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Financing Universal Sanitation: Regulation, Investibility and the Political Economy of Water Infrastructure

Abstract

Sanitation is difficult to finance for reasons that have little to do with the availability of savings. Networks absorb sunk capital, revenues are set politically, assets outlive the governments that authorise them, and universal service obliges providers to reach households whose capacity to pay is weakest exactly where unit costs run highest. Four literatures have grown around these facts and rarely speak to one another: public health and human rights, concerned with access, affordability and accountability; utility regulation, concerned with commitment, tariffs and administrative capacity; infrastructure finance, concerned with risk allocation, bankability and creditor protection; and critical political economy, which follows the financialisation of water through debt, ownership and valuation. This review integrates them around a single object: the claim on future tariff revenue, and the institutional work that manufactures, prices and enforces it. Financeability, on this reading, is produced rather than discovered. Territorial design, revenue rules, project preparation, regulatory credibility and enforceable creditor rights make an asset investible; public development banks shape that outcome through preparation and standardisation at least as much as through lending. Because the same arrangements redistribute risk and authority among users, governments and investors, the volume of capital mobilised tells us almost nothing about universalisation on its own. Brazil supplies the sharpest available test. A statutory deadline of 2033, a drive towards regionalised provision, national reference norms and a fast-growing market in infrastructure debentures now operate in a sector still marked by deep territorial inequality and uneven regulatory capacity. The review sets out what a credible research agenda must measure, and why ownership is the wrong variable to measure it with.

Keywords: water and sanitation; infrastructure finance; regulation; financialisation; human rights; development banks; Brazil

1. Introduction

Brazil has written a deadline into law. Article 11-B of Law 11,445/2007, as amended by Law 14,026/2020, requires every contract for water and sewerage services to carry universalisation targets: 99 per cent of the population supplied with potable water and 90 per cent with sewage collection and treatment by 31 December 2033. The most recent national figures, published by the Ministry of Cities through the *Sistema Nacional de Informações em Saneamento Básico* (National Sanitation Information System) for reference year 2023, put piped water at 83.1 per cent of the

population and sewerage collection at 59.7 per cent (Brasil, 2007, 2020; Ministério das Cidades, 2025). Closing that distance inside a decade is not, in the first instance, an engineering problem. It is the problem of persuading capital to fund assets whose returns depend on tariffs that politicians set, regulators police and courts occasionally rewrite.

The Brazilian deadline sits inside a global arithmetic. Costing the water and sanitation targets of Sustainable Development Goal 6 across 140 countries, Hutton and Varughese (2016) estimated an annual capital requirement of roughly US$114 billion for safely managed services, about three times the investment then flowing into the sector. Figures of this kind are usually deployed to reach a single conclusion: public budgets cannot carry the burden alone, so private capital must be mobilised. The inference moves too quickly. It treats the shortfall as a quantity of money rather than as a set of conditions under which money will or will not move, and it stops precisely where the interesting questions begin, namely what happens to tariffs, service and public authority once capital does arrive.

Sanitation is an unusually demanding case for any theory of infrastructure investment, and it is worth being explicit about why. The assets are sunk and specific: a trunk sewer has no alternative use and no resale market. Revenues come from tariffs that households see on a monthly bill, which makes them politically salient in a way that wholesale electricity prices are not. Service is spatially fixed, and no government can credibly threaten to abandon a neighbourhood it has already connected. Users cannot substitute away from the network. Put together, these features mean that the value of the investment depends on public decisions taken long after the money is committed, and that the ordinary remedies of contract law sit uneasily beside an obligation the state cannot renounce.

Four bodies of scholarship have taken up different parts of this problem. Public-health research measures what inadequate water and sanitation do to human beings; the estimates are large and concentrated among the poor (Prüss-Ustün et al., 2019; Wolf et al., 2023). Human-rights scholarship converts those findings into a normative standard with observable components, from availability and quality through to affordability, non-discrimination and accountability (Brown et al., 2016; Heller, 2022). Utility regulation asks how a state binds itself credibly enough to attract sunk capital while retaining the discretion that changing circumstances demand (Armstrong & Sappington, 2006; Estache & Wren-Lewis, 2009; Levy & Spiller, 1994). Infrastructure finance studies the architecture through which future cash flows are turned into securities with maturity, price and priority (Esty, 2004; Subramanian & Tung, 2016). Critical political economy, finally, treats water as a site where accumulation is reorganised, and asks who ends up bearing the risks and who collects the returns (Bayliss, 2014; Loftus et al., 2019; Swyngedouw, 2005).

These conversations touch without converging, and the failures of contact are specific rather than general. Rights-based work often treats finance as an implementation constraint and leaves the contractual claims sold to investors unexamined, so that leverage and covenant structure disappear from an analysis of exclusion. Financial economics carries the analysis as far as spread and tenor and stops, rarely asking who pays the tariff that services the debt. Regulation scholarship is rich on commitment and information asymmetry but comparatively quiet about the balance sheets regulators inherit after financial close, even though those balance sheets constrain every subsequent tariff review. Critical political economy supplies the sharpest vocabulary for the distribution of risk and value, and is at its strongest when it names particular mechanisms

rather than inferring them from the presence of private capital (Ahlers & Merme, 2016; Christophers, 2015; Loftus et al., 2019). The result is four sets of findings about what appear to be four different objects, when in fact they are one.

This review does three things. It reads the four literatures against a common object, the claim on future tariff revenue, and asks how each explains that claim's construction, pricing, enforcement and distributive consequences. It converts the critical vocabulary of financialisation into variables an empirical researcher can actually observe, since leverage, distributions, tenor, security and regulatory accommodation are recorded somewhere, while "financialisation" as such is not. And it uses Brazil not as an illustration but as a case selected for its analytical leverage, because the country now varies on regulatory capacity, ownership, territorial scale and financing instrument simultaneously, and because a statutory deadline supplies an unusually clean benchmark against which performance can be judged.

