

## Article

# Access to Water and Sanitation Services in Brazilian Vulnerable Areas: The Role of Regulation and Recent Institutional Reform

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**Abstract:** Access to water and sanitation services (WSSs) in low- or middle-income countries is constrained by the poverty and vulnerability conditions of the population. In this context, it is urgent to establish public policies for WSSs that will increase the economic access to these services so that they will be more comprehensive and comprise the entire population, ensuring a balance between social and financial objectives. This paper contributes to a better understanding of the provision of WSSs in vulnerable areas and of the difficulty in achieving universal access using Brazil as a case study. The role of regulation in the provision of WSSs in vulnerable areas and the impact of the recent institutional reform that took place last year in that country is discussed. The different experiences analyzed provide interesting lessons that contribute to the improvement of the Brazilian status quo and that, at the same time, can be good practices that can be applied in other countries. One of the main conclusions of this research is related to the contributions that regulation should provide in the universalization of WSSs, mainly when the provision of these services is ruled by a contract. Furthermore, we observed that public authorities have resigned their role in this scope and that they must be more effective and, particularly, more proactive so that universalization can be achieved.

**Keywords:** access to water and sanitation services; vulnerable areas; Brazil; poor population; regulation; universalization



**Citation:** Narzetti, D.A.; Marques, R.C. Access to Water and Sanitation Services in Brazilian Vulnerable Areas: The Role of Regulation and Recent Institutional Reform. *Water* **2021**, *13*, 787. <https://doi.org/10.3390/w13060787>

Academic Editor: Julio Berbel

Received: 18 February 2021

Accepted: 9 March 2021

Published: 13 March 2021

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## 1. Introduction

The Sustainable Development Goals (SDGs) set in 2015 replaced the Millennium Development Goals (MDGs) with the aim of fulfilling human rights for all and achieving gender equality and women's empowerment in social, economic, and environmental dimensions. In this sense, SDG 6 defines the targets that ensure the availability and sustainable management of water and sanitation services (WSSs) for all until 2030. Unlike MDGs whose objectives were specifically to provide access to WSSs, SDG 6 intends to ensure access to sustainable WSSs. If the focus in the former was on access to and the availability of the infrastructure, in the latter the focus shifts to service provision, assuming that the infrastructure, although necessary, is not sufficient for the existence of a sustainable service [1]. This is certainly an important paradigm shift that makes the challenge even greater. As we are addressing the drinking water service used by households, accessibility, availability, and quality are fundamental principles for sustainability. Sustainable sanitation services comprise the wastewater collection and treatment or the emptying and cleaning of septic tanks and the destination of sludge or effluents for treatment and possible discharge or reuse [2].

The level of access to WSSs by the world population has been a focus of the Joint Monitoring Program (JMP) of the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) since 2000. This monitoring activity displays the evolution in the coverage levels of WSSs worldwide. In this scope, the drinking water supply grew by approximately 9% from 2000 to 2017, reaching nearly 70% of the world population; sanitation services improved by approximately 17%, covering 45% of the total

population; and the world population grew by approximately 25% in the same period [3]. In that period, in Brazil, the monitoring activity shows that there was an increase in safe drinking water coverage of nearly 1% in urban areas and of roughly 16% in rural areas, reaching 98% of households aggregated across urban and rural areas. However, in rural areas, the most common solution is improved water sources for which the fetching time does not exceed 30 min for a return trip. The indicator of sanitation service coverage with improved facilities grew by approximately 23%, reaching almost 49% of the total Brazilian population, which, in the same period, also increased by nearly 25%, comprising around 208 million inhabitants [3]. Please note that in many cases, slums and other informal settlements are excluded from urban areas and, most likely, they are not assessed in the statistics provided. They are nobody's land. In addition, there are doubts about the reliability of the figures related to safe water, particularly if they comply with the criteria of SDG 6 and if, indeed, they correspond to sustainable water services.

