The adoption of governance, risk management, and compliance practices in Brazilian water and sanitation utilities

A adoção das práticas de governança, gestão de riscos e conformidade nas empresas brasileiras de água e saneamento

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Abstract: Brazil's sanitation sector still faces significant service gaps, with sewage treatment serving only 55% of the population and potable water coverage at 84%, despite regulations aiming for universal access by 2033. In this challenging context, enhancing Governance, Risk Management, and Compliance (GRC) practices is essential for boosting utility performance and accountability. This study applies a composite indicator of formally documented GRC practices comprising 45 variables to benchmark the structural adoption of governance, risk management, and compliance across Brazilian water and sanitation utilities. Due to limited transparency, only 34 of the 233 regulated water and sanitation utilities provided enough documentation for analysis; however, this sample covers 78.5% of Brazil's population, making it highly representative. The findings reveal that only 26% of sampled utilities have formally established GRC units and that overall implementation of GRC practices averages 58.1%. Nonetheless, notable differences exist in the formal adoption of documented GRC arrangements across utility ownership types: public providers account for 64.8%, while private providers account for only 39.4%. To explain these results, expert interviews were conducted, indicating that political–managerial instability remains the primary barrier to GRC institutionalization. In contrast, strong leadership commitment and executive sponsorship are the primary enablers. The study presents an original framework for benchmarking the implementation of GRC practices, reveals significant transparency deficits among utilities, and provides insights to strengthen corporate governance practices across Brazil's sanitation sector.

Keywords: Sanitation utilities; Corporate governance; Risk management; Compliance.

Resumo: O setor de água e saneamento no Brasil ainda enfrenta lacunas significativas na prestação de serviços, com o tratamento de esgoto atendendo apenas 55% da população e a cobertura de água potável alcançando 84%, apesar da legislação que visa garantir o acesso universal até 2033. Nesse contexto desafiador, o fortalecimento das práticas de governança, gestão de riscos e conformidade (GRC) é essencial para melhorar o desempenho e a conformidade das empresas prestadoras do serviço público. Este estudo aplica um indicador composto de práticas formalmente documentadas de GRC, com 45 variáveis, para avaliar comparativamente a adoção estrutural de governança, gestão de riscos e compliance entre as empresas de água e saneamento no Brasil. Devido à limitada transparência, apenas 34 das 233 empresas reguladas forneceram documentação suficiente para

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compor a amostra; ainda assim, essa amostra cobre 78,5% da população brasileira, tornando-a altamente representativa. Os resultados revelam que apenas 26% das empresas analisadas possuem unidades de GRC formalmente estabelecidas e que a implementação geral dessas práticas atinge uma média de 58,1%. Contudo, há diferenças relevantes entre os tipos de propriedade: os prestadores públicos alcançam 64,8%, enquanto os prestadores privados atingem apenas 39,4%. Para explicar esses resultados, foram realizadas entrevistas com especialistas, que indicaram que a instabilidade político-gerencial é a principal barreira à institucionalização do GRC. Em contraste, o forte compromisso da liderança e o patrocínio da alta administração destacam-se como os principais fatores facilitadores. O estudo apresenta um indicador composto original para a avaliação comparativa da implementação das práticas de GRC, evidencia limitações relevantes quanto à transparência entre as empresas e oferece recomendações para o fortalecimento das práticas de governança corporativa no setor de água e saneamento no Brasil.

Palavras-chave: Empresas de saneamento; Governança corporativa; Gestão de riscos; Conformidade.

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1. INTRODUCTION

Despite major regulatory reforms and increasing private sector participation, the Brazilian water and sanitation sector continues to exhibit profound service deficits and governance challenges. Sewage treatment serves just over half of the population, and access to drinking water remains uneven, especially among low-income and peripheral communities, even after the implementation of ambitious universalization targets for 2033 (SNIS, 2023). While existing research has extensively examined infrastructure gaps, regulatory design, and ownership arrangements (Saiani; Azevedo; Menezes, 2023), little research examines how Governance, Risk Management, and Compliance (GRC) practices are adopted within these utilities. Limited information exists on the extent to which utilities have established formal and operational GRC capacities that support accountability, risk-informed decision-making, and long-term sustainability in a highly regulated and politically sensitive sector.