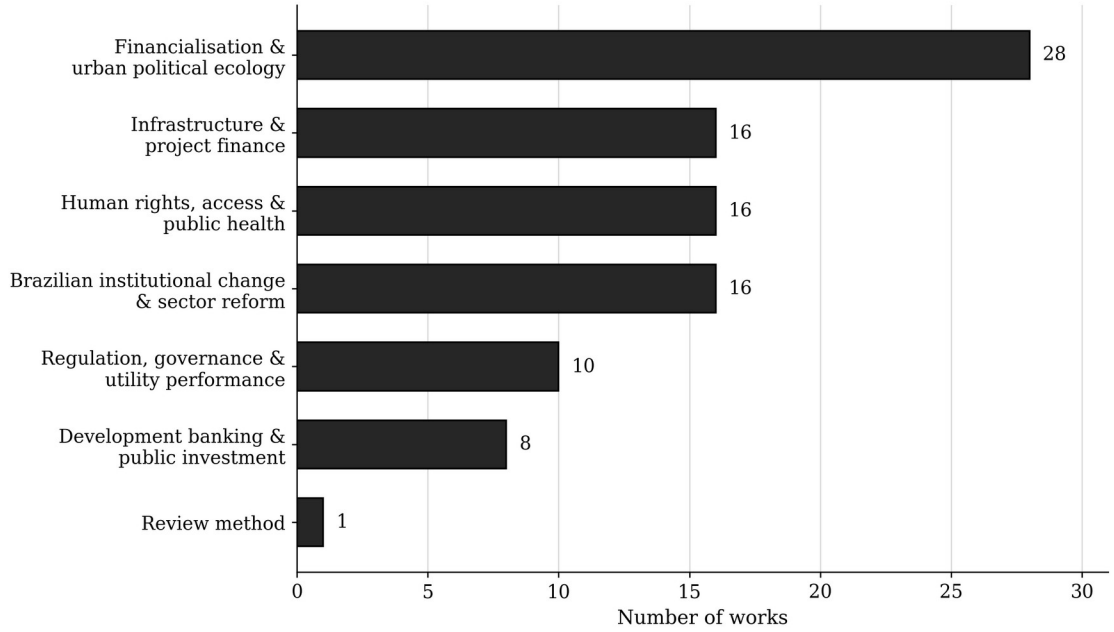
The claim developed here is that financeability is produced, not discovered. Long before a security is placed or a loan signed, territorial organisation defines the revenue base; tariff and indexation rules shape expected cash flow; concession and corporate forms locate obligations; project preparation converts statutory goals into engineering and financial schedules; regulators and courts condition commitment; and creditor protections determine what happens when performance deteriorates. Public banks supply capital, but their organisational capacity to prepare, coordinate and standardise projects may matter more. Once those arrangements harden, finance holds enforceable claims on the revenue that households generate, and the analytical question becomes how financial durability interacts with affordability, investment execution and public authority across the life of the asset.

This review is integrative and mechanism-centred rather than systematic, and the choice is deliberate. Systematic protocols work best when a field shares concepts, units of analysis and outcome measures; this field shares none of the three, and a protocol optimised for comparability would have excluded much of the critical geography and most of the legal-institutional work that carries the argument (Snyder, 2019). Searches combined water and sanitation with finance, bankability, project finance, regulation, tariffs, concessions, development banks, financialisation, political ecology, human rights, affordability and Brazil. Targeted searches of publisher platforms and scholarly indexes were supplemented by backward and forward citation chaining from canonical and recent contributions, and completed on 12 August 2026. Peer-reviewed articles took priority, alongside scholarly books of direct conceptual relevance. Every item retained in the analytical corpus carries a DOI verified against publisher or bibliographic metadata; items whose bibliographic identity could not be established with confidence were dropped rather than cited. Ninety-five works survived that filter. The corpus is not a census of sanitation scholarship, and readers should treat the descriptive figures that follow as a description of what this review reads, nothing more.

That distribution reflects fields that matured on different timetables. Work on neoliberalisation and urban political ecology predates the contemporary debate over blended finance by a decade or more, while scholarship on human rights, on financialisation and on Brazilian regulatory change has expanded sharply since the mid-2010s. That convergence is the interpretive point of Figures 1 and 2: financeability, rights and political economy increasingly appear in the same empirical settings, yet they continue to be analysed with different dependent variables and, more often than not, by different people.

Figure 1

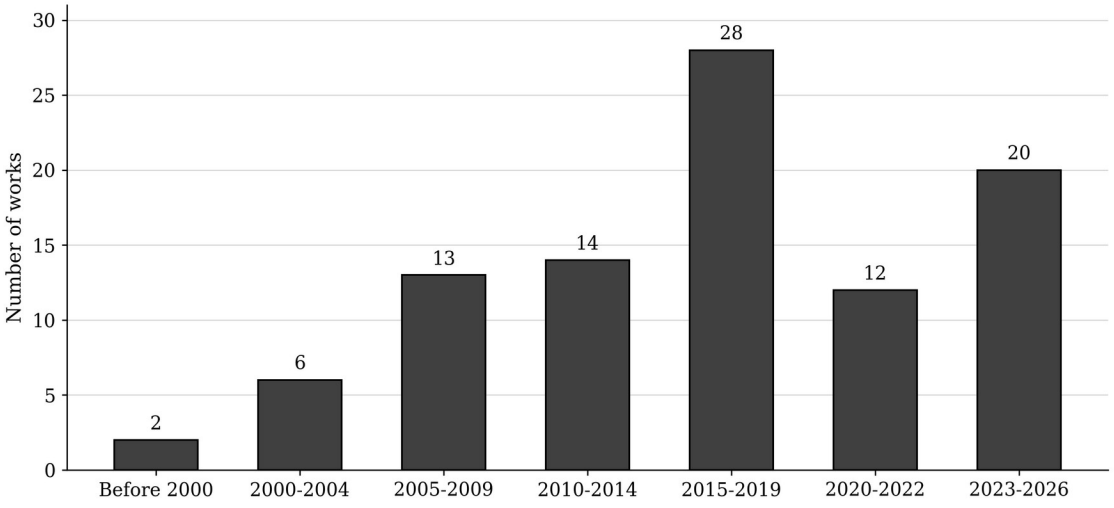
Analytical composition of the reviewed corpus



Note. Source: author coding of the 95 DOI-verified works retained in this review. Each work is assigned to its dominant analytical contribution. The categories describe the review corpus and do not measure the wider sanitation literature. Official documents and statistical sources cited in the text are excluded from the coding.