The challenge to WSS universalization worldwide and in Brazil, in particular, consists mainly of intensifying the coverage for populations located in peri-urban areas, slums, and other informal settlements, which are very condensed; while in rural areas, the population to be served is very scattered. The provision of WSSs in vulnerable areas is complex, depending on the combination of formal and informal infrastructure that may be able to fulfill the requirements of that territory [4].

This complexity exists mainly because there are irregularities in the land tenure; in the poor settlements; and in the concentration of low-income households that are in risky and vulnerable areas, such as households in areas requiring environmental protection, slopes or riverbeds, or even in areas under the control of criminal organizations. Moreover, these vulnerable areas are always seen to be temporary solutions, although they last over time and there are no actions to change them. Due to these factors, these areas have different connection costs that depend on physical access to users, the absence of roads, overlapping construction, and high population density. Moreover, it would be necessary to adopt a social approach to address the unserved population in nonurbanized areas [5]. In addition, vulnerable rural areas have different characteristics and institutional problems, raising social and economic issues as they concentrate on a significant part of the poorest population of the country, properties are distant from each other and they often lack enough human and material resources necessary for adequate WSSs [6,7]. Moreover, financial sustainability is clearly more intricated in the rural systems than in peri-urban areas [8].

Regulation has the function of setting the standards and norms for the proper access and quality of the services provided to satisfy users, ensuring compliance with the conditions and targets established in contracts and in investment plans, preventing and suppressing the abuse of economic power and defining affordable tariffs that guarantee the economic and financial sustainability of the provision of WSSs [9]. In this context, the regulatory agencies responsible for ensuring and supervising the provision of WSSs can meaningfully contribute to the achievement of a universal service by establishing a balance between the various actors and promoting inclusiveness through positive discrimination of the vulnerable population [10]. However, vulnerable areas and the populations living there are the ones that need regulation the most and are where regulation can actually make a difference. Nevertheless, they are rarely regulated and are left at their own risk. Governmental entities resign from their roles there, which can be observed through the lack of inclusion and application of regulation and public policies that consider these problems [11].

In Brazil, the outlook is similar to other low- or moderate-income countries, as India or Indonesia [12–14]. The concentration of the population in large cities continues to grow with a higher concentration of families in peri-urban areas, especially in slums and other informal settlements, making the challenge of universalization harder. In rural and scattered areas, the problems, although different, are also great, especially in the northeast and northern regions of the country where there are larger dispersions and resources are scarcer [15]. Another challenge to universalization in Brazil is to meet the particular needs

of special communities, such as indigenous and quilombo communities, among others [16]. It should also be noted that in Brazil, legislation makes it compulsory to regulate the provision of WSSs, and in fact, this happens in a substantial part of the country. However, regulation is asymmetric since in rural areas and especially in informal areas, it has been nonexistent or very inefficient and ineffective, despite these areas being precisely where regulation is needed the most [17].

This research discusses the universalization of the provision of WSSs in vulnerable areas, investigates commonly adopted practices, and seeks to identify the main challenges for universalization, debating, in particular, the role of regulation in this respect. The Brazilian case is particularly analyzed. The study describes how WSSs are provided in areas with greater social vulnerability, identifies the main problems and challenges and discusses the contributions of regulation to the improvement of the provision and universalization of WSSs in the country and what should they be. The study also discusses the recent reform of the sector occurred in the country whose main objective is exactly to speed-up the universal access to WSSs. The results of the research led to proposed suggestions and recommendations focused on these areas of need to improve the Brazilian regulatory model.

The article is organized as follows. After this introduction, the second chapter analyzes the provision of WSSs in vulnerable areas, discusses the evolution of access to WSSs in Brazil with a focus on social vulnerability areas and highlights the main public policies and reforms that occurred in this scope. The third section discusses the regulatory model in Brazil and how it can contribute and even be decisive in improving universal access to WSSs in the country. The fourth section examines the recent institutional reform of the sanitation sector and its contributions to the universalization of services. The main bottlenecks are identified, and recommendations for their elimination are provided. Finally, the fifth section draws the main conclusions.