The National Basic Sanitation Law (Law No. 11.445/2007), reinforced by its 2020 reform (Law No. 14.026/2020), established clear universalization targets, such as 99% water supply and 90% sewage collection and treatment by 2033, while strengthening regulatory oversight and encouraging new investment models (Gadelha et al., 2021). Achieving these targets, however, requires more than just financial resources and expanding infrastructure; it fundamentally depends on utilities' ability to govern effectively, manage risks, comply with regulations, and align strategic goals with

operational decisions. Thus, corporate governance, risk management, and compliance have become central to contemporary debates on public utility management.

Governance structures define decision-making authority, oversight mechanisms, and accountability relationships; risk management provides systematic tools to identify, assess, and mitigate uncertainty; and compliance ensures adherence to legal, regulatory, and ethical standards (COSO, 2017; IBGC, 2023). Integrated GRC frameworks are seen as internal infrastructures that help organizations operate reliably in complex environments by balancing governance, integrity, transparency, and stakeholder expectations (Tarantino, 2008). In these essential public services, characterized by high capital costs, long-lived assets, multiple regulators, and social externalities, robust GRC frameworks are critical.

The literature on GRC adoption in public utilities, particularly in Brazilian sanitation, is fragmented and limited. Existing studies tend to focus on isolated dimensions of governance, single-case studies, or compliance with specific legal requirements, such as the State-Owned Enterprises Law (Law No. 13.303/2016) (Nascimento; Maracajá, 2024; Sousa, 2021). There is a lack of comparative empirical analyses that benchmark GRC practices across utilities with different ownership, legal, and organizational structures. Additionally, little research focuses on how transparency deficits affect GRC adoption, regulatory effectiveness, governance quality, and accountability (Jacobi et al., 2009).

This study addresses these gaps by developing and applying a composite GRC indicator to benchmark the adoption of governance, risk management, and compliance practices across Brazilian water and sanitation utilities. By combining documentary analysis of formal organizational instruments with qualitative insights from senior GRC practitioners, the research offers a comprehensive assessment of both the presence of the GRC framework and the organizational factors that enable or hinder its institutionalization.

2. CONCEPTUAL FRAMEWORK

Governance, Risk Management, and Compliance (GRC) has emerged as an influential framework for organizational accountability, control, and strategic decision-making (Barbosa et al., 2023). GRC operates as an internally oriented framework that integrates governance structures, risk management processes, and compliance mechanisms to align organizational behavior with regulatory requirements and strategic objectives (Chairani; Siregar, 2021).

Within GRC, governance is embedded in internal oversight arrangements, decision-making processes, and control systems that guide

organizational behavior (COSO, 2017; IBGC, 2023). The literature indicates that governance practices serve as the connective infrastructure through which objectives are translated into operational practices, performance monitoring, and disclosure routines. A strong corporate governance improves firm value and performance (De Freitas Brandão; Crisóstomo; López-Iturriaga, 2024; Hakki; Sofianty; Simanungkalit, 2025; McShane; Nair; Rustambekov, 2011). GRC supports risk management through structured processes and enterprise risk management systems that identify, assess, and mitigate risks. Moreover, the GRC framework applies to both the corporate and public utility sectors, which face similar challenges: complex regulations, stakeholder demands, service reliability, and resource accountability. In water and sanitation utilities, GRC practices are key for governance, risk management, and regulatory compliance via performance management systems.