Figure 2

Publication profile of the reviewed corpus



Note. Source: author coding of the 95 DOI-verified works retained in this review, by year of publication as cited. Publication periods describe the review corpus only.

Seven further sections follow. Section 2 treats sanitation as an essential service and a set of enforceable rights. Section 3 turns to regulation and governance in capital-intensive utilities. Section 4 examines infrastructure finance, bankability and development banking. Section 5 brings in the British and wider critical literature on neoliberalisation, urban political ecology and financialisation. Section 6 uses Brazil as the site where these approaches meet. Section 7 develops an integrated research agenda, and Section 8 concludes.

2. Sanitation, public health and the right to services

Any argument about sanitation finance rests on a prior claim about why the service matters, and the epidemiological evidence here is stronger than in most areas of infrastructure policy. Safe water, adequate sanitation and hygiene shape exposure to diarrhoeal disease, enteric infection, parasitic disease and, through repeated infection, to nutritional deficit; inadequate provision compounds vulnerabilities already produced by poverty and poor housing (Prüss-Ustün et al., 2019). The most recent global assessment, covering domestic settings across a wide set of adverse outcomes, reinforces the scale of the attributable burden and its concentration in low- and middle-income countries (Wolf et al., 2023). What matters analytically is the causal chain those studies describe. Health gains depend on continuity, on safe management and on actual use, which means that expenditure and installed capacity are poor proxies for policy performance. Investment is an input, network availability an intermediate condition, and effective household service the outcome through which welfare gains are realised. Financing arrangements that optimise the first two while leaving the third to chance are not simply incomplete; they are measuring the wrong thing.

Léo Heller's work matters for this review because it connects legal obligation to the practical conditions under which a service becomes usable. The human rights to water and sanitation carry substantive dimensions — availability, accessibility, affordability, quality, acceptability — together with procedural ones: equality, non-discrimination, participation, information and accountability (Heller, 2022). Earlier work with Brazilian co-authors showed how the framework reorients public policy by obliging governments to ask who is excluded, why the exclusion persists, and what institutional remedy is available (Brown et al., 2016). Those criteria survive changes in ownership, financing instrument and regulatory architecture, which is precisely what makes them useful as dependent variables in studies of financial reform.

Among groups that network indicators obscure, the distributive content of the framework becomes visible. Research with vulnerable populations in Brazil shows formal entitlement coexisting with practical barriers to water and sanitation, among them unstable housing, discrimination and dependence on discretionary access granted case by case (Neves-Silva & Heller, 2016). Work with people experiencing homelessness documents the gap between the presence of public-space infrastructure and the everyday capacity to obtain water, hygiene and sanitation with dignity (Neves-Silva et al., 2018). Because inadequate provision touches health, housing, education, work and bodily security at once, the interdependence of rights is not a rhetorical flourish but an empirical observation about how deprivation compounds (Neves-Silva et al., 2019).

Territory and gender complicate measurement further. Evidence from an urban occupation in the Belo Horizonte metropolitan region links inadequate water and sewerage to health outcomes, quality of life and gendered burdens inside households and communities (Arruda &

Heller, 2022). Heller's later intervention on gender equality presses the point that the state carries responsibility for conditions routinely displaced onto unpaid care and domestic labour (Heller, 2023). For infrastructure finance the implication is uncomfortable. Service areas and investment schedules aggregate households whose exposure to service failure differs sharply, and a project can hit an average coverage target while concentrating burdens at its margins — which is exactly where the marginal cost of connection is highest and the marginal revenue lowest.

Tariffs concentrate the tension. They recover operating costs, fund maintenance and can contribute to investment, and in doing so they distribute the cost of a monopoly service across consumption bands, income groups and territories. Affordability depends far more on tariff structure, connection charges and subsidy rules than on the average tariff, and the classic cross-country evidence on utility subsidies is sobering: consumption subsidies delivered through the tariff frequently benefit connected, better-off households rather than the unconnected poor (Komives et al., 2005). Recent work continues to find that subsidy design, not subsidy volume, determines whether affordability improves (Fagundes et al., 2025; Neto & Camkin, 2020). A rights-based assessment asks whether households can sustain effective use without sacrificing other basic needs, and that question becomes sharper as financing agreements make future cash-flow commitments more rigid.

Rural provision shows why bankability cannot substitute for public responsibility. A detailed post-mortem of a failed rural water and sanitation initiative in Brazil traces how implementation collapsed despite a recognised social need, because coordination and delivery arrangements did not hold (Roland et al., 2022). Rural and peripheral systems combine sparse demand, higher unit costs and thinner local administrative capacity. Each of those features lowers commercial attractiveness and, by the same token, strengthens the case for public finance, subsidy and sustained institutional support. The places that markets reach last are the places where the statutory target will ultimately be won or lost.

The rights literature also sharpens the privatisation debate, and does so in a way that resists slogans on either side. Evidence from Minas Gerais maps how government, private-sector and civil-society actors attach materially different meanings to universalisation and to the risks of tariff increases or service exclusion under privatisation proposals (Neves-Silva et al., 2023). Internationally, human-rights scholars have questioned policy agendas that elevate financial mobilisation into an organising objective for water without comparable attention to public obligation (Heller et al., 2023; Karunananthan, 2019). The empirical implication is precise rather than polemical: evaluations of reform must observe financial structure and service outcomes together, and must stop treating ownership as a proxy for either.

Once debt enters, these criteria become inputs to regulatory risk analysis rather than external commentary on it. Debt disciplines project companies through reporting requirements, reserve accounts and restrictions on transfers; debt service simultaneously narrows managerial room when affordability measures, deferred maintenance or unforeseen capital needs press on the same cash flow. Whether that trade-off turns socially damaging depends on covenant design, tariff regulation, refinancing exposure and what regulators can actually see. Brazilian evidence from the Covid-19 period shows agencies varying considerably in their responsiveness to continuity and affordability (Victral & Heller, 2023), and recent work on a heavily financialised concession raises pointed questions about leverage, tariffs and unequal access (Barra et al., 2026).

The contribution of human-rights analysis to this literature is not moral framing. It is a set of observable outcomes against which claims about financeability can be tested.

