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A qualitative analysis of the deficit in access to water and sanitation services in the Amazon Brazilian Region

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Abstract
The states of the Brazilian Amazon region have chronically low indicators of access to drinking water and sanitation services (WSS). In view of the objectives of universalization of services established in the Brazilian legal framework, as outlined by Law no. 14026/2020, as well as the United Nations Sustainable Development Goals (SDGs), it is necessary to reflect on the aspects that have led to this scenario. In this context, the aim of this study was to analyze the lack of WSS access in the region, with a geographical focus on the North region of Brazil in the Amazon. To this end, interviews were conducted with stakeholders, and the method of content analysis was adopted. Thematic categories were created regarding financial, geographical, political, and social aspects, technical deficiencies, planning, service provision, and regulation. The main reasons for the access deficit are related to financial and political aspects, and the solutions proposed include policy issues and regulation of services. The results of this study highlight important issues that need to be addressed to achieve the goals of WSS universalization and development of this region, which is so important for the country.

Keywords: Amazon Brazilian region. Deficit. Water supply. Sanitation. Universal access.

Avaliação qualitativa do deficit de acesso a serviços de água e esgoto na região Amazônica brasileira

Resumo
Os estados da região Amazônica brasileira cronicamente apresentam baixos indicadores de acesso aos serviços de água potável e esgoto sanitário (SAA&ES). Tendo em vista as metas de universalização dos serviços estabelecidos no arcabouço legal brasileiro, a Lei nº 14.026/2020, bem como os Objetivos de Desenvolvimento Sustentável (ODS) das Nações

Unidas, é necessário refletir sobre os aspectos que levaram a esse cenário. Assim, o objetivo deste estudo foi analisar o déficit de acesso aos SAA&ES nos estados da Amazônia brasileira com recorte geográfico para os estados da região Norte. Para tanto, foram realizadas entrevistas com os atores envolvidos no setor e adotado o método de análise de conteúdo. Foram criadas categorias temáticas relacionadas a aspectos financeiros, geográficos, políticos e sociais, deficiências técnicas, planejamento, prestação de serviços e regulamentação. Os principais motivos do déficit de acesso estão relacionados a aspectos financeiros e políticos, e as soluções propostas incluem questões política e a regulação de serviços. Os resultados deste estudo destacam questões importantes que precisam ser abordadas para o alcance das metas de universalização dos serviços e do desenvolvimento desta região tão importante para o país.

Palavras–chave: Região Amazônica brasileira. Déficit. Abastecimento de água. Esgotamento sanitário. Universalização.

Un análisis cualitativo del déficit de acceso a los servicios de agua y saneamiento en la región amazónica brasileña

Resumen
Los estados de la región amazónica brasileña presentan crónicamente bajos indicadores de acceso a los servicios de agua potable y saneamiento (APS). Teniendo en cuenta las metas de universalización de los servicios establecidas en el marco legal brasileño, la Ley 14.026/2020, así como los Objetivos de Desarrollo Sostenible (ODS) de las Naciones Unidas, es necesario reflexionar sobre los aspectos que han llevado a este escenario. Por lo tanto, el objetivo de este estudio fue analizar la falta de acceso a los servicios de agua y saneamiento en los estados de la Amazonia brasileña, con un enfoque geográfico en los estados de la región Norte. Para ello, se realizaron entrevistas a los actores implicados en el sector y se adoptó el método de análisis de contenido. Se crearon categorías temáticas relacionadas con aspectos financieros, geográficos, políticos y sociales, deficiencias técnicas, planificación, prestación de servicios y regulación. Las principales razones del déficit de acceso están relacionadas con aspectos financieros y políticos, y las soluciones propuestas incluyen cuestiones políticas y la regulación de los servicios. Los resultados de este estudio ponen de relieve cuestiones importantes que deben abordarse para alcanzar los objetivos de universalización del APS y el desarrollo de esta región tan importante para el país.

Palabras clave: Región amazónica brasileña. Déficit. Abastecimiento de agua. Saneamiento. Universalización.

1 Introduction

Access to drinking water and sanitation has been defined as an essential human right for life and dignity, recognized by the United Nations (UN) General Assembly and the Human Rights Council in 2010, through Resolution A/RES/64/292 (UN, 2010). However, many people worldwide still lack this right. According to the UN in 2023, 26% of the world's population did not have access to drinking water, which corresponds to around 2 billion people, while 46% of the planet's inhabitants did not have safe sanitation services, equivalent to 3.6 billion people (UN, 2023).

In Brazil, in 2021, around 100 million Brazilians lacked access to sanitation systems, and almost 34 million were not supplied with treated water (SNIS, 2022). The data also shows that the deficit is greatest in the North and Northeast regions

(SNIS, 2022) and among the most vulnerable populations, where 67.5% of the population below the poverty line in the country did not have access to a sewage network in 2018, and more than half (51.7%) did not receive water regularly - daily and in adequate quantities (ITB, 2021).

Understanding the aspects that have led Brazil to the current context is important for promoting the necessary changes for regional development and better management of water and sanitation systems, ensuring the achievement of the goals for universal service delivery established in the sector's legal framework by Law no. 14026/2020, as well as the Sustainable Development Goals (SDGs), particularly SDG number 6, which specifically addresses this issue (UN, 2015).

The North region of Brazil consists of the states of Acre, Amapá, Amazonas, Pará, Roraima, Rondônia, and Tocantins. According to the Brazilian Institute of Geography and Statistics (in portuguese Instituto Brasileiro de Geografia e Estatística - IBGE) Census, the population living in this region in 2022 was 17,354,884 inhabitants, representing 8.5% of the total Brazilian population. In terms of area, it is also the largest region, covering 3.8 million square kilometers, which corresponds to approximately 45.2% of the national territory, with a population density of 4.51 inhabitants/km². In contrast, the Southeast is the most populous region, encompassing 924,558 square kilometers with a density of 91.8 inhabitants/km² and housing 84.8 million people (IBGE, 2023). This region is situated in the world's largest tropical rainforest, the Amazon, which is renowned for its environmental significance.