While integrated GRC practices support unified policy and process management, their adoption varies across organizational contexts (Brustbauer, 2014; Chang et al., 2020). Ownership structure has been identified as a key factor influencing the design and implementation of GRC. State-owned enterprises (SOEs) face increased regulation and oversight, leading to conservative risk management. While this strengthens formal compliance, it can restrict proactive GRC frameworks that need flexibility and risk-taking. Regulatory mandates often prioritize procedures over innovation, hindering the development of integrated GRC. Privately owned firms may adopt more aggressive growth strategies and riskier approaches, thereby facilitating the implementation of GRC and Enterprise Risk Management (ERM). Ownership heterogeneity affects this. Family-owned firms may forgo robust ERM due to limited leadership. In contrast, firms with institutional investors are more likely to adopt structured risk management to protect long-term value (González et al., 2020). Firm size and regulation influence GRC adoption. Larger and highly regulated firms are more likely to implement ERM and compliance systems to manage complexity and risks (Brustbauer, 2014).

The interplay between ownership structure and ERM adoption can also be viewed through the lens of strategic management and corporate governance. Pagach and Warr (2011) suggest that firms driven by performance objectives are more inclined to implement ERM to mitigate risks associated with market volatility and regulatory challenges. The link between ownership structure and GRC adoption involves institutional and organizational factors. Legally, state-controlled enterprises are subject to regulations requiring governance bodies, controls, risk management, and compliance, thereby raising formal GRC levels even with limited managerial autonomy. Political ties and managerial turnover also affect GRC adoption; frequent leadership changes,

often linked to elections, can disrupt continuity and learning, leading to formal structures that coexist with repeated failures.

Conversely, market-based mechanisms also influence the adoption of GRC. Private operators, especially those relying on external finance or concession contracts, face pressure from lenders, investors, and regulators to show risk preparedness, controls, and compliance. When these pressures are weak or uneven, GRC structures may remain informal, fragmented, or partly institutionalized. Ownership structure does not directly determine GRC adoption but influences the balance of legal coercion, market discipline, and organizational stability, shaping GRC's form and extent across utilities. This study is also informed by the multidimensional and contingent view of corporate governance advanced by Brandão, Crisóstomo, and López-Iturriaga (2024), extending that perspective to the context of water and sanitation utilities and shifting the analytical focus from firm value to the formal adoption and institutionalization of GRC practices.

3. METHODOLOGY

This study uses a cross-sectional, mixed-methods approach to examine GRC practices in Brazilian sanitation utilities. It aims to characterize organizational GRC structures through documentary analysis and managerial insights. The initial population comprised 2,338 sanitation service providers, according to the 2022 National Sanitation Information System report (SNIS, 2023). The study focused on utilities, including statutory agencies, private firms, state-controlled corporations, social organizations, and wholly state-owned enterprises, which supply water and sewage to over 90% of Brazilians and are subject to GRC standards. Public authorities that provide services directly were excluded due to their distinct operational and regulatory contexts.

Table 1. Distribution of service providers by ownership

Legal Structure	Ownership	Quantity	Percentage
Public service directly provided by the public authority (out of the research sample)	Public	2103	89,95
Statutory Agencies	Public	148	6,33
Private Enterprises	Private	45	1,92
State-controlled Corporations	Public	24	1,03
Social Organizations	Private	17	0,73
Wholly State-owned Enterprises	Public	1	0,04

Total		2338	100

During sample refinement, 26 private companies with different NSIS codes were subsidiaries of five parent companies, and seven social organizations belonged to a single rural sanitation system that shared documents. This reduced the effective analysis population to 200 providers, with 34 submitting documents serving 78.5% of Brazilian municipalities.

Documentary data included Articles of Association, Internal Regulations, and policies, mainly from institutional websites. When unavailable online, requests were made via access channels, emails, or platforms. In rare cases, direct contact was made by phone and ombudsperson offices. The 2022–2025 period was used, with 2022 as the baseline, corresponding to the latest SNIS report at the start of the study (SNIS, 2023). Articles of Association establish foundational rules and are resistant to change, while Internal Regulations detail operational procedures and responsibilities. Corporate policies reflect GRC implementation. Together, these materials provide a robust understanding of governance and operations within the sample.