3. Regulation and governance in capital-intensive utilities

Water and sewerage systems display, almost in caricature, the features that made utility regulation a founding problem of institutional economics. Assets are sunk and specific, duplication is usually wasteful, and providers know more about their own costs than users or public authorities ever will. Investors face the prospect that tariffs or service conditions will change after capital is committed; governments and users face underinvestment, cost padding and strategic renegotiation. Regulation must hold this reciprocal commitment problem together across horizons in which demand, environmental standards, technology and political preferences will all move (Estache & Wren-Lewis, 2009; Levy & Spiller, 1994). Three decades of theory have clarified the instruments available and the informational conditions under which each performs, without dissolving the underlying dilemma (Armstrong & Sappington, 2006).

The credible-commitment tradition supplies one foundation. Investment depends in part on whether institutional arrangements constrain arbitrary policy change and offer workable procedures for resolving disputes, and those arrangements extend well beyond the regulator to courts, administrative law, legislative checks and the organisation of political competition (Levy & Spiller, 1994). The instruments chosen to govern tariffs, disclosure, performance and contracting also determine what actors can see and contest, which makes policy design part of the institutional environment rather than a neutral application of it (Lascoumes & Le Galès, 2007). Incomplete-contract analysis reinforces the point from another direction: residual control rights and renegotiation procedures shape investment incentives precisely because comprehensive contracting over a thirty-year horizon is impossible (Hart, 2003). A concession can specify indexation formulae and review windows in considerable detail and still leave most of the future unaddressed.

Developing-country regulation adds capacity constraints and institutional fragmentation to that problem. Agencies may lack specialised staff, reliable cost data or insulation from short electoral cycles. Authority over tariffs, service territories and environmental obligations is often divided across levels of government, reproducing the tension between decentralisation, depoliticisation and scale that ran through the water reforms of the 1990s (Herrera & Post, 2014). Formally adopting an independent regulator therefore produces limited behavioural change where surrounding institutions supply weak support for monitoring or enforcement. Scholarship on the regulatory state in the Global South warns against treating organisational form as a portable technology whose effects travel independently of political and administrative context (Black, 2001; Dubash & Morgan, 2012). Regulatory quality is manufactured out of information systems, professional capacity, legal authority and working relationships with ministries, municipalities, courts and civil society — none of which arrives with the statute.

Concessions make the difficulty visible because renegotiation is so common. Evidence from Latin American infrastructure shows contracts being reopened after award at high rates, with outcomes shaped by regulatory arrangements and political incentives (Guasch et al., 2008). Some of that adaptation is unavoidable and even desirable over long horizons. The problem arises when adaptation becomes opaque or opportunistic, or when it systematically returns risk to the public sector after competitive bidding has established the terms. Finance introduces

a further party to the negotiation. Lenders and bondholders may welcome contractual changes that preserve debt service even where the distributive consequences for users or taxpayers are adverse, which is why a regulator who reads the service contract without reading the financing structure behind it is working with half the document.

Tariff regulation concentrates these tensions in a single instrument. Price-cap and cost-based models distribute productivity risk differently and demand different informational capacities from the regulator. In sanitation, tariffs also fund investment programmes whose geography is uneven: dense urban areas generate stronger revenues, while peripheral and low-income territories require more capital per connection. Cross-subsidy can pool those differences within a service area, but its feasibility turns on territorial scale and on whether redistribution can be defended politically. Regionalisation is therefore an engineering arrangement and a financial institution at the same time. Pooling municipalities with different revenue bases and investment needs supports internal subsidy and enlarges the cash-flow base; it also distances decisions from local users and complicates intergovernmental accountability. Whether consolidation delivers the efficiency gains attributed to it is, notably, an open empirical question even in high-income settings (Klien & Michaud, 2019).

Brazilian scholarship offers unusually rich evidence on these governance problems. Studies preceding the 2020 reform documented heterogeneous efficiency across providers and linked performance to regional provision, ownership arrangements and operator independence without reducing outcomes to any single variable (Ferro et al., 2014). Research on regulatory authorities found that institutional design and regulatory presence could support efficiency and universalisation, while warning that implementation varied sharply across jurisdictions (Carvalho & Sampaio, 2015). Later estimates confirm measurable associations between regulation and utility efficiency, again within a sector marked by deep heterogeneity in governance and operating conditions (Carvalho et al., 2023). Assessments conducted after the new framework continue to find uneven autonomy, transparency, accountability and technical capacity across agencies (Andres et al., 2024).

Federalism intensifies the coordination problem. Municipal responsibility for local services coexists with state-level utilities, metropolitan systems and federal legislation; tariffs may be regulated by local, intermunicipal or state bodies, while national institutions now issue reference norms intended to reduce divergence. The architecture generates a standing tension between decentralised titularity and the benefits of regulatory scale (Sampaio & Sampaio, 2020). A national reference norm improves comparability and sets common expectations, yet implementation still depends on subnational agencies with unequal resources and different political environments. Standardisation can lower transaction costs for investors long before it standardises regulatory performance, and the gap between those two effects is where much of the interesting variation lives.

This perspective clarifies what bankability actually asks of regulation. Creditors price the probability that promised cash flows will remain available over the life of the debt, and that assessment takes in tariff adjustment, enforceability, the allocation of demand and construction risk, termination compensation and the regulator's capacity to apply rules predictably. Stronger commitment lengthens financing horizons. But credible regulation must also preserve lawful adaptation to new information, environmental shocks and affordability pressure, and a regime

that protects investors by extinguishing legitimate public discretion tends to become politically fragile — generating, in the end, the very risk it was designed to suppress.

4. Infrastructure finance, bankability and development banking

Discussions of sanitation finance conventionally open with a gap. Investment needs are estimated, public budgets are compared against them, and the difference is offered as evidence that private capital must be mobilised — a framing that has organised debate on private participation in urban water for well over a decade (Marin, 2009). The arithmetic usefully conveys scale. It also obscures the mechanisms that stop savings from becoming infrastructure. Water and sewerage projects offer weak or uncertain revenue precisely where social need is greatest. Municipal balance sheets are constrained, utilities may lack audited accounts, preparation is often poor, and tariff systems frequently fail to generate cash flows that commercial lenders regard as predictable. The distance between social need and investible opportunity is institutional before it is financial (Machete & Marques, 2021; Pories et al., 2019). Public-finance analysis of public-private partnerships reaches a compatible conclusion from first principles: contract design and the allocation of public risk determine the economic substance of the arrangement, whatever its accounting treatment (Engel et al., 2013). Critical reviews of the PPP revival add that the instrument has often been selected for its fiscal optics rather than its efficiency properties (Bayliss & Van Waeyenberge, 2018).