## 2. Access to WSSs and Major Public Policies

In Brazil, the first major public policy for WSSs dates to 1971 when the National Water and Sanitation Plan (PLANASA) was launched. The plan established guidelines and sources of funding were defined to enable the construction of water supply systems on a regional/state scale. It was very important because it created the state companies, which currently continue working, in nearly all states. However, the focus (as expected) was on water supply and in the main urban areas and in this scope, it was well-succeed. Unfortunately, PLANASA was terminated in the 1980s (with the end of the military government) and was not completed neither much attention was given to sanitation [18]. Since 2007, with the publication of law no. 11.445 of 5 January 2007, known as the basic sanitation regulatory framework, the universal access to WSSs has been defined as a fundamental principle; and the governments should coordinate the policies of urban and regional development, housing, fighting poverty and its eradication, health promotion, water resources, and others of social interest aimed at improving the quality of life, for which WSSs are a determining factor. The National Sanitation Plan (PLANSAB), revised in 2019 (an initial version was published in 2013), defines goals to universalize access to basic sanitation in the country by 2033. The plan intends to universalize WSS service coverage with projected investments of approximately R\$ 357 billion (89 billion US dollars) in a 14-year period, allocating 40% to the water supply and 60% to sanitation. It has been observed that the investments are predominantly made in urban areas, representing 92% of the amount by 2033. In rural areas, the estimated investments are concentrated in the northeast and southeast regions, which have the highest demands due to the percentage of the population that is unconnected [19].

Considering that it is not feasible to recover and remunerate all the projected investment through tariff revenues alone, PLANSAB incorporates a strategic perspective by establishing the need to increase the level of federal public investments, citing parliamentary amendments and government programs, in addition to the private investments made

in the WSS sector and maintain affordable tariffs. However, even with detailed industry planning, with the current pace of WSS infrastructure construction, universalization objectives will be achieved several decades later than expected [20]. To achieve the established goals, it will be necessary to break with the current model and expand the capacity to develop projects that include the design, public procurement, construction, and management and execution of contracts to accelerate the volume and flow of investments necessary for WSS universal access [21].

Thus, law no. 14.026 of 15 July 2020 (known as the new law on water and sanitation) updated the legal framework of the WSS sector and set even greater incentives for private sector participation and the granting of WSSs in regional blocks to make them more financially attractive. However, the changes made expanded the constraints so that municipalities and public providers have access to funding from the federal government and reduced the scope of the law in relation to vulnerable and rural areas, attributing the responsibility for WSS universalization in poor areas to other policies, such as urbanization, housing, and poverty eradication. In Brazil, there have been no effective regulatory actions aimed at universalizing these services in vulnerable areas. The main actions found include only the definition of social tariffs and cross subsidies without any specific pro-poor regulatory direction for universalization. With the updating of the legal framework, the responsibility for universalization in these areas has been further reduced in scope [22].

In addition to the coverage indicators of formal WSS providers, there are still unofficial (informal) alternative WSS providers and cases of illegal water distribution. The definition of an alternative supplier becomes somewhat ambiguous, and it is difficult to establish boundaries between those who simply operate in the informal economy and those who commit fraud [23]. The informal connections are constituted by the portion of households that have no internal plumbing, receive water that does not meet the drinking water quality standards and have prolonged supply interruptions or rationing. They also include the use of a cistern for rainwater and the use of a site storage tank supplied by mobile vendors who provide water frequently without sanitary safety and that is of insufficient quantity for consumption and hygiene [19]. In some cases, the water distribution in vulnerable areas, much of it irregular, is offered by the main WSS provider, but there is no charge, and the distributed volume is considered by the WSS provider as water loss volume or its own service volume (nonrevenue water volume), highlighting the lack of billing and of better solutions. Also note that in some of these areas, the water supply only exists for a limited set of water supply points that cannot be considered door-to-door services; nonetheless, in many situations, there are no distribution into homes. The phenomenon of resale by the leaders of these communities, sometimes associated with criminal practices, is also frequent [24].

The formal WSS provider respects several legal assumptions, including private law, the constitutional right of private property and the relationship with ownership or land ownership, revealing a mismatch between two constitutional rights: the right to property and the right to human dignity, encompassing the universal human right to water [25]. When a household makes a request to connect to a WSS provider, it will follow the regulations requiring basic documents, and in the absence of proof of ownership of housing (property or lease), the application is denied. As a usual procedure, the user goes to court, which commonly determines a provisional connection. In this way, the judiciary exempts the formal WSS provider from the responsibility of infringing upon the regulations overlapping the right to property through the principle of the human right to water while the issue of land tenure is being discussed. This model in many cases guarantees the right to water, but it does not promote a public policy of universalization, and it even less promotes the provision of a sustainable service, implying unplanned costs, dispersed investments and the precariousness of the service [26]. Furthermore, it perpetuates inequality as only those who have the means or the tenacity to navigate the judicial system can go down this path.

According to the federal government, in 2019, there were approximately 40 million people without access to a piped water supply, corresponding to nearly 18% of the popula-

tion. Concerning sanitation, around 100 million Brazilians do not have access to a network and depend on inadequate or rudimentary individual solutions [27]. The percentage of the population without wastewater treatment is even worse. According to the last estimate of the Brazilian Institute of Geography and Statistics (IBGE), in 2019, there were more than 5 million households occupying more than 13 thousand informal settlements. These communities were in 734 municipalities in all states of the country, including the federal district, i.e., Brasília [28]. In 2010, there were more than 3 million households located in informal settlements, i.e., the number of households in these areas increased by 59%, the number of vulnerable areas increased by 108% and the number of these areas in cities increased by 127% in ten years. The percentage of the population living in informal settlements is important because when these settlements are not set aside, they are regarded as having network-supplied water, but in fact there is no supply there and they do not benefit from the provision of the WSS in a sustainable way and in line with SDG 6. Therefore, realistically, the population that does not enjoy sustainable WSSs is much larger than announced and not to face this sad situation the official authorities always neglected it.

In view of this scenario, Figure 1 shows the quantity and distribution of permanent households in informal settlements in the federal state (a and b) and the growth rate that took place in 10 years according to data from the IBGE and Ministry for Regional Development (MDR) for 2019. It is observed that the states of São Paulo and Rio de Janeiro have the largest numbers of households in informal settlements, but in Amazonas, Espírito Santo, and Amapá, the households located in these areas represent more than 20% of the total number of households in each state.

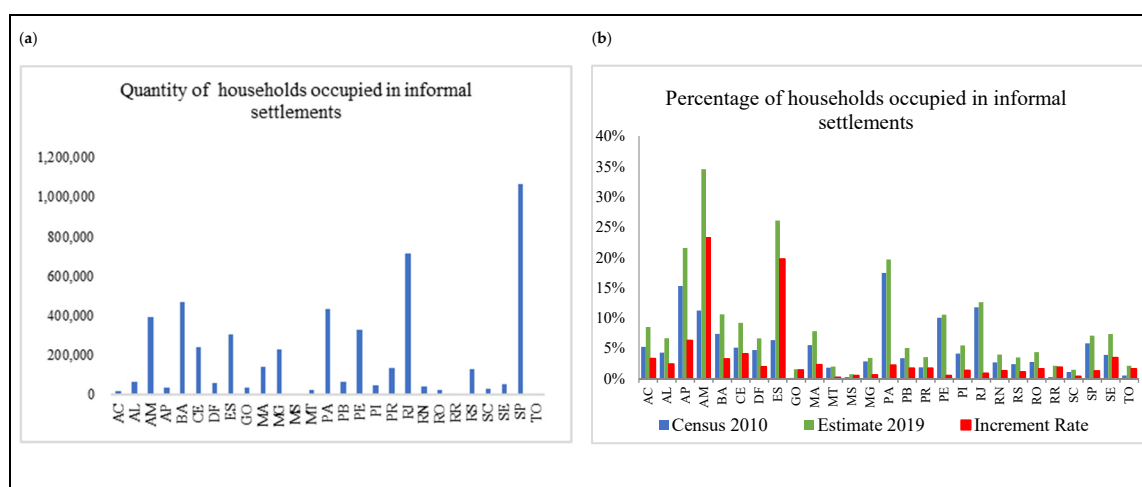
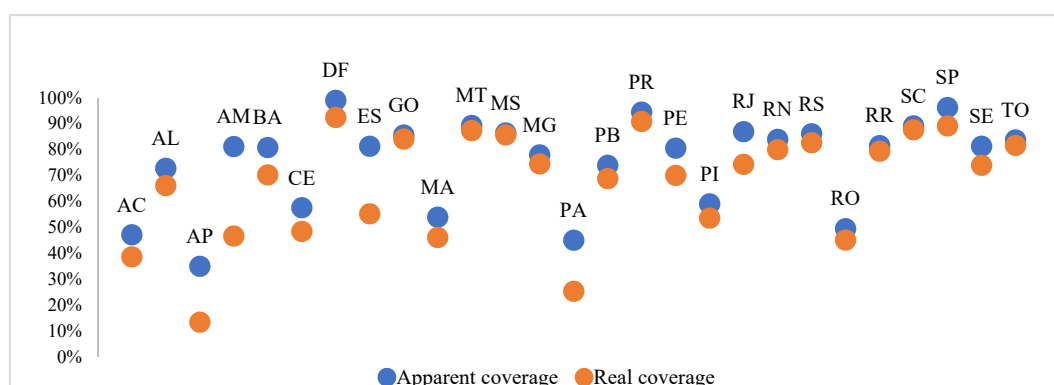


Figure 1. Private households and informal settlements by federal state (a,b).

The best indicators of access to water are observed in the federal district and in the states of São Paulo and Paraná with more than 90% coverage. However, the information disclosed considers the indicator of apparent coverage. Since most informal settlements do not have adequate services, they remain out of the quality standards and show low willingness to pay. When considering informal settlements, the actual water access percentages are much lower. For example, in Manaus, the apparent water coverage is 81% while the real water coverage is 46%. The same occurs in all Brazilian states. In Espírito Santo, for example, the apparent water coverage is 81%, and the real water coverage is 55%. In Rio de Janeiro, the apparent water coverage is 87%, and the real water coverage is 74%. The same rationale applies to the coverage indicators of sanitation services where apparent coverage indicators are much lower than those of the water supply service. Figure 2 shows the apparent and actual water coverage indicators for all states of the federation and the federal district. Thus, the need to recognize that a general expansion of WSSs is necessary should consider equal and inclusive universalization with robust projects that provide access to WSSs, even to poor and vulnerable areas.



**Figure 2.** WSS coverage indicators by federation state.

The context presented shows the size of the informal WSS market in Brazil considering the number of inhabitants outside the formal provision of WSSs. Please note that the coverage indicators highlighted can have distortions, so it is possible that there is a percentage of households with adequate individual services that are not included in the formal provision. This situation is observed mainly in rural areas (farther away) and in large cities where there are greater concentrations of informal settlements, there is unmetered water distribution that is provided for free and recognized as water losses or nonrevenue volume, there is low fraud prevention, and private law prevail over human rights, even when services are provided in a precarious way. Regarding sanitation, households use local alternatives with improved or rudimentary solutions that need maintenance and control [29]. Note however that there are also some good examples and experiences to include the informal population, for example, SABESP, the State Water and Sanitation Company in São Paulo with the program “connect to network” among others, particularly adopting performance-based contracts paying to the private sector by the new effective connections made in the slums and only after ensuring that they are active, at least, for two years [5].

The setting presented in this section emphasizes the market and policy failures of the WSS sector in Brazil and the need for strong regulatory action to reverse this scenario, especially actions able to integrate public development policies targeted to human dignity and social equity.

### 3. WSS Regulatory Model in Brazil

#### 3.1. Introduction

The model of WSS regulation in Brazil comprises three different levels of WSS provision: local public ownership, state public ownership, and private ownership. Except for metropolitan regions, whose responsibilities can be shared, the ownership and responsibility for service provision is municipal; however, the providers do not assume the same responsibility when acting in rural areas or in informal settlements. In rural areas, the main actors are local organizations or community providers; while in informal settlements, although frequent access can exist, there is actually no sustainable service provision. In this last case, there are usually no household connections, and the volume supplied is considered a social loss or theft and goes into the system as nonrevenue water. The best solution for each informal settlement tends to be specific; and it is up to each municipality, in partnership with the WSS provider and the community and under its supervision, to develop the best alternative for each place, including the technical solution, either a provisional, elemental, or definitive solution, as access to the services is more important than lawfulness due to the relevance of the principle of human rights [30]. To better understand this situation, this chapter presents the Brazilian regulatory model in the WSS sector; analyzes the performance of regulation in vulnerable areas; discusses the

recent regulatory framework, the recent projects and the possible improvements that took place; and, finally, proposes improvements to reach the targets set for universalization.

### 3.2. Brazilian Regulatory Model in the WSS Sector

The regulatory model for WSSs and other public services in Brazil is based on discretionary regulation by a regulatory agency. The transition occurred when the country began to transfer the provision of different public services to the private sector and adopted the position of an arbiter, creating and developing independent regulatory agencies, at least in theory. This happened at the national level in energy, oil, communications, civil aviation, and other industries. In the WSS sector, the regulatory model was decentralized due to the municipal ownership of these services and occurred through state, intermunicipal (consortium of municipalities) and municipal agencies. Federal law no. 11.445 of 5 January 2007 defines the joint responsibility of the service holder (municipality), including the provision and regulation of the service. Since 2007, several WSS regulatory agencies have been created in Brazil, and several forms of regulation by agency can be found, including state, intermunicipal (consortium) or municipal regulation. In October 2020, there were 72 WSS regulatory agencies in the country, comprising more than 3 thousand regulated municipalities, and some of them regulate the same WSS provider and the same issues [31].

In fact, the Brazilian regulatory model is a hybrid model because providers, except when there is direct management, make contracts, or at least should, with the municipalities that own the service. Thus, state companies sign program contracts with municipalities, and private companies sign concessions or public-private partnership (PPP) contracts with municipalities. However, the quality of the contracts is very poor, and there is no coordination of their content or their monitoring by regulatory agencies [32]. This lack of coordination between contractual regulation and discretionary regulation can become the worst of both worlds [33].

Nonetheless, since 2007, after the publication of the WSS legal framework, even with all the evolution provided by the various regulatory agencies, there has been no effective progress in the provision of services, especially in poor areas; therefore, it is possible to believe that the SDGs related to water and sanitation will not be achieved. The regulatory model was one of the possible reasons for failing to achieve these objectives. Therefore, members of the Brazilian parliament passed an update to the legal framework through law no. 14.026 of July 15, 2020 and assigned the National Water Agency (ANA), a federal entity with responsibilities to regulate water resources, the ability to establish national regulatory standards for the WSS sector, especially standards related to quality, efficiency, and price. This action aims to standardize the actions of state, intermunicipal and municipal regulatory agencies to increase the legal certainty of the sector and attract more private capital through viable projects with lower risk [34].

One of the main bottlenecks of WSS regulation in Brazil is related to inadequate contracts that have been signed without the participation of a regulatory agency. In the recent past, considering the size of the Brazilian market, there were few contracts in the country; and even the program contracts, which were signed between public entities (municipalities and state companies), were precarious (without targets and adequate rights and obligations) or did not exist. This reality resulted in several situations in which contracts were signed without considering the existence of regulatory agencies. This hindered the relationship between concessionaires, grantors, and regulators, mainly concerning the access to information by regulatory bodies, essential regulatory measures, and the commitments made in the public tender and when the contract was signed, which always overlap with possible regulatory decisions and limit their regulatory functions [35].

By contracting WSSs and with the expansion of the private sector, regulation by contract combined with regulation by agency, i.e., hybrid regulation, has proven essential [36]. In most countries where regulatory agencies survive with contracts, the regulator participates in the precontractual phase and issues opinions on the bidding documents and on the draft of the contract, but it does not express itself on the award or on the choice of the

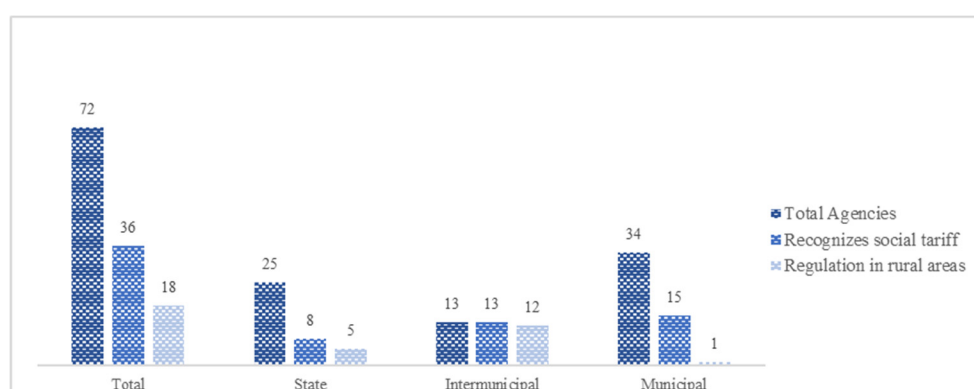
winning player, which is the sole responsibility of the grantor [33]. All negotiations and the monitoring of the contract are made with the participation of the regulatory agency, strengthening the governance, monitoring, and modus operandi of WSSs. In Brazil, after the review of the current legal framework, this model should be adopted, allowing regulatory agencies to participate in the preparation phase of the contracts to reduce contractual failures as much as possible, increase competition and monitor execution, which can have significant impact on the performance and achievement of defined goals.

Regulation by contract does not in any way replace regulation by agency, but it can be an excellent tool to complement it. Therefore, hybrid regulation can represent the best of both worlds, combining the best practices of two regulatory models already consolidated [33], i.e., first, the contract has the capacity to mitigate most regulatory risks. Second, the regulatory agency tends to eliminate the imperfections of contracts, bridge the gaps, and act as a third party to improve the contract and make it a complete instrument. If there is no such integration between the two regulatory models, the worst of both worlds may be revealed, and regulation by agency may work separately from regulation by contract, implying conflicts between regulatory obligations versus contractual obligations, and emphasizing the market failures of each regulatory model [35].

### 3.3. *The Regulatory Landmark and the Performance of Pro-Poor Regulation*

Law no. 11.445 of 5 January 2007, assigned clear functions to regulation, including the monitoring of the universal access, the quality of service, affordable tariffs, and tariff subsidies for WSSs. However, even when social tariffs exist, there is no monitoring of the extent to which social goals or coverage targets are achieved by regulators. Furthermore, it would be very important to regularly compute performance indicators related to the sustainability of the WSS provision both in rural and urban systems [37–39]. In Brazil, approximately 21% of the population is enrolled in the program for social assistance of the federal government (CadÚnico). Nevertheless, many do not benefit from social tariffs, either because they do not require it or are not eligible or even because they are not connected to the WSS [40]. The national WSS policy aims to guarantee adequate means to connect the dispersed rural population and irregular areas, along with other vulnerable populations. This can be done using solutions compatible with their peculiar economic and social characteristics and through the adoption of objective criteria for the eligibility and priority of investments. However, if the national policy, *de jure*, can be well intended, *de facto*, it has not been well succeeded [41].

The process of inclusion and WSS universalization for people living in informal or rural areas is not always defined in the regulatory principles of the regulatory agencies and, in some cases, may not even be a regulatory objective. Regulatory agencies usually regