and municipal budgets. ² Total WWS also indicates both state and municipal budgets.

4.2 SCENARIOS FOR COMPLEMENTARY FINANCING

Forest preservation generates dual benefits: it safeguards water sources by enhancing aquifer recharge and soil–vegetation conservation, while creating revenue opportunities through PES, particularly carbon credit markets. A portion of these resources could be directed to WRM, simultaneously advancing socio-environmental development. Data from the CAR in

2020 illustrate Brazil’s vast PES potential (Serviço Florestal Brasileiro, 2020). CAR registered 543.7 million hectares, including 192.9 million hectares of native vegetation. Additionally, 26.9 million hectares of LR and 8.8 million hectares of APP lacked native vegetation. Together, these 228.7 million hectares represent the potential PES area. Ecosystem services derived from these areas provide a solid foundation for PES programs. Even compliance with environmental legislation could generate measurable environmental benefits and carbon credit opportunities. This study links potential PES areas to carbon markets, estimating revenue flows that could partially finance WRM. Table 4 presents these scenarios, highlighting the strategic role of carbon credits in complementing WRM funding.

Table 4 - Design of PES scenarios using carbon credits for WRM

PES application scenarios¹	Potential credits² (t.CO₂e)	Generated credits³ (t.CO₂e)	Amount raised⁴ (BRL million)
Weak (20% of the potential area)	419,404,311	41,940,431	1,082.06
Medium (30% of the potential area)	629,106,467	62,910,647	1,623.09
Strong (40% of the potential area)	838,808,623	83,880,862	2,164.13

Source: authors.

Note: ¹ Potential area for PES = 228,765,988 hectare. ² Potential credits = area x carbon sequestration rate x conversion factor (see Methodological procedures section). ³ Generated credits = 10% potential credits. ⁴ Amount raised for 2022. Consider the average exchange rate for the year 2022: USD 1.00 = BRL 5.16.

Voluntary donations also represent a promising complementary source for WRM. Resources from philanthropic institutions, CSOs, or local communities could support conservation, restoration, and protection initiatives aligned with basin-level management. This mechanism fosters partnerships, diversifies stakeholders, and strengthens society-driven governance. According to IPEA (2024), Brazil had 567 projects led by 462 CSOs in 2022, mobilizing BRL 26.9 billion – equivalent to BRL 6.9 billion applied in that year alone. Despite this substantial funding capacity, donation-based resources remain absent from WRM financing strategies. Considering the magnitude of CSO contributions, channeling even a fraction toward WRM would significantly enhance financial sustainability. Table 5 illustrates potential scenarios, emphasizing how donations could consolidate a vital complementary funding source.

Table 5 - Design of donation scenarios through CSOs for WRM (BRL million)

Donations application scenarios¹	Amount raised
Weak (10% of the amount raised)	686.91
Medium (20% of the amount raised)	1,373.82
Strong (30% of the amount raised)	2,060.73