Bankability names part of this problem, though the literature uses the term inconsistently enough to cause trouble. Sometimes it refers narrowly to the capacity of project cash flows to service debt under plausible stress. Elsewhere it stretches to cover governance, sponsor quality, regulatory credibility, project preparation and the entire enabling environment. That elasticity matters, because a project may be technically sound and socially valuable while failing a commercial lender's return threshold, and another may clear the threshold only because guarantees or tariff commitments have transferred risk away from investors at public expense. Treating bankability as actor-dependent resolves much of the confusion: what a commercial bank, a development bank, an institutional investor and a public authority each regard as financeable reflects different mandates, risk tolerances and required returns (McCoy & Schwartz, 2023).

Project finance shows, in concrete terms, how a long-duration claim is assembled. The wider law-and-finance literature establishes the premise that enforceable rights and creditor priority shape both the supply and the terms of capital (La Porta et al., 1998; Pistor, 2013). Special-purpose companies then isolate project cash flows and liabilities from the sponsor's balance sheet; contracts allocate construction, operating and demand risk among counterparties; and security interests, reserve accounts, covenants and step-in rights give creditors instruments with which to defend repayment. Project-finance loans differ from ordinary syndicated credits precisely because lenders lean so heavily on project-specific contractual architecture and monitoring (Kleimeier & Megginson, 2000). Legal institutions matter because creditor rights have value only where claims can be verified and enforced (Subramanian & Tung, 2016), and non-financial contracts feed back into financing terms by moving identifiable risks onto contractors, suppliers or offtakers (Corielli et al., 2010).

Sanitation complicates the template, because the revenue underneath the structure is a regulated essential service. Creditors are pricing tariff cash flow inside the public-law environment that produces it, which makes the service area, the tariff formula, the investment obligation and

the legal status of the concession integral parts of the asset rather than context surrounding it. Political risk consequently enters debt structure through far more than sovereign instability: tariff freezes, contested indexation, changes in service requirements, non-payment by public counterparties, licence disputes and renegotiation all sit in the same category. Development-bank participation can mitigate several of these risks and signal confidence, although causal identification is genuinely hard, since public lenders may simply select stronger projects (Hainz & Kleimeier, 2012).

Maturity deserves more attention than it usually receives. Long-lived assets can in principle support long-term finance, and institutional investors can supply long-duration capital where governance, scale and risk profile match their mandates (Andonov et al., 2021). In practice, uncertainty about cash flows, regulation or refinancing shortens the horizon creditors will accept, pushing sponsors towards repeated refinancing and exposing essential infrastructure to whatever market conditions prevail at each rollover. Tenor in project finance reflects project risk, contractual structure and the institutional environment rather than physical asset life alone (Thierie & De Moor, 2019). Evidence on project bonds points the same way: primary-market spreads can differ systematically from comparable corporate debt, which should caution anyone assuming that access to capital markets automatically lowers financing costs (Guedes & Pinto, 2023). For sanitation, tenor and spread are best treated as separate outcomes, since a structure may buy maturity by paying investors more for it.

Blended finance attempts to bridge the distance between socially valuable projects and private risk-return requirements by combining concessional and commercial capital. Guarantees, first-loss tranches, concessional loans and technical assistance can improve terms or absorb risks that markets decline to hold. Where public intervention addresses an identified constraint, the logic is sound. Evaluation becomes far more difficult when success is measured by leverage ratios, because mobilising a large volume of private capital looks efficient even when public actors retain the downside, users fund high returns through tariffs, or projects cluster in commercially attractive territories. The WASH literature is consistent on the sequencing: blended structures work after core service institutions, revenues and project preparation have been strengthened, not instead of them (Pories et al., 2019).

Public development banks occupy a distinctive position because they can lend, structure and shape markets at once. Conventional accounts emphasise their capacity to relieve long-term credit constraints, provide counter-cyclical finance and support investments whose social returns private lenders undervalue (Griffith-Jones & Ocampo, 2018). A market-shaping perspective widens the mandate, focusing on how public banks create investment opportunities, set conditions and coordinate actors around policy objectives rather than merely correcting failures (Mazzucato & Penna, 2016). Empirical work on BNDES shows that state-owned development banks can affect firm-level finance and investment, with benefits contingent on allocation and governance rather than ownership form as such (Lazzarini et al., 2015). Historical analysis situates the bank within a developmental state whose instruments adapted to liberalised capital markets and shifting political coalitions (Hochstetler & Montero, 2013).

Water finance makes the organisational role of these institutions especially visible. Project preparation is expensive, specialised and uncertain: engineering studies, demand forecasts, legal due diligence, environmental licensing, tariff modelling and public consultation must all be coordinated before an auction can be held or financing arranged. Small municipalities rarely

have the capacity to procure and supervise that work. A development bank can fund preparation, establish common documentation and convene several levels of government around a single timetable. Comparative research on development banking in the water sector shows public lenders operating with horizons and policy objectives that differ from those of commercial banks (Reis, 2022). The governance question is what they do with that position, since the same institution can absorb risk quietly or attach conditions to investment quality, affordability and delivery.

Mission-oriented scholarship presses exactly that question. Framing finance as a means of organising investment around measurable societal goals, it argues that public institutions should share risks while also shaping rewards and retaining the capacity to steer (Mazzucato, 2018; Mazzucato & Zaqout, 2025). Sanitation fits the frame closely, because universal service is a mission with an explicit distributive edge: the hardest investments are the ones with the lowest direct financial return. Public capital, cross-subsidy and conditionality are therefore not transitional supports to be withdrawn as markets deepen. They are structural components of universalisation, and a financing architecture that treats them as temporary is likely to stall at the point where the remaining deficit is concentrated.

5. Financialisation and the distribution of risk and value

Critical political economy widens the frame from the price of capital to the institutions and spatial relations through which water is reorganised as an economic and financial object. Harvey's account of neoliberalisation is useful at this level of abstraction because it directs attention to privatisation, market discipline and the redistribution of assets and decision-making power that accompanied late twentieth-century restructuring (Harvey, 2005). Water scholarship made that argument concrete. Swyngedouw read privatisation as a contested reworking of access, ownership and accumulation, while urban political ecology situated water networks inside conflicts over scale, class and the uneven production of the city (Swyngedouw, 2005; Swyngedouw & Heynen, 2003). An earlier and still valuable corrective came from Budds and McGranahan (2003), who showed that the privatisation debate had largely missed its target, since the great majority of the unserved were nowhere near a network that any operator, public or private, was proposing to extend.

The British critical-geography tradition pushed the analysis closer to everyday infrastructure. Loftus and Lumsden showed how urban waterscapes are reproduced through social relations and struggles over hegemony alongside the engineering system (Loftus & Lumsden, 2008). Loftus subsequently argued for political ecologies capable of connecting material flows, labour, institutions and political contestation without collapsing water politics into a generic narrative of scarcity (Loftus, 2009). His later work on water security placed the right to water inside that critical geography, drawing attention to the political choices concealed by apparently technical security frameworks (Loftus, 2015). Hydrosocial-territory research extends the argument by treating territory itself as produced through interactions among infrastructure, institutions, knowledge and power (Boelens et al., 2016).

England and Wales remain the best-documented case of how these processes become financial. Market environmentalism recast water utilities around private ownership and regulatory price-setting, embedding environmental and service objectives inside a commercial framework whose distributive consequences stayed contested (Bakker, 2005, 2010). Later work followed

the financial structures built on top of regulated household revenues. Allen and Pryke reconstructed how the ring-fenced utility and its ownership chain could support financial strategies that were almost impossible to read from the operating company's accounts alone (Allen & Pryke, 2013). Bayliss documented the expansion of leverage and investor-oriented practice, and then examined the material and regulatory infrastructures that made those strategies workable (Bayliss, 2014, 2017). Evidence on private-equity ownership shows value extraction outpacing the regulatory tools designed to observe it (Bayliss et al., 2023).

England matters analytically above all because it separates privatisation from financialisation. A private operator can remain conservatively financed; a regulated utility can become highly leveraged through ownership structures, intra-group debt or upstream distributions. The variables that matter sit in balance sheets, financing vehicles, covenant packages, dividend policies and regulatory rules, not in the ownership label. Broader work on infrastructure as an asset class makes the same move at the level of the financial product, showing how local revenue streams are reassembled into instruments legible to distant portfolios (O'Neill, 2019; Torrance, 2008). Pryke and Allen arrive at the issue from the direction of Chile, where infrastructure value is constructed through contractual and valuation practices that link local water revenues to Canadian pension liabilities (Pryke & Allen, 2022). Ahlers and Merme make the corresponding governance point: financialisation has uneven effects because governance arrangements determine which risks, returns and development outcomes are socialised and which are privatised (Ahlers & Merme, 2016).

Project-level research adds a necessary distinction. Financialising desalination can involve public guarantees, purchase agreements and risk allocation that stabilise returns without reproducing the corporate structures observed in English utilities (Loftus & March, 2016). Studies of the Spanish water industry show accumulation strategies shifting with the corporate and financial environment rather than following a single script (March & Purcell, 2014). The wider political-economy literature accordingly treats financialisation as a family of mechanisms with heterogeneous institutional forms (Loftus et al., 2019), and Christophers' (2015) caution against conceptual overreach applies with particular force here: a term that explains privatisation, leverage, valuation, austerity and asset management equally well is at risk of explaining none of them. Evidence from Kenya reinforces the point empirically, since the slow development of financialised water arrangements there reflects political and institutional limits on converting service revenues into investible claims, even where governments and donors actively sought private finance (Williams, 2021).

Territorial scale runs through all of these mechanisms. Financial value depends on which users and assets fall inside the revenue perimeter, on how profitable and costly areas are combined, and on whether cross-subsidy is permitted. Regionalisation can pool risk and sustain investment in lower-income municipalities; it can equally reallocate authority away from local institutions. Urban political ecology is helpful precisely because it treats the service territory as an object of governance with distributive consequences rather than as a technical given. The same boundary that improves cash-flow diversification also decides who subsidises whom, which peripheral investments enter the programme, and whose claims take priority when resources tighten.

Debates over remunicipalisation supply an institutional counterpoint. Return to public ownership has occurred where governments or users grew dissatisfied with private provision,

yet outcomes depend on financing capacity, legal design and administrative competence, and the ownership label again reveals only part of the change (Hall et al., 2013; McDonald, 2018). Bakker's analysis of "public" water warns against treating publicness as a simple property category, since public authority is assembled out of institutions, service obligations and forms of accountability (Bakker, 2013). Read together, these contributions discipline causal inference: ownership changes matter through specific governance and financing mechanisms, and the mechanisms are what require identification.

The Wall Street Consensus literature situates contemporary de-risking within a broader transformation of development policy, in which fiscally constrained governments are encouraged to convert social needs into asset classes that satisfy institutional-investor requirements through guarantees, blended finance and regulatory reform (Gabor, 2021). Subsequent work on green hydrogen extends the diagnosis to industrial policy, showing how de-risking reorganises the state's relationship to private capital well beyond social infrastructure (Gabor & Sylla, 2023). Water exposes both the power and the limits of the argument. Public intervention is unavoidable in systems where low-income areas cannot recover full costs through tariffs; what remains genuinely contestable is whether public risk absorption is designed around service goals or around the protection of investor returns. Mission-oriented finance and critical political economy start from different normative premises and converge on the same empirical requirement: examine conditionality, risk distribution and public capacity directly (Mazzucato & Zaqout, 2025).

Brazil has become a major setting in which these arguments can be tested against a changing regulatory and financial architecture. Research has connected fiscal austerity and market-oriented reform to the expansion of private finance in sanitation (Almeida & Hungaro, 2021), traced the institutional work through which actors secure financial returns under political uncertainty (Cruxên, 2024), and interpreted the recent reforms through a financialisation lens (Britto, 2025). The newest evidence also shows why claims must stay mechanism-specific: leverage, tariff commitments, dividend policy, concession design and regulatory oversight need to be observed directly before system-level consequences can be attributed to financialisation at all (Barra et al., 2026).

6. Brazil as a critical site of convergence

Brazil brings the literature together because its sanitation sector combines a large federation, historically significant state-owned utilities, municipal service authority, severe territorial inequality and a financing environment in rapid transition. Public, mixed and private providers have coexisted for decades; private concessions predate the 2020 reform, as do development-bank lending and capital-market instruments. What has changed since 2020 is the scale and contractual form through which investment is organised, as regionalisation, national reference norms and large concession programmes reshape the perimeter within which revenue is pooled and obligations are assumed.

Evidence from the pre-reform period already showed why ownership alone explains little. Efficiency varied across providers with regional organisation, scale and managerial independence as much as with property structure (Ferro et al., 2014; Seroa da Motta & Moreira, 2006). Regulatory institutions influenced the path to universalisation because investment incentives had to coexist with user protection and service obligations (Carvalho & Sampaio, 2015). More recent estimates find measurable relationships between regulation and utility efficiency while

preserving the picture of a heterogeneous sector (Carvalho et al., 2023). Work on public-private partnership arrangements in Brazilian water reached a similarly two-sided verdict well before the reform, identifying gains in investment capacity alongside recurrent weaknesses in contract design and regulatory supervision (Marques, 2016).

Federalism adds a coordination problem inseparable from finance. Municipal authority over local services coexists with state utilities, metropolitan systems and federal legislation; tariffs may be regulated by local, intermunicipal or state entities, while national reference norms seek to reduce divergence. The architecture generates transaction costs in project preparation and supervision, and uncertainty about how common standards will be implemented (Sampaio & Sampaio, 2020). Assessments of Brazilian regulatory agencies continue to find wide variation in autonomy, transparency, accountability and technical capacity (Andres et al., 2024) — variation that matters more, not less, once national norms create the appearance of uniformity.

Law 14,026/2020 addresses part of this fragmentation (Brasil, 2020). It strengthens universalisation targets, encourages regionalised provision and competitive contracting, and assigns the *Agência Nacional de Águas e Saneamento Básico* (National Agency for Water and Basic Sanitation) a reference-norm role intended to harmonise regulatory practice across a fragmented landscape. From a financing perspective, regionalisation enlarges revenue pools and investment programmes, making project preparation and capital-market issuance viable at scales unavailable to isolated municipalities. From a rights perspective, the same aggregation demands scrutiny of how investment, cross-subsidy and voice are distributed among participating municipalities. Minas Gerais illustrates how contested those choices are, with government, private-sector and civil-society actors holding materially different expectations about privatisation, tariffs and universal access (Neves-Silva et al., 2023).

Empirical work has begun to measure outcomes directly rather than infer them. A generalised synthetic-control study evaluates sanitation concessions in Southern Brazil against service indicators (Silva et al., 2024). A difference-in-differences analysis covering more than three thousand municipalities over two decades finds positive effects of private provision on access to water, sewerage and treatment alongside higher tariffs, which is a useful reminder that access and affordability are separate dependent variables that can move in opposite directions (Côrtes et al., 2023). Research on utilities' financial standing shows that pathways into privatisation are related to firms' prior financial condition, raising a selection problem that undermines naive public-private comparisons (Nunes & Marques, 2025). Work on tariff regulation, affordability and emergency responsiveness indicates that institutional capacity shapes who absorbs adjustment costs (Fagundes et al., 2025; Victral & Heller, 2023).

The financing layer has become materially more consequential over the same period. Debentures issued under Law 12,431/2011, and since 2024 under the parallel regime created by Law 14,801/2024, give creditors a direct relationship with regulated service revenue (Brasil, 2011, 2024). Of the R$236.3 billion raised through debenture offerings in Brazil in 2023, sanitation accounted for R$28.4 billion, ranking third behind electricity and transport and logistics (ANBIMA, 2024). Development-bank project preparation can reduce coordination costs before capital enters, and public lending can extend maturities or support investments that commercial finance would price more punitively. Brazil is therefore an unusually good setting in which to combine project-finance variables — maturity, security, amortisation, covenants, sponsor support — with regulatory variables such as tariff review, investment execution and service targets.

Absent that integration, rising issuance will continue to be misread as improving sector performance.

A wider Brazilian literature on state capacity sharpens the point from outside the sector. Research on the country's nuclear programme shows how ambitious, capital-intensive policy underperforms when technological strategy, institutional coordination and domestic capability-building fail to align over time (Nicolini Gabriel & Belém Lopes, 2025). The comparison has obvious limits, but the institutional lesson travels: durable investment programmes require organisations able to connect long-horizon objectives to domestic capabilities, implementation and political continuity. Sanitation adds regulated household revenue and non-renounceable local service obligations to that coordination problem, which makes it harder rather than easier.

Critical research then asks who benefits from the new architecture and who remains exposed. Studies of austerity, financial returns and recent concession structures identify risks arising from leverage, distribution and the priority attached to investor claims (Almeida & Hungaro, 2021; Barra et al., 2026; Britto, 2025; Cruxên, 2024). The human-rights literature supplies observable criteria against which those concerns can be tested: continuity, affordability, access in informal and rural areas, non-discrimination, information and participation (Arruda & Heller, 2022; Heller, 2022; Roland et al., 2022). Connecting those measures to specific debt and contract structures would move the Brazilian debate past its long-running and largely unproductive argument about public versus private ownership.

The research opportunity is strong because Brazil combines institutional variation with increasingly granular financial and service data. A mature empirical agenda can compare concessions and utilities across regulatory environments, trace financing from project preparation through to issued instruments, and follow service outcomes over time. The central identification challenge is selection, and it operates at two levels: projects that reach capital markets differ systematically from those that do not, and municipalities included in regional concessions differ from those left outside. Credible designs will need pre-treatment information, transparent case selection and a clear analytical separation between financing outcomes and service outcomes.

7. Discussion: towards an integrated research agenda

The literature now supports a more integrated account of sanitation investment than any single field can provide. Public-health and rights research identifies the outcomes that justify intervention; regulation explains how long-lived monopoly obligations are governed; finance shows how future revenues become claims with price, maturity and priority; political economy reveals how those claims redistribute authority and value. The analytical gain comes from following the same project or utility across all four domains, which allows financeability, regulatory credibility and universalisation to be treated as related outcomes rather than as substitutes for one another. Movement in one does not guarantee movement in the others, and the cases where they diverge are the informative ones.