Regional development in the Amazon, particularly in the states of the North region, is intrinsically linked to environmental preservation and the promotion of decent living conditions for its population. In this context, the universalization of water supply and sanitation services plays a crucial role, as it ensures decent public health conditions for all and prevents the pollution of water resources.

Amidst this scenario, a few questions arose to guide this research: "Why do the states of the North region have such lower indicators of access to water and sanitation compared to other Brazilian regions?" and "What is the path to achieving the universalization goals set out in the Legal Framework and SDG 6?"

Some studies on access to water and sanitation services in the Amazon (Giatti, 2007; Aragão; Borges, 2018; Ferreira; Alves; Pereira, 2019; Montefusco *et al*., 2021; Oliveira *et al*., 2021; Santos; Santana, 2021; Silva; Trindade, 2021; Bordalo, 2022) address aspects such as infrastructure, financing, and management in isolation. Hence, there is a lack of studies that integrate the elements and causes underlying the deficit while considering the socio-economic and environmental peculiarities of the Amazon. Given these gaps, this study aims to analyze the deficit in access to services from the perspective of specialists in the sector. The objective is to obtain an integrated view that contributes to this field of knowledge and to the development of the region, especially regarding the universalization of WSS.

Thus, the objectives of this study were to analyze the lack of access to WSS in the Brazilian Amazon, specifically in the states of the North region, based on the perceptions of the sector's actors, identify the regional specificities in the management of WSS, and point out ways of achieving the universalization targets.

2 Water supply and sanitation sector in Brazil

The guidelines for basic sanitation in Brazil are defined by the Brazilian Legal Framework, specifically Law No. 11.445/2007 and its update, Law No. 14.026/2020, which provides a more comprehensive definition of sanitation. In the country, it refers to the set of public services, infrastructures, and operational installations for drinking water supply, sanitation, urban cleaning, solid waste management, and stormwater management (Brazil, 2007; 2020). In this study, we will address the first two.

The WSS management in Brazil is defined by aspects of planning, regulation, provision, inspection, and social control (Brazil, 2020). These elements, particularly WSS provision, are supported by fundamental principles defined by the Legal Framework, including universal access and effective service provision; comprehensiveness; coordination with other policies; efficiency and economic sustainability; transparency of actions; and safety, quality, regularity, and continuity (Brazil, 2020).

A variety of models and methods exist for providing these services, which can be either public (municipal or state) or through concessions (partial or full) for private initiatives and public-private partnerships.

The changes brought about by the promulgation of the "new" Legal Framework have sparked intense debate among various sectors involved. Among the definitions that continue to generate questions and reflections is Article 11-B, which addresses contracts for the provision of public basic sanitation services, defining universalization goals that ensure 99% (ninety-nine percent) of the population has access to drinking water supply and 90% (ninety percent) of the population benefits from wastewater collection and treatment by December 31, 2033, as well as quantitative goals for non-intermittency of supply, reduction of losses, and improvement of treatment processes (Brazil, 2020).

Regional inequalities can be observed in many areas of Brazil. Pereira and Marques (2022) point out that in the case of WSS, socioeconomic development, climate, colonial history, and the heterogeneous distribution of immigration have contributed to the asymmetries observed.

Therefore, it is crucial to discuss how such a vast country with distinct regional characteristics will meet the established targets.

It is also essential to mention some international studies and experiences that can guide the sector in Brazil. For example, on the African continent, there are initiatives such as the World Health Organization's (WHO) Participatory Hygiene and Sanitation Transformation program. This initiative is an innovative and effective approach that enables communities to identify their water, sewage, and hygiene needs, formulate plans to improve their environmental health conditions, request support from local and external sources, and participate in the operation and maintenance of infrastructures (Mustapha *et al*., 2024).

According to Tseole *et al*. (2022), increased investment, adequate sanitation facilities, and the development and strengthening of community participation are facilitating factors that can enhance the expansion of services in Southern Africa. Mustapha *et al.* (2024) emphasizes the importance of political commitment, expanded partnerships with national and international support agencies, and investments in professional training.

In Latin America, Fuchs *et al*. (2022) mention characteristics that influence the sanitation sector in countries such as Chile, Peru, Mexico, and Brazil, including per capita income, institutional capacity, and the dispute over ownership of services among national, state, and municipal levels.

With regard to financing, WSS has primarily been supported through public funding, as is the case in most countries, due to the monopolistic nature, as well as issues of scale and structural difficulties within municipalities, which face high levels of indebtedness, insufficient infrastructure, a restricted revenue base, and management weaknesses (Kuwajima *et al*., 2020). It is important to note that even in developed countries, improving sanitation indicators has required considerable effort, always supported by public policies (Santos; Kuwajima; Santana, 2020). Countries such as South Korea, Chile, and Denmark experienced periods marked by deficiencies and environmental impacts. However, after adopting comprehensive strategies for the sector, they made significant progress (Santos; Kuwajima; Santana, 2020).

The National Confederation of Industry (in portuguese *Confederação Nacional da Indústria* - CNI) points out that international experience reveals there is no single successful model in the sector, due to the wide variety of institutional structures that reflect specific historical contexts. Nonetheless, three essential components are identified for the sector's development: planning, regulation, and management (CNI, 2017).

In this context, it is also worth mentioning the experiences related to community water management, where Brazil has a wide range of efforts, policies, and partnerships that can also indicate paths forward (Santos; Santana, 2020). Some studies have evaluated the efficiency of these models, producing varying results. Choosing the most efficient model depends on many factors, and there is no consensus in the literature (Chaves; Marques; Malheiros, 2024).