A content analysis guided the creation of the composite GRC indicator, based on organizational patterns and theoretical frameworks. Composite indicators are practical for comparing complex organizational phenomena and, when grounded in theory, improve validity and reliability (OECD, 2008). Given diverse ownership structures, a single GRC model isn't practical; instead, the composite highlights key GRC practices rather than providing an exhaustive list.

The indicator has 45 questions aligned with the GRC model's three dimensions, across two: Articles of Association and Internal Regulations. Each element was defined in line with the data quality principles of relevance, accuracy, timeliness, accessibility, interpretability, and coherence (OECD, 2008). The indicator enabled descriptive statistical analysis, revealing GRC elements and the level of structural development among utilities. Quantitative analysis was limited to descriptive statistics due to the 34 participating organizations. In line with the OCEG (2024) model, qualitative analysis focused on six GRC categories: Governance and Supervision, Strategy and Performance, Risk and Decision Support, Compliance and Ethics, Security and Continuity, and Audit and Assurance.

Five semi-structured interviews were conducted with managers responsible for GRC in the sampled utilities. Extreme case sampling was used to capture organizations with particularly advanced or underdeveloped GRC practices. Of the 32 utilities invited to participate, five agreed: three state-controlled corporations and two private enterprises. All had dedicated GRC

departments, though only two state-controlled corporations formalized these in their Internal Regulations. Private enterprises did not disclose their organizational structures.

Table 2. Profile of interview participants

ID	Position	Ownership	Time at the Utility	Time in the Position
PE1	Executive Manager of Compliance, Risks and Internal Controls	Private enterprise	2 years and 10 months	2 years and 10 months
PE2	Chief Compliance Officer	Private enterprise	1 year and 4 months	1 year and 4 months
SOC1	Planning and Risk Manager	State-controlled corporations	15 years	7 years
SOC2	Risk and Compliance Advisor	State-controlled corporations	4 years and 5 months	4 years and 5 months
SOC3	Head of Governance and Regulation Advisory	State-controlled corporations	11 months	11 months

Interviews explored managerial perceptions of enablers and barriers to GRC adoption, as well as additional practices beyond those documented in corporate policies. Participants gave informed consent before the virtual session interviews. Transcripts were analyzed using categorical content analysis, with themes serving as the unit of registration.

4. RESULTS

4.1 Composite GRC indicator applied to water and sewage utilities

Document analysis found significant transparency issues among Brazilian sanitation utilities. Out of 200, only seven made all documents publicly accessible; three disclosed no contact information, resulting in 190 requests. Twenty-seven responded with documents; eight had none or unrelated materials; the rest didn't reply. Despite legal requirements, just 12 disclosed their statutes. The minimum requirement for the sample was to provide the Articles of Association.

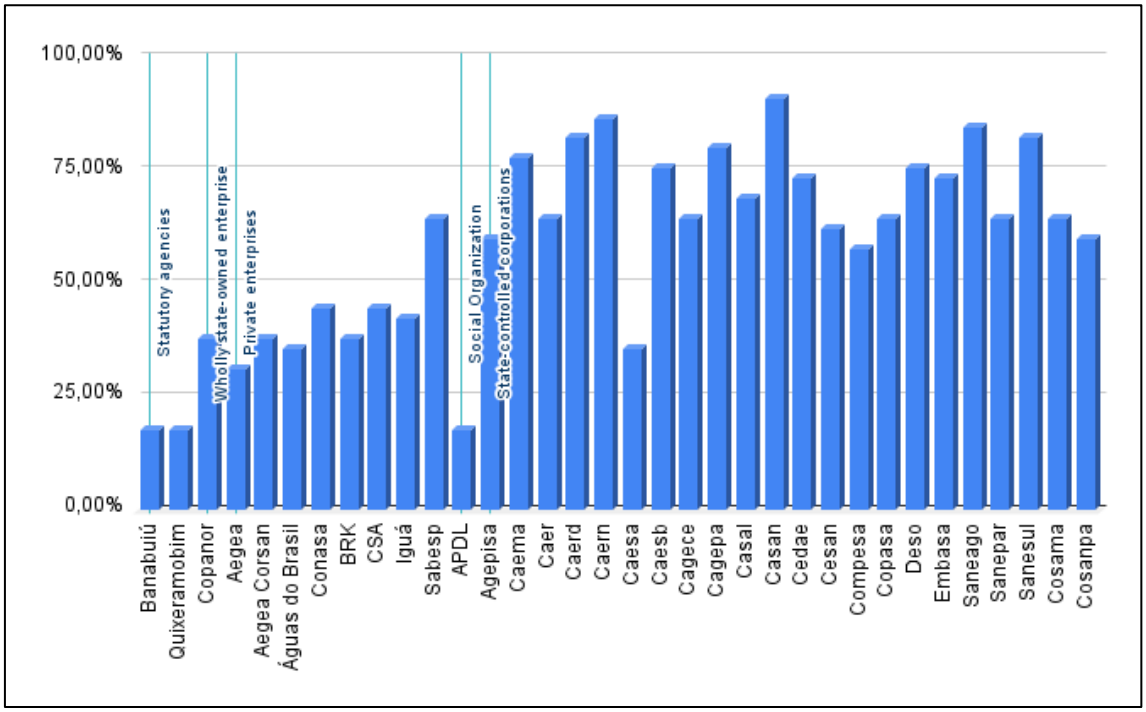
Only organization-wide regulations were accepted for Internal Regulations, as submissions from ten providers limited to specific departments would hinder comparability. Overall, document accessibility was low: of 200 providers, only 34 (17%) shared documents online or upon request, while 154 (83%) disclosed none. This reveals a transparency gap in the sanitation sector,

especially among organizations that handle public services and are subject to governance rules.

The sample covered 34 utilities serving 4,374 municipalities (78.5%) across Brazil's five regions. Their legal forms included one state-owned enterprise, one social organization, two statutory agencies, eight private firms, and 22 state-controlled corporations. A total of 50 documents were analyzed: 34 Articles of Association and 16 Internal Regulations, which were more accessible among private providers. Limited disclosure may indicate sensitivities regarding the internal structure.

The average GRC adoption rate was 58.12%, but scores vary by legal structure. Statutory agencies and social organizations perform the worst at 17.7%. State-owned and private enterprises perform better at 37.7% and 42.18%. State-controlled companies perform best at 70.36%.

Figure 1. Level of formal development of GRC practices.



Public providers scored an average of 64.84%, while private providers averaged 39.46%. The t-Welch test confirmed these differences are statistically significant (22.4 = −4.46, $p < .001$). However, caution is advised in interpretation, given potential selection bias and the small, non-random sample. The comparison is exploratory, indicating only the magnitude and direction of differences, not causality or population effects. Diagnostic tests showed normality was not met (Shapiro–Wilk: p=.004), but homogeneity of variances was acceptable (Levene's: p=.267).

11 state-controlled corporations disclosed their Internal Regulations identifying GRC sectors, but two organizations lacked competency details and were excluded. About 45% covered all GRC practices, combining managerial and advisory roles in strategic decision-making and technical support. Another 45% included only risk management and compliance, with varied structural formats and scopes. One organization omitted risk, focusing solely on governance and compliance.

4.2 Barriers and enablers for GRC mechanisms

The interviews with experts identified key barriers: political instability, legal uncertainty, revenue limits, immature risk assessment, pressure to deliver results, resistant organizational culture, top management's lack of GRC awareness, and environmental volatility. Facilitators included management commitment, the guidelines of Law No. 13.303/2016, GRC culture, teamwork, simple processes, and training.