Territorial design is the most promising bridge. Service boundaries determine demand, the composition of the tariff base, the scope for cross-subsidy and the distribution of investment obligations; they also fix the scale at which regulators collect information and communities exercise voice. Urban political ecology describes those boundaries as hydrosocial and political, while project finance reads them as the perimeter supporting cash flow. Both readings are correct, and empirical work can use them together by testing how alternative territorial arrangements affect

financing terms, investment distribution and household access (Boelens et al., 2016; Klien & Michaud, 2019).

Financial claims deserve direct observation rather than inference. Debt carries maturity, indexation, amortisation profile, security, covenants and refinancing exposure. Equity brings governance rights, expected returns and exit horizons. Public support appears as direct lending, guarantees, grants or subsidised preparation. Each of these features allocates risk across time and among institutions, and each is recorded somewhere — in prospectuses, regulatory filings, concession contracts and rating reports. Treating them as measurable variables avoids the standard error of reading the financing mechanism off the ownership structure, and it makes critical claims testable, since the effects of financialisation should be visible through identifiable channels: leverage, distributions, the priority of debt service, regulatory accommodation.

Regulatory information systems need to match that granularity. A regulator who observes service indicators but cannot see refinancing risk, covenant pressure or intra-group transfers will discover financial fragility only after it has already affected investment or tariffs. A regulator who monitors balance sheets without mapping household connections and affordability can protect solvency while missing exclusion entirely. The reporting architecture that would serve both purposes links financing instruments, project identifiers, investment schedules, concession territories and service outcomes over time, and its absence is currently the binding constraint on research as much as on supervision. Such integration would also let analysts distinguish temporary financing stress from structural underinvestment, a distinction that matters enormously for policy and is almost impossible to draw from published accounts alone.

Public development banks sit at a consequential point in the chain, and their effect cannot be assessed by the volume they lend or the private capital they claim to have mobilised. Preparation, standardisation, technical assistance and conditionality change which projects become financeable and what obligations those projects carry (Griffith-Jones & Ocampo, 2018; Mazzucato & Penna, 2016; Reis, 2022). Mission-oriented finance supplies a usable evaluation criterion: public risk-taking should be tied to measurable public value, with governance arrangements capable of learning and adjusting as implementation unfolds (Mazzucato & Zaqout, 2025). Leverage ratios are an input to that assessment, never a substitute for it.

The critical literature adds a question about durability that the finance literature tends not to ask. Long-term finance stabilises investment; it also locks in claims on tariff revenue and narrows future regulatory choice. The empirical task is to establish when contractual commitment protects productive investment and when it hardens distributive arrangements that later prove socially or environmentally costly. England and Wales demonstrate how ownership chains and leverage evolve inside a formally stable regulatory regime (Allen & Pryke, 2013; Bayliss et al., 2023). Developing-country evidence shows financialisation advancing slowly and unevenly where political and institutional conditions resist standard asset-making strategies (Williams, 2021). Neither pattern is the default; both need explaining.

Rights-based scholarship keeps the dependent variable anchored in service. Universalisation requires effective connections, continuity of supply, water quality, sewage collection and treatment, affordability, dignity and non-discrimination. These outcomes should be disaggregated by income, gender, race where data permit, rurality and settlement type, because average coverage systematically conceals the populations for whom service is most precarious (Arruda & Heller, 2022; Neves-Silva & Heller, 2016; Neves-Silva et al., 2018). Financial research becomes

more precise, not less rigorous, when these variables enter the design, since they reveal whether a financing architecture delivers the public purpose invoked to justify it.

The agenda that follows is demanding but coherent. It asks how states and firms construct financeable claims, how regulators govern those claims after financial close, how financial commitments redistribute risk, and whether investment reaches households on acceptable terms. Sanitation is a particularly good laboratory for the inquiry because physical assets, regulated cash flows and social rights remain inseparable across very long horizons. The strongest future work will combine security-level and firm-level financial data with contract analysis, regulatory institutions and household service outcomes, and will resist letting any one layer stand in as a proxy for the others.

8. Conclusion

Sanitation finance is usually presented as a paradox: enormous social need alongside persistent difficulty in mobilising long-term investment. The literature reviewed here supports a more concrete diagnosis. Capital reaches networks through institutional arrangements that define territories, revenues, obligations, regulatory procedures and creditor rights, and project preparation together with public coordination determines whether those elements cohere before financial markets become relevant at all. The quantity of savings available to investors is one part of the financing problem, and rarely the binding one.

Those arrangements carry distributive consequences. Long-term debt matches funding to asset life and imposes useful discipline on execution; leverage, refinancing pressure and rigid cash-flow commitments shift adjustment onto tariffs, maintenance or public support. Regionalisation diversifies revenues and sustains cross-subsidy; it also redistributes authority among municipalities and users. Public development banks absorb risk and organise projects; the public value of their intervention depends on the conditions attached to finance and on the capacity to monitor delivery. In each pair, the second clause is not a caveat. It is the part that determines whether universalisation actually arrives.

Brazil concentrates these questions in a sector undergoing simultaneous institutional and financial transformation. Regulatory heterogeneity persists alongside national reference norms; large concessions coexist with state-owned providers; development-bank preparation interacts with capital-market issuance; human-rights research continues to document uneven access and vulnerability. The combination makes the country a strong setting for causal and mechanism-oriented research, provided studies distinguish project selection from financing outcomes and both from service outcomes, and resist the temptation to infer performance from ownership or from financial close.

A rigorous sanitation-finance literature should ultimately follow the money into service. It should identify how a claim on future tariff revenue is constructed, measure the terms on which capital enters, observe how regulators and public authorities respond over time, and test whether households receive continuous, affordable and safe services. That approach preserves the economic importance of finance while keeping universalisation as the criterion against which every institutional innovation is judged. On the evidence assembled here, the 2033 deadline will not be met or missed in the capital markets. It will be met or missed in the peripheral and rural territories where the remaining deficit is concentrated, and where financeability, as currently constructed, is weakest.

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