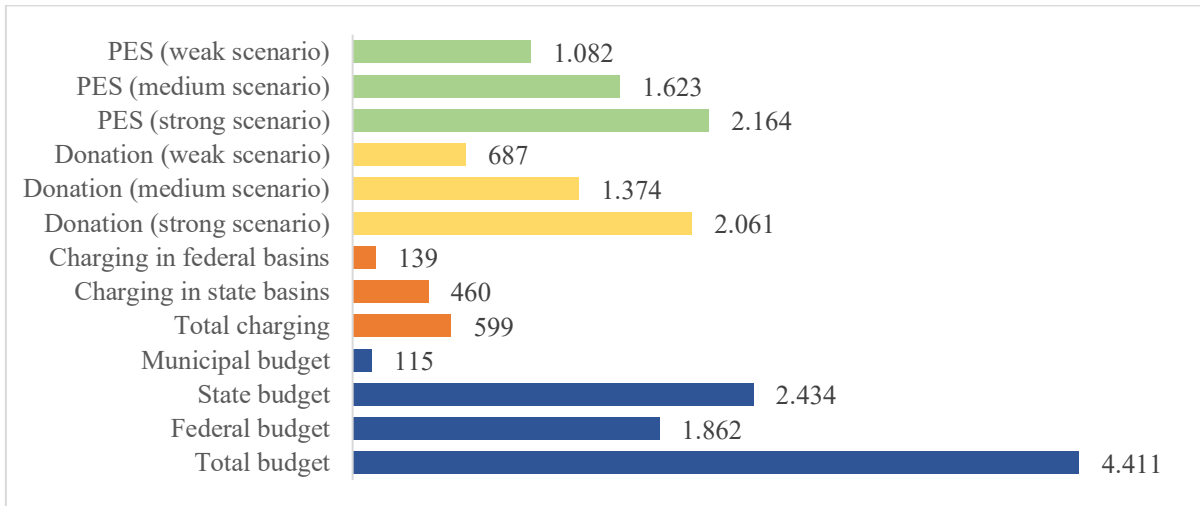
Source: authors.

Notes: ¹ Amounts of funds raised = BRL 6,869.11 million (annual average for projects in operation in 2022), based on general fundraising from CSOs. Consider the average exchange rate for the year 2022: USD 1.00 = BRL 5.16.

The scenarios indicate that PES programs and CSO donations could mobilize resources comparable to public budgets and far greater than current tariffs in Brazil. In the strongest scenario, combined PES and donations equal the sum of state and federal budgets; in the weakest, they still match the federal budget. Even under conservative assumptions, PES and donations exceed tariff revenues by 678% and 394% in federal basins and by 135% and 49%

in state basins. They also surpass municipal budgets for WRM by 842% and 498%, respectively. Nationwide, total tariff revenues represented only 55% and 87% of the weak PES and donation scenarios. Figure 1 compares complementary and traditional sources, underscoring their potential to strengthen WRM financing.

Figure 1 - Comparison of complementary financing scenarios and financing through public budget and charges (BRL million)



Source: authors.

Note: Consider the average exchange rate for the year 2022: USD 1.00 = BRL 5.16.

Most studies on multistakeholder governance in environmental or natural resource management overlook financing, often assuming it is solely a government responsibility. However, as Han et al. (2024) point out, addressing scarcity, pollution, and extreme events requires financial strategies. Complementary financing is not a “one-size-fits-all” solution but a flexible approach adapted to local contexts (den Heijer & Coopens, 2023; Mota et al., 2023).

PES represent significant opportunities, especially when linked to carbon markets and climate financing (Mota et al., 2023). Donations also provide valuable resources, engaging governments, companies, CSOs, and multilateral agencies in collaborative efforts. These mechanisms expand governance, fostering broader participation but requiring balance between financial contributions and decision-making influence (Han et al., 2024).

Complementary financing redistributes risks and institutionalizes new stakeholder roles in funding (den Heijer & Coopens, 2023), aligning with multistakeholder governance trends. However, donations may be linked to environmental misconduct (Wu et al., 2021), and PES programs can face ethical challenges (Salzman et al., 2018). Transparency and accountability are essential, and effective allocation is as critical as mobilization. These sources can advance WRM in Brazil if supported by sound governance and ethical safeguards.

5 CONCLUSIONS

This study highlights the potential of complementary sources – PES programs and CSO donations – to strengthen WRM financing in Brazil. Traditional mechanisms such as public budgets and tariffs remain essential but face limitations, especially in cases where charges are absent. The scenarios constructed reveal that complementary sources can mobilize significant resources, in some cases comparable to or exceeding public budgets. This approach expands the discussion beyond conventional mechanisms, offering innovative and community-based

alternatives for sustainable water management. A limitation concerns the risk of double counting revenues from PES and CSO donations, suggesting the need for case-based studies. Future research should evaluate practical applications, financial and governance outcomes, and opportunity costs, deepening understanding of these mechanisms in WRM.

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