Table 3. Enablers and barriers for the implementation of GRC practices

Category	Synthetic Factors	Underlying Elements
Barriers	Institutional fragility and political–managerial instability	Political instability of senior management; volatility of internal and external environments; pressure for results
	Low organizational maturity in risk management and ethical governance	Lack of maturity to conduct risk assessments; excessive corporate policies stemming from low ethical maturity; legal uncertainty
	Cultural resistance and limited executive awareness of GRC	Organizational culture averse to change; limited awareness of GRC among top management
	Resource and revenue constraints	Revenue constraints affecting operational capacity
Enablers	Strong leadership commitment and executive sponsorship	Senior management commitment and institutional support
	Regulatory and normative drivers	Guidelines stemming from Law No. 13,303/2016
	GRC-oriented organizational culture and cross-department collaboration	GRC-oriented culture; teamwork and interdepartmental engagement
	Capacity building and streamlined processes	Employee training, well-designed and simple processes

Institutional fragility due to political–managerial instability is pointed as the main barrier, especially in state-controlled firms. Frequent leadership changes from electoral cycles weaken continuity, accountability, and learning. As senior management shifts due to political reasons, GRC efforts often restart rather than consolidate. As one respondent observed, the entire training and persuasion process starts all over again [...] with the people who have the most decision-making power (SOC1). This emphasizes GRC as an ongoing process rather than a fixed framework.

Political interference further weakens governance maturity by undermining leadership commitment and prioritization. Interviewees noted that mandates are often temporary and that appointments are politically motivated, resulting in managers who are not committed to the organization (SCC2). Another respondent noted that political dynamics pose some obstacles, mainly from a political standpoint (SCC3). Together, these accounts indicate that political cycles systematically erode leadership continuity and constrain the long-term sustainability of GRC initiatives.

Institutional fragility worsens due to regulatory volatility and legal uncertainty. Interviewees described the sanitation sector as operating in a complex, evolving regulatory environment at the federal, state, and municipal levels, muddying compliance and long-term planning. This was summarized as great regulatory complexity and constant evolution of a vast, changing set of regulations (SCC3). In some regions, governance gaps worsen these issues, leaving utilities at the mercy of federal agencies (SCC3) and raising operational risks and compliance costs.

A second barrier is low organizational maturity in risk management and ethical governance, especially among new or restructured utilities. Private operators noted that young organizations lack structured risk assessment processes as their risk culture is still developing. One interviewee said the organization didn't have a robust risk assessment process and had been operating in the region for only two or three years (PE2). In state-controlled utilities, low ethical maturity is associated with over-formalization, relying on rules and policies as substitutes for shared values. As SCC2 stated, if the community within that organization had even a minimum of ethics and integrity, it wouldn't need so many documents, since rules focus more on sanctions than on internalized norms.

Cultural resistance and limited executive awareness also hinder GRC implementation. Organizations with long-tenured staff often resist change, resisting risk practices to maintain the status quo (SCC2). At the executive level, GRC is seen as distant from core duties and requires ongoing efforts to demonstrate its strategic importance. One respondent stated that without senior

engagement, it simply doesn't work (SCC1). Political turnover worsens this by resetting awareness efforts. Resource and revenue constraints, combined with performance pressures, hinder the implementation of integrated GRC. Private utility interviewees highlighted that the push for short-term results reduces the time and coordination needed for governance and risk management, limiting cross-functional engagement. As PE1 noted, utilities face significant pressure to manage risks effectively while relying on cross-unit collaboration.

Interview evidence indicates that leadership commitment and executive sponsorship are crucial for effective GRC. A strong tone at the top legitimizes GRC, shifting it from a compliance task to a strategic priority. When leadership supports GRC, managerial engagement improves (PE1).

Enabling conditions include developing a GRC-oriented culture and cross-department collaboration. Interviewees emphasized that GRC can't operate alone and requires shared ownership across units. SCC1 noted that GRC doesn't produce results on its own, while SCC2 said that without a sense of belonging, it's no use. In sensitive contexts, a cohesive culture is key to maintaining legitimacy and organizational growth (SCC3).

Capacity building and streamlined processes are key to sustainable GRC. Interviewees emphasized simple, well-designed procedures, especially during personnel changes. SCC1 noted that simple processes ease implementation over complexity. Training is vital because policies alone don't suffice unless employees understand what's expected of them (SCC1). Continuous training, accessible tools, and simplified processes strengthen organizational resilience and help GRC evolve from formal to stable institutional practices.