3 Methods

To understand the context of access to WSS in the region, standard online interviews were conducted with actors familiar with and active in the sector. The interview script was prepared in advance and contained two questions: i) "*There is a deficit in access to sanitation in the states of the North region, when compared to the other states of the country and to meeting universalization targets. What factors influence this deficit?*" and ii) "*What is the path to reducing inequalities?*"

The selection of interviewees was intentional, based on the authors' judgment regarding their relevance in addressing the research questions, and employed a heterogeneous sampling technique to ensure a diverse range of participants, aimed at identifying key issues on the topic. This diversity among interviewees provided insights into regional specificities from various perspectives. The number of interviews was not predetermined; rather, the initial guideline focused on the representativeness of the corpus, which included professionals from different states and varied backgrounds: academics (university professors), technicians (service providers and government agency personnel), regulatory/enforcement professionals (individuals from regulatory agencies and

courts of auditors), and communications sector representatives (individuals working on electronic portals related to water and sanitation).

After conducting eight interviews, two for each profile, covering five of the seven states in the region, the recurrence of terms and expressions was analyzed, indicating that the information collected was sufficient for developing the research based on the concept of theoretical saturation (Campos and Saidel, 2022).

The interviews were recorded and transcribed, and content was analyzed using the content analysis methodology, which encompasses techniques aimed at describing the content of messages and is used to interpret all types of communication (Bardin, 2016; Moraes, 1999 *apud* Cardoso; Oliveira; Ghelli, 2021). Bardin's (2016) phases of content analysis consist of three stages: pre-analysis, exploration of the material, and results treatment.

In this study, pre-analysis involved organizing the transcripts for an initial engagement with the content through a floating reading. Several hypotheses were formulated: terms and expressions related to "political issues," "regulation," and 'investments' suggest factors influencing access to drinking water indicators in the northern region of Brazil, while "new legal framework" and "regulation" propose potential paths to achieve the universalization of WSS.

Analyzing the material, the collected data was processed through coding. According to Holsti's definition (1969 *apud* Bardin, 2016, p. 133), coding "is the process by which raw data is systematically transformed and aggregated into units, which allow an accurate description of the pertinent characteristics of the content." The coding process comprised three stages: selecting units of record and context; establishing enumeration rules; and categorization.

The recording unit represents the unit of meaning to be coded and corresponds to the content segment serving as the base unit for categorization. In this study, the defined recording units were themes. The context units, which aid in understanding the recording units, were Justifications and Solutions regarding the deficit.

The established enumeration rules focused on the presence (or absence) and frequency of the recording units.

Categorization involves classifying and grouping elements based on shared characteristics (Moraes, 1999 *apud* Cardoso; Oliveira; Ghelli, 2021). The adopted categorization criterion was semantic.

Finally, the last phase of the content analysis of the interviews involved drawing inferences and interpreting the results. The analysis was conducted using MAXQDA Analytics Pro 2022 software, a commonly utilized tool for analyzing qualitative data and mixed research methodologies (MAXQDA, 2025). Among the resources employed were hierarchical coding, resulting in the identification of relevant text elements, to which codes, colors, and symbols were assigned, alongside quantitative analysis based on word frequency and the generation of a word cloud.

4 Results and discussion

Using MAXQDA Analytics Pro 2022 software, the interviews were analyzed and recording units (codes) were created based on the themes identified in the

participants' responses. The recording units and their frequency resulted in the word cloud displayed in Figure 1.

Figure 1: Code cloud (registration units) produced with MAXQDA Pro 2022

Source: Elaborated by authors (2024).

Using the semantic categorization criteria, the thematic categories shown in Table 1 were developed. Then, the recording units were contextualized according to the interview question: Explanations (reasons) for the deficit in WSS access; and Solutions. A total of 152 segments were analyzed, 105 of which were justifications and 47 solutions.

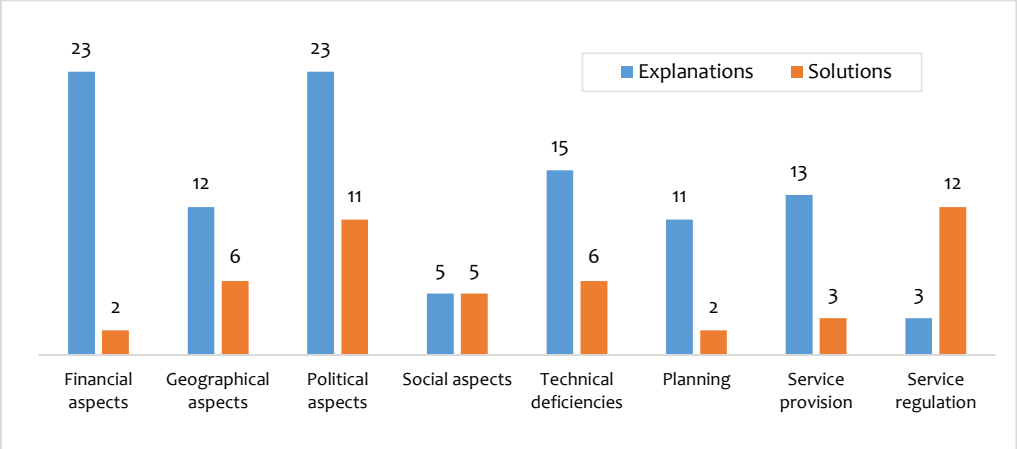
Table 1: Thematic categories and segments for analysis

Categoria	Total
1. Financial aspects	25
2. Geographical aspects	18
3. Political aspects	34
4. Social aspects	10
5. Technical deficiencies	21
6. Planning	13
7. Service provision	16
8. Service regulation	15
Total Geral	**152**

Source: Elaborated by authors (2024).

Regarding the context, the financial and political aspects were the most frequently cited explanations, while the service regulation category was the most frequently cited solution, as shown in Figure 2.

Figure 2: Segments for analysis according to context by thematic category



Source: Elaborated by authors (2024).

As observed in Figure 2, the explanations are generally linked to WSS management. The term 'management' was mentioned in various contexts by the participants. According to Philippi Jr and Galvão (2012), the main issues linked to basic sanitation management refer to planning, service provision, regulation, and financing. Based on this idea, the thematic categories were detailed and described below; the categories were listed in alphabetical order, with examples of verbalizations given in quotation marks.