Nevertheless, PE2 stated that framing GRC as necessary and mandatory could help secure resources, budget, and tools, thereby enabling organization-wide adoption. Regulatory drivers such as Brazil's State-Owned Enterprises Law (Law No. 13.303/2016) serve as enablers. Interviewees recognize that the law significantly changed governance and professionalized internal structures (SCC2). Its binding nature embeds accountability, making enterprises subject to the obligation to remain compliant at all times (SCC3) and reducing reliance on discretionary management.

Qualitative evidence provides details on why formal GRC structures often fail to become lasting practices, citing political instability, leadership changes, and cultural resistance as barriers. These findings point to a gap between formal compliance and effective institutionalization, emphasizing that documented GRC practices are necessary but insufficient for mature governance.

5. DISCUSSION

The results suggest that GRC adoption in Brazilian water utilities is mainly driven by legal pressure, stability, and integration with management systems. Higher documented GRC in state-controlled utilities is driven more by stronger legal pressures than by ownership structure alone, which may result in better institutionalization of GRC. Public utilities and state-controlled corporations in Brazil have higher GRC scores, driven by strict governance laws such as Law No. 13.303/2016, which require internal control, risk management, and compliance systems. Document analysis indicates that these entities are more transparent and consistent with the OECD (2023) principles, which call for SOEs to have enhanced transparency and accountability comparable to those of private firms.

According to Brandão, Crisóstomo, and López-Iturriaga (2024), the GRC framework should be viewed as a multidimensional, contingent organizational setup. The higher formal adoption among public providers doesn't indicate stronger governance; rather, it may reflect a configuration shaped by legal coercion, political instability, transparency issues, and uneven institutionalization across governance dimensions. Findings support the argument that adopting governance practices doesn't guarantee effective institutionalization, revealing gaps between structure and practice influenced by organizational and contextual factors (Cuomo; Mallin; Zattoni, 2016).

Consistent with prior analyses of Brazilian public bodies, these factors suggest that legal coercion primarily promotes compliance and structure in GRC, rather than fully integrated systems (Vieira, 2019). Public providers have visible governance, but political instability hampers GRC development. Leadership changes due to elections disrupt continuity, weaken ownership, increase risk, and hinder routine consolidation, leading to formal structures coexisting with ongoing re-implementations. International GRC and ERM frameworks stress that governance and culture, especially tone at the top, oversight stability, and clear responsibilities, are key to effective risk management (COSO, 2017). Without leadership stability, these relationships weaken, turning GRC into a mere compliance exercise instead of a strategic tool.

Furthermore, deficiencies in transparency constitute a significant factor. Despite legal obligations under Law No. 11.445/2007 for sanitation providers to ensure transparency and share information, most Brazilian utilities failed to disclose basic governance documents. Transparency goes beyond data access; it's central to GRC adoption. It serves as an input, a process, and a result within governance, risk management, and compliance systems. As an input, it provides regulators and stakeholders with reliable information for risk assessment and accountability. As a process, it supports ongoing monitoring, control, and learning through disclosure routines. As a result, transparency indicates how well GRC mechanisms are institutionalized and how consistently

they produce auditable information. Ongoing transparency gaps indicate deeper governance limitations, hampering the effectiveness and sustainability of GRC in public services.

Transparency and disclosure are key mechanisms for reducing capture risks, strengthening integrity, and improving service performance in essential public services (Jacobi et al., 2009). Utilities that lack basic disclosure capacity limit regulators, financiers, and civil society's ability to monitor risks, compare performance, and demand corrective action, thereby reinforcing low levels of GRC institutionalization. These factors explain the ownership gap, as public utilities outperform private ones due to stricter legal standards. Private providers, especially newer ones, often face market pressures that lead to less well-documented governance practices, particularly in younger or subsidiary organizations.

Brazil's 2033 water and sanitation goals highlight that effective GRC goes beyond formal compliance. Sustainable, resilient service expansion with integrity requires stable leadership, clear responsibilities, transparency, and integrated risk management. Thus, GRC maturity is better understood as a multidimensional outcome influenced by mandates, stability, and openness, not just ownership. These findings underscore GRC as the governance system that enables credible environmental and social commitments in public services through operational management, monitoring, and disclosure. Without mature GRC frameworks, such commitments may remain symbolic.

Although the composite GRC indicator developed in this study is theoretically grounded, some significant limitations should be considered when interpreting the results. First, the empirical analysis relies exclusively on documentary evidence disclosed by utilities, which inherently biases the sample toward organizations with greater transparency capacity and more formalized governance structures. Although the final sample covers a substantial share of the Brazilian population served, the exclusion of 83% of eligible providers due to non-disclosure limits the generalizability of the findings. This is likely to overestimate the sector's average GRC adoption. Second, the study uses a cross-sectional design, capturing formal governance, risk management, and compliance at a single point in time. It cannot infer causality or track GRC evolution over time, including changes due to reforms, leadership transitions, or development stages.

The composite indicator primarily measures structural readiness through documented rules and procedures, not their effectiveness or practical use. This may reveal a disconnect between documented arrangements and actual managerial behavior, as evidenced by interviews describing political instability and cyclical implementation. Finally, the indicator uses a binary

assessment of GRC mechanisms, which may oversimplify differences in quality and integration across utilities. It neither tests the indicator's internal consistency nor applies weighting or sensitivity analyses, limiting its robustness. The qualitative analysis, based on a few expert interviews with utilities that have advanced GRC, might underrepresent the challenges faced by smaller or less mature organizations, which are common in Brazil's sanitation sector. These limitations define the study's scope without undermining its contribution to advancing the understanding of GRC frameworks in the Brazilian water and sanitation utilities.

6. CONCLUSION REMARKS

This study provides a systematic analysis of GRC adoption in Brazilian water and sanitation utilities. By developing and applying an original composite indicator grounded in international GRC frameworks and Brazilian regulatory requirements, the research suggests that GRC implementation in the sector remains uneven and predominantly formalistic. While state-controlled utilities exhibit higher levels of documented GRC structures than private providers, overall adoption remains partial, with limited integration between governance arrangements, risk management processes, and performance-oriented management systems. These findings question simplistic ideas about ownership effects and indicate that legal mandates appear to foster formal compliance and documentary visibility. Still, they do not, by themselves, secure the institutionalization of integrated, durable, and managerialized GRC.

Beyond Brazil, the findings inform international debates on ownership, governance, and risk in highly regulated public infrastructure. The evidence indicates that ownership structure alone doesn't determine GRC effectiveness. Instead, outcomes depend on the interaction of ownership, political influence, leadership stability, regulation enforcement, and transparency. The Brazilian sanitation sector mirrors global patterns of hybrid governance, in which state, market, and regulation coexist. Similar patterns are seen in the water, energy, and transport sectors worldwide, with formal structures often hampered by political interference, organizational issues, and weak disclosure practices. These findings support the view that formal compliance alone isn't enough for good governance, emphasizing the importance of stability and managerial agency in translating ownership into effective GRC.

Results suggest political–managerial instability and transparency gaps hinder GRC consolidation. Leadership turnover disrupts continuity and risk ownership, causing repeated re-implementation, especially in state-owned enterprises. Moreover, failure to disclose governance documents, despite legal mandates, exposes weak governance and regulatory compliance. These issues limit accountability, benchmarking, and the sharing of good practices, affecting

long-term planning, financial sustainability, and service reliability toward the Brazilian 2033 water and sewage universalization targets.

This study advances the literature by emphasizing GRC as a foundational infrastructure for public services. Future research may create multi-level, mixed-measure GRC indicators that combine documentary, process-based, outcome-focused, and perception-driven data. It should also employ larger sample sizes and longitudinal studies to evaluate reliability, sensitivity, and the extent to which formal GRC adoption translates into institutional practice. Such research would help clarify how GRC reforms influence performance in critical public services, guiding scholars and policymakers on how these frameworks can evolve from mere compliance to fostering sustainable and equitable public service delivery.

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