4.1 Financial aspects

Thematic category 1 identified verbalizations linked to the lack of investment in the sector. Public policies such as the National Water and Sanitation Plan (in portuguese Plano Nacional de Saneamento - PLANASA), instituted in the 1970s by the then Military Government, were highlighted: "it is a low priority that governments make at all levels concerning the investments in water and sanitation, especially in the interior of the states, this is already historical [...] a lot was invested in the capitals, but this comes from PLANASA at the end of the 1960s and beginning of the 1970s, in which there was a great investment in the largest cities, in the state capitals"; and "So it really started there, but more focused on water, and sanitation was very rare". Rosito (2019) pointed out that PLANASA prioritized investments in water supply, urban areas of large cities, and the creation and establishment of an institutional model through the regional water and sanitation companies (in portuguese *Companhias Estaduais de Saneamento* - CESBs).

According to Rosito (2019), the period after PLANASA and before the approval of the Legal Framework in 2007 was characterized by low annual investment volumes and a significant reduction in annual investment per urban inhabitant in water and sanitation.

According to Capobianco *et al.* (2023), the total public investment in water and sanitation in Brazil, per inhabitant, shows the lack of priority given to the sector. In line with the National Sanitation Information System (in portuguese *Sistema Nacional de Informações de Saneamento* - SNIS), in 2021, the highest value calculated for investments in water and sanitation (considering the sum of the

values in three groupings: according to the contractor, the destination of the application, and the origin of the resources) was R$17.3 billion. The Southeast macro-region received the largest volume of resources (R$8.6 billion (49.5%), while the North received the lowest amount, with around R$898.7 million (5.2%) (SNIS, 2022).

Also, according to SNIS, in 2021, the North and Northeast macro-regions had lower percentages of investments made than the percentages of access deficits (SNIS, 2022).

The financial sustainability of service providers was addressed in terms of difficulties in applying adequate tariffs ("tariffs have always been in deficit, they don't cover costs at all"), dependence on the public budget, and the consequent inefficiency of services ("Often companies, entities are at the mercy of state public budgets, and this often leads to total failure, or totally ineffective service provision").

Data from the SNIS for 2021 show that, except in Tocantins, the other six states in the Northern region have higher expenses for services than the tariffs charged (in average values), signaling difficulties in maintaining service sustainability and potentially compromising their quality (SNIS, 2022).

The solutions put forward include "increased public or private investment" and "public funds coupled with development banks."

4.2 Geographical aspects

In thematic category 2, the deficits in access to services are justified by geographical issues, such as the occupation of the territory: "we have aspects directly linked to the historical occupation of the territory itself."; the low demographic density: "it's related to issues of a physical and socio-economic nature in the region, in which we have very dispersed populations, in a large territory, in which from the point of view of the sustainability of the service, particularly from a financial point of view and from the point of view of its minimum size, they are not interesting."; and difficulty of access: "we have many realities but we have difficulties with logistics, access, cost."

The North region is characterized by internal diversity, ranging from small municipalities to large metropolises. Giatti (2007) points out that there are several small towns in the region, spread out over a large territory, posing logistical and budgetary difficulties for the implementation of infrastructure. In the metropolis of Manaus in Amazonas, for example, Aragão & Borges (2018) found that with high population growth and no planning, the population ended up living in areas of precarious urbanization, with unhealthy aspects, as well as occupying the banks of streams, in flood areas, low levels and at risk of landslides, making it difficult to install systems for water supply and wastewater collection.

According to Bordalo (2017), talking about a "water crisis" in the Amazon is a paradox, because even with the water wealth found in the region, many people still do not have access to drinking water. The author concludes that this is due to poor management of water resources and low financial and technological investment.

The participants pointed out that the way to reduce inequalities in access in the North involves "looking for technologies that are adaptable to the

characteristics of the region (simple)" and also looking at "special areas, places that won't give a return, flooded areas for example," in other words, regional characteristics must be taken into account when designing projects.

4.3 Political aspects

Thematic category 3 dealt with issues related to political influence and political disinterest. Specifically, the first refers to the influence on decisions caused by the nomination or appointment of key positions in WSS entities operating in the sector due to governmental shifts, as different governments often have varying interests. The second issue pertains to the lack of political interest in basic sanitation or the lack of priority, which can be described as "neglect."

Finally, it emphasizes the necessity to "prioritize basic sanitation as a sector, with public policy, not government policy. But a public policy, regardless of the mandate, in municipal and state management."

The implementation of the basic sanitation legal framework is viewed as a solution by stakeholders. The key aspects of the law cited include regionalization (Art. 49): "cities that are very far apart but that can somehow be regionalized, I think it's very important, because sometimes they alone won't continue to deal with the problem, now them coming together is even a regionalization made by the state government or by an entity of the region, I think it's going to be a very beneficial way out for many places"; cross-subsidization: "One of the points that the new legal framework preconizes is cross-subsidization, what is cross-subsidization? The richest, who consume the most, pay for those who consume the least, etc."; and the obligation to bid for new contracts (Art. 10), which could encourage the entry of the private sector: "And then I think it will certainly attract the private sector [...] I mean, you could even ask, but do you think the private sector is interested in this city in the North? the little I know about the private sector, I would say yes, because these are cities that have nothing, there is a gigantic possibility that you could start a new market."

4.4. Social aspects

The social issue was addressed in two recording units, namely: concerning the users, where cultural issues and user habits contribute to the deficit in WSS access ("the absence of politicization, education and social awareness in general in civil society prevents it from organizing itself and contributing to participation and social control of the sector."); and also concerning the number of people living in poverty ("in the North it's a little more complicated than in the others because of what we talked about earlier, because the poor are much larger.").

In the first aspect, it is worth adding the definition of social control provided by Law No. 11.445/2007 as the "Set of mechanisms and procedures that guarantee society information, technical representation and participation in the processes of policy formulation, planning and evaluation related to public basic sanitation services" (BRASIL, 2007a, p.2). Moraes (2012) points out that participation and social control are important instruments that should contribute to the construction of socially fairer public policies.

Despite this, in practice, the sector still faces difficulties in implementing these mechanisms, especially due to the absence of a citizen culture that takes an interest in political matters.

Oliveira *et al.* (2021) corroborate that because the North region has a high number of people in situations of socioeconomic vulnerability, universal and equal access to water and sanitation becomes a utopia.

Suggested solutions in this category also emphasize the need for and importance of raising community awareness, "we have to bring the culture of information, of the right, of the obligation of service providers, what is their obligation? To warn about quality, intermittency, and contingency plans. And also, of the obligations of the users, of the beneficiaries, of conscious consumption, avoiding waste, helping maintain the system, contributing to their share, which is legal, in the tariffs, so all of this is an indication for you to help reduce inequalities."

4.5. Technical deficiencies

Technical deficiencies related to the lack of qualifications among professionals working in the sector accounted for 14.3% of the comments made by interviewees. These shortcomings were attributed, firstly, to managerial positions held by "unqualified people"; "the managers who hold positions in the companies or entities that provide water and sanitation services are people, [] most of the time, who are not qualified to handle the service." Secondly, they were attributed to technical roles that influence the drafting of projects and processes, leading to difficulties in accessing resources: "the projects are very incomplete, so because they are incomplete you don't achieve the social and environmental goal, because [] they start, there's an amendment, they change the project, they don't approve it... That slowness."

Giatti (2007) and Oliveira *et al.* (2021) noted a considerable human deficit in technical competence for the design and implementation of water and sanitation projects in the region. SNIS (2022) highlights issues with the lack of project quality, difficulties in obtaining environmental licensing and regularizing the land where the operational units of the planned systems will be constructed, very slow bidding processes, and often, once the works are contracted, various difficulties in executing them on schedule (SNIS, 2022).

Regarding the shortage of water and sanitation schools, as mentioned by the participants, it is essential to note that, according to data from the Ministry of Education, 34 sanitary and/or environmental engineering courses were identified among higher education institutions, both public (federal or state) and private (for-profit or not-for-profit). Among the federal universities, courses were found in Amazonas (UFAM), Pará (UFPA), Oeste do Pará (UFOPA), Rondônia (UNIR), and Tocantins (UFT).

Therefore, there is a need to invest in technical training "mainly for service providers and municipal authorities," as well as "strengthening ties with teaching, research, and extension institutions at universities and federal institutes, with a view to promoting research and innovation and applying them to service provision, the ordinary daily routine of service providers and decision-makers."

4.6 Planning

The lack of planning in the WSS sector was cited as one of the reasons for the shortcomings found in the region, especially concerning parliamentary amendments: "The example I give is the issue of parliamentary amendments for funding, which are not made on the basis of planning, i.e. it's in the municipal plan that you're going to invest here and so on. But no, it's a loose demand that leads to lose execution, that there's no dialogue, that you don't talk to anybody about what was planned, so it gets complicated [...]".

In general, according to Silva and Trindade (2020), Brazil has historically lacked urban planning and structured policies to avoid discontinuities and investment losses. Specifically in the North region, Ferreira *et al.* (2019) conclude that the fragmented and administrative discontinuities of public policies for the provision of WSS are factors that contribute to the serious deficit in the provision of these services. For instance, Aragão and Borges (2018) argue that urban planning inefficiencies in Manaus, combined with unregulated growth, have resulted in delayed delivery of WSS.

Category 6 also included recording units dealing with the management model adopted, especially concerning "institutional changes" in WSS provision. Moraes *et al.* (2012) emphasize that WSS provision is part of management. Therefore, this category specifically addresses changes in the WSS delivery model.

At the regional level, institutional changes were listed as determining factors for delays in access to essential services, including WSS. Montefusco *et al.* (2021) report that the city of Rio Branco in the state of Acre has undergone several changes in the management and operation of the water supply system, but these have not resulted in significant improvements towards universalization.

An important instrument mentioned is the Municipal Basic Sanitation Plans (in portuguese *Plano Municipal de Saneamento Básico* - PMSB): "So the construction of municipal plans, reviews, evaluation, monitoring, this is important if we are to follow a path. Because we're doing things in isolation. So, this is one of the paths we have to follow [...]".

Law no. 11.445/2007 established that the WSS holder, the municipality, must formulate its respective policy, including instruments and mechanisms for the provision of services. According to data from the Brazilian Institute of Geography and Statistics (IBGE), in 2017 in Brazil, 2116 municipalities (38%) had PMSB that covered water supply and sewage activities. Also, in line with the IBGE, in the North and Northeast regions, which have the most precarious and least universalized services, the percentage of municipalities with plans was 28% and 22%, respectively (IBGE, 2021).

The PMSB is a fundamental instrument for guaranteeing the expansion and improvement of services. However, many municipalities face difficulties in drafting and implementing it, whether due to a lack of technical training and financial resources, or the absence of up-to-date data for an accurate diagnosis, as well as difficulties in social mobilization. These barriers lead to discontinuity in actions and precarious services. The lack of planning also prevents access to sources of funding and compliance with universalization targets, exacerbating regional inequalities.

At the national level, the National Basic Sanitation Plan (in portuguese *Plano Nacional de Saneamento Básico* - PLANSAB) aims to achieve integrated planning for basic sanitation in the country. It covers the components of drinking water supply, sewage disposal, urban cleaning and solid waste management, and urban drainage and rainwater management. PLANSAB is evaluated annually and revised every four years, with a 20-year horizon (2014 to 2033).

Although PLANSAB provides important guidelines for the sector, there is still a significant gap between the requirements of the law and the plan's full implementation (Santos; Mendes, 2023). The authors point out that the complexity of PLANSAB requires addressing conditions of a political-institutional, legal and juridical nature, economic-financial, administrative, cultural, and technological that impact the established goals and objectives (Santos; Mendes, 2023).

4.7 Service provision

Category 7 grouped together the recording units related to the WSS provision. The stakeholders attributed the deficit to an "inability to manage"; "nowadays, the management of the state water and sanitation companies is disastrous, so much so that the state companies here in the Amazon, and some in the Northeast as well, but you're here in the Amazon, are the worst sanitation companies in the country, there's no comparison with São Paulo, if you pull up any of them, then they all have management problems, they all have deficits, they all have indicator problems."

Also noteworthy is the control of water losses, or lack of it: "it's efficiency, so how do you evaluate efficiency, losses, real losses and apparent losses?"; "And then there was no control of losses either, the collection was done by taxation, ... so you throw away 70%, in Brazil it's already higher than 40%, but 70% is extremely high."

Regarding corruption, it was mentioned that "it's a company that's sunk, basically in corruption and in its own inertia and lack of will. So that was one of the problems we saw in Rondônia [...]".

One of the solutions mentioned is benchmarking, which, in simplified form, consists of a comparative process that allows an agent to improve its performance by studying the behaviour of other agents and subsequently adapting and implementing parts of that behaviour to suit its specific situation (Blokland, 2010). Cities such as Palmas (Tocantins) and Boa Vista (Roraima) were pointed out as possible references in the North.

4.8. Service regulation

Deficient regulation of services was identified as one of the factors contributing to the North region's deficit in WSS.

Montefusco *et al.* (2021) emphasize that WSS regulation in the state of Acre began late, with the establishment of the regulatory agency in 2003 and the issuance of resolutions only in 2015.

Strengthening regulation was highlighted by the participants as a key solution for improving access to water and sanitation indicators in Brazil's North

region. The definitions introduced by the new water and sanitation legal framework were also noted, particularly with the inclusion of the National Water and Sanitation Agency (in portuguese *Agência Nacional de Águas e Saneamento*, ANA) in the enactment of reference standards.

4.9 Main findings from the content analysis of the interviews

The pre-established interview questions allowed the participants to cite factors that they believe influence the indicators of WSS access in the North region and to point to solutions that could reduce the deficit.

The results of the content analysis align with Nascimento and Heller's (2005) findings regarding the factors that help understand the shortcomings in the water and sanitation sector in Brazil, including high rates of urban population growth, fragmentation of public policies for the provision of sanitation services, the lack of technological updating, a shortage of human resources, and a lack of regulatory instruments.

Specifically in the North, with statements categorized by theme, it was found that aspects related to politics, whether due to influence or lack of interest from political actors, accounted for 22% of the justifications given.

The term management was used in different contexts. Regarding service provision, it was linked to management incapacity, i.e., the difficulties faced by WSS providers and institutional issues, or the "management model" that influences how the service is provided.

The issue of investment highlighted the need for more investment in the water sector, as well as the difficulty WSS providers have in accessing financial resources. This category is associated with the technical issue, as technical deficiencies prevent providers from developing good projects or structuring processes to apply for federal funds, for example.

Among the regional characteristics that may have influenced the current scenario is the occupation of the region, which has several cities spread over a vast territory characterized by the presence of many rivers and the Amazon Rainforest itself. Access to many of these towns is exclusively by river or air, hindering their development in multiple ways.

Furthermore, in the case of large cities, rapid population growth has disconnected from urban planning, meaning that infrastructure has not kept pace with this growth. There has also been the occupation of irregular and flooded areas, for example, making it impossible to implement basic services such as WSS.

The Amazon region presents deficiencies in several sectors, as pointed out by the Superintendency of the Amazon Development (in portuguese *Superintendência do Desenvolvimento da Amazônia* - SUDAM, 2023). In addition to access to basic sanitation, some critical aspects that deserve attention include the environmental issue, logistics infrastructure, guided productive development in the bioeconomy, research and innovation, alternative energy sources, internet access in remote areas, informal work, access to quality education, and healthcare (SUDAM, 2023).

Moreover, according to Atlas Brazil, in 2021, the states in the North region were among the lowest in the Municipal Human Development Index (MHDI) ranking. The MHDI was developed using data from the IBGE's National Continuous

Household Sample Survey (in Portuguese *Pesquisa Nacional por Amostra de Domicílios Contínua*, PNADC 2012 - 2021) and comprises the same three dimensions as the Global HDI: income, education, and longevity (UNDP, 2023). Additionally, according to IBGE data, there was an increase in extreme poverty and general poverty in the North region, raising the share of these areas in the total number of poor people in the country in 2021 (IBGE, 2022).

In sum, the content analysis allowed us to identify the regional specificities that influence the management and provision of WSS in the region, which are related to political, financial, geographical, operational, and social aspects.

Regarding the solutions suggested, the importance of strengthening the regulation of services stands out, with the definition of mechanisms that promote a more transparent and effective environment.

A further important issue is the political aspects involved, such as prioritizing WSS in public policies. Government commitment is crucial for improving planning, securing investments, and ensuring that sanitation remains a strategic priority.

Moreover, social aspects must be considered, such as environmental education issues, awareness campaigns to reduce waste, the proper use of systems, and the effective connection of users to networks.

Another important specificity to observe, especially when designing projects, refers to geographical characteristics, flooding areas, distances from cities, and the technical capacity of the providers.

Improving the conditions of access to WSS requires proper planning that begins with the preparation of the PMSB and the consideration of all the aspects mentioned above. This is a complex challenge that necessitates collective efforts.

The environmental impacts of the lack of WSS, such as contamination of water resources and soil degradation, jeopardize regional development. Similarly, the absence of these services affects public health, education, real estate, urban development, and intensifies social inequalities and vulnerability (Ferreira; Alves; Pereira, 2019; Oliveira *et al.*, 2021).

The lack of these services has various consequences and compromises the dignity and quality of life of the population (Oliveira *et al*., 2021). Thus, guaranteeing universal access is an indispensable condition for promoting health, sustainability, and development in the region.

5 Conclusions

The qualitative analysis carried out in this study made it possible to evaluate the deficit in access to WSS and to understand, from the perspective of stakeholders in the sector in Brazil, various factors that can influence access indicators and regional specificities in system management.

Quantitative indicators, such as SNIS or IBGE data, are often utilized in performance evaluation studies and indicate that the northern states have low levels of access to WSS.

Accordingly, the qualitative analysis offered a more detailed understanding of this critical issue, especially considering the universalization targets established by the legal framework and the 2030 Agenda. According to the thematic categories generated in the content analysis, the primary explanations for the deficit relate to

financial and political factors. The proposed solutions highlight the necessity to enhance public policies and regulatory frameworks. This suggests that, in addition to increasing financial investments, it is essential to advance technological innovations tailored to the regional context and to focus on professional training.

This comprehensive approach can facilitate better planning and resource application efficiency, expand services to more vulnerable and remote areas, and ensure greater operational sustainability, thereby improving socio-environmental indicators and supporting regional development.

Some recognized methodological limitations include the researchers' subjective interpretation during software usage, coding, and categorization, as well as the limited number of interviewees in the study, which may restrict the generalizability of the results. Although in-depth interviews allow for an understanding of regional specifics, a larger sample could enhance the representativeness of the findings.

By identifying regional particularities, this study contributes to reflecting on possible strategies to achieve universalization targets, considering the diversity present in a country as vast as Brazil.

Future research should concentrate on finding tools suitable for regional realities that can aid in managing these systems to improve indicators and, consequently, meet universalization targets, thereby contributing to the development of this important region of the country.

REFERENCES

ARAGÃO, J. S.; BORGES, J. T. A busca pela universalização do abastecimento de água e esgotamento sanitário: evolução, desafios e perspectiva. Um estudo de caso em Manaus-AM. **Novos Cadernos NAEA**, v. 21, n. 3, 2018

BARDIN, L. **Análise de Conteúdo**. 3ª reimpressão da 1ª edição. São Paulo, Edições, v. 70, 2016.

BORDALO, C. A. L. Pelo direito humano ao acesso à água potável na região das águas: uma análise da exclusão e do déficit dos serviços de abastecimento de água potável à população da Amazônia brasileira. **Novos Cadernos NAEA**, v. 25, n. 1, 2022.

BRASIL. **Lei n° 11.445, de 5 de janeiro de 2007**. Estabelece Diretrizes Nacionais para o Saneamento Básico. Diário Oficial da União: Brasília, DF, Presidência da República, [2007]. Disponível em: https://www.planalto.gov.br/ccivil_03/_ato2007-2010/2007/lei/l11445.htm. Acesso em: 8 jun. 2020.

BRASIL. **Lei n. 14.026, de 15 de julho de 2020**. Atualiza o marco legal do saneamento básico [...]. Diário Oficial da União: Brasília, DF, Presidência da República, [2020]. Disponível em: https://www.planalto.gov.br/ccivil_03/_Ato2019-2022/2020/Lei/L14026.htm. Acesso em: 20 jul. 2020.

CAMPOS, C. J. G.; SAIDEL, M. G. B. Amostragem em investigações qualitativas: conceitos e aplicações ao campo da saúde. **Revista Pesquisa Qualitativa**, v. 10, n. 25, p. 404-424, 2022.

CAPOBIANCO, J. P. R.; SANTOS, G. R. D.; CHECCO, G. B.; MENDES, A. T. Saneamento básico no Brasil: perfil do investimento público para a universalização e promoção do direito humano à água. **Boletim Regional, Urbano e Ambiental**, v. 29, n. 1, p. 25-33, jun. 2023.

CARDOSO, M. R. G.; OLIVEIRA, G. S.; GHELLI, K. G. M. Análise de conteúdo: uma metodologia de pesquisa qualitativa. **Cadernos da FUCAMP**, v. 20, n. 43, 2021.

CHAVES, H. P.; MARQUES, R. C.; MALHEIROS, T. F. Performance evaluation of water supply service providers: a review with a focus on Brazil. **Water Supply**, v. 24, n. 9, p. 3118-3131, 2024.

CNI - Confederação Nacional da Indústria. **Comparações internacionais: uma agenda de soluções para os desafios do saneamento brasileiro.** Brasília: CNI, 124 p, 2017. Disponível em: https://static.portaldaindustria.com.br/media/filer_public/92/13/92132cd2-f22c-4372-aa83-f705d21d2cbb/estudo_-_comparacoes_internacionais_em_saneamento_basico.pdf. Acesso em 2 jul. 2024.

FERREIRA, M. A.; ALVES, C. de M. A.; PEREIRA, J. S. **Desafios para a universalização do acesso aos serviços de água e esgoto na região Norte do Brasil**. XXIII Simpósio Brasileiro de Recursos Hidrícos Centro, v. 3107, p. 0940, 2019.

FUCHS, A. G. P.; MACIEL, F. G.; PIMENTEL, L. B.; MITERHOF, M. T. Saneamento na América Latina: panorama das trajetórias institucionais e do nível dos serviços de água e esgoto na Bolívia, no Chile, no México e no Peru. **BNDES Set**. Rio de Janeiro, v. 28, n. 55, p. 7-66, mar. 2022.

GIATTI, L. L. Reflexões sobre água de abastecimento e saúde pública: um estudo de caso na Amazônia brasileira. **Saúde E Sociedade**, 16(1), 134–144, 2007. https://doi.org/10.1590/S0104-12902007000100012

IBGE - Instituto Brasileiro de Geografia e Estatística. **Atlas de saneamento: abastecimento de água e esgotamento sanitário.** Coordenação de Geografia e Coordenação de Recursos Naturais e Meio Ambiente. Rio de Janeiro, IBGE, 2021.

_____. **Síntese de indicadores sociais: uma análise das condições de vida da população brasileira: 2022** / IBGE, Coordenação de População e Indicadores Sociais. Rio de Janeiro, IBGE, 2022.

_____. **Censo demográfico 2022: população e domicílios: primeiros resultados.** Rio de Janeiro: IBGE, 2023.

ITB - Instituto Trata Brasil. **As despesas das famílias brasileiras com água tratada e coleta de esgoto.** Relatório Completo. 2021. Disponível em: <https://tratabrasil.org.br/wp-content/uploads/2022/09/Relatorio_Completo-2.pdf>

KUWAJIMA, J. I.; SANTOS, G. R.; FECHINE, V. M. R.; SANTANA, A. S. **Saneamento no Brasil: proposta de priorização do investimento público**. Texto para Discussão 2614, Instituto de Pesquisa Econômica Aplicada - Ipea. Brasília: Ipea 2020. DOI: <http://dx.doi.org/10.38116/td2614>.

MONTEFUSCO, C.; TAMWING, D. S.; CRUZ, W. M.; MOREIRA, J. G.V.; SERRANO, R. O. P. Direito e diretrizes de acesso à água: contexto geral e abordagem para a cidade de Rio Branco, Acre, Brasil. **Enciclopédia Biosfera**, v. 18, n. 37, 2021.

MAXQDA. **Software para análise de dados qualitativos**. Disponível em: https://www.maxqda.com/pt. Acesso em: 04 fev. 2025.

MORAES, L. R. S. (Coord.). **Modelos de Gestão dos Serviços de Saneamento no Brasil: Limites e Possibilidades.** Relatório Final: Programa de Pesquisa em Saúde e Saneamento. Fundação Nacional de Saúde: Engenharia De Saúde Pública, 332p, Salvador, 2012.

MUSTAPHA, A.; LANIYAN, T.; REIGNS, A.; BIRKE, W.; ZAWIDE, F. Pathway to equity in water, sanitation, and hygiene (WASH) in Africa: challenges and opportunities. **Environmental Epidemiology**, *v. 8*, n. 4, p. e315, 2024. DOI: 10.1097/EE9.0000000000000315

OLIVEIRA, C.; PORTELLA, C.M.M.; GONÇALVES, R.J.; OLIVEIRA JÚNIOR, Z. Saneamento básico e a relação intrínseca com o desenvolvimento sustentável: um desafio frente à desigualdade socioeconômica na Região Norte do Brasil. **Meio Ambiente (Brasil)**. v.3, n.3, 062-074, 2021.

ONU – Organização das Nações Unidas. **Resolução da Assembleia Geral da ONU A/RES/64/292.** ONU, 2010. Disponível em: <https://documents-dds-ny.un.org/doc/UNDOC/GEN/N09/479/35/PDF/N0947935.pdf?OpenElement>. Acesso em: 16 Out. 2023.

_____. **Transformando Nosso Mundo**: A Agenda 2030 para o Desenvolvimento Sustentável. 2015. Disponível em: https://brasil.un.org/pt-br/sdgs. Acesso em 16. Out. 2023.

_____. **Relatório das Nações Unidas sobre o Desenvolvimento Mundial da Água 2023: Parcerias e Cooperação para a Água**. UNESCO. 2023. Disponível em: <https://unesdoc.unesco.org/ark:/48223/pf0000384655> Acesso em: 13. Out. 2023.

PEREIRA, M. A., MARQUES, R. C. Technical and scale efficiency of the Brazilian municipalities' water and sanitation services: A two-stage data envelopment analysis. **Sustainability**, 14(1), 199, 2022.

PHILIPPI JUNIOR, A.; GALVÃO JUNIOR, A. C. **Gestão do saneamento básico: abastecimento de água e esgotamento sanitário**. Barueri, SP: Manole: 2012.
PNUD – Programa das Nações Unidas para o Desenvolvimento. **Atlas do desenvolvimento humano no Brasil 2021**. Programa das Nações Unidas para o Desenvolvimento - PNUD; Instituto De Pesquisa Econômica Aplicada - IPEA; Fundação João Pinheiro – FJP. Brasília: PNUD, 2022. Disponível em: http://www.atlasbrasil.org.br/ranking. Acesso em: 9 out. 2023.
ROSITO, C. A. Do PLANASA ao PLANSAB. Os últimos 50 anos da água e do esgoto no Brasil. **Saint-Gobain, Rio de Janeiro**, 2019.

SANTOS, G. R.; SANTANA, A. Água, Saneamento e Objetivos de Desenvolvimento Sustentável (ODS) na Amazônia: Dificuldades na gestão integrada e universalização dos serviços. **Revista tempo do mundo**, n. 27, dez. 2021.

SANTOS, G. R.; MENDES, A. T. O lugar do Plansab: uma contribuição ao aprimoramento das ações do governo federal no saneamento básico. Instituto de Pesquisa Econômica e Aplicada. **CADERNO DE DEBATES – Plano Nacional de Saneamento Básico**, p. 9. 2023

SANTOS, G. R.; KUWAJIMA, J. I.; SANTANA, A. S. **Regulação e investimento no setor de saneamento no Brasil: trajetórias, desafios e incertezas**. Texto para Discussão 2587, Instituto de Pesquisa Econômica Aplicada - Ipea. Rio de Janeiro: Ipea 2020. DOI: <http://dx.doi.org/10.38116/td2587>.

SILVA, F. A.; TRINDADE, A. B. Política nacional de saneamento, desigualdades regionais, avaliação e perspectivas: considerações sobre a gestão dos serviços no Norte e Sudeste do Brasil. In: HELLER, L., MONTENEGRO, M. H. F.; MORETTI, R. S (Org.). **Olhares sobre a realização dos direitos humanos à água e ao saneamento.** 1. ed. - Rio de Janeiro : Letra Capital, 2021

SNIS - Sistema Nacional de Informações sobre Saneamento . ***Diagnóstico dos serviços de água e esgotos – 2020.*** Ministério do Desenvolvimento Regional, 2022. Disponível em: < http://www.snis.gov.br.>

SUDAM – Superintendência do Desenvolvimento da Amazônia. **Plano Regional de Desenvolvimento da Amazônia – PRDA 2024-2027.** Belém, SUDAM, 2023. Disponível em: Disponível em: https://www.gov.br/sudam/pt-br/assuntos/planos-de-desenvolvimento/PRDA2427.pdf. Acesso em: 9 out. 2023.

TSEOLE, N. P.; MINDU, T.; KALINDA, C.; CHIMBARI, M. J. Barriers and facilitators to Water, Sanitation and Hygiene (WaSH) practices in Southern Africa: A scoping review. **PLoS One**, v. 17, n. 8, p. e0271726, 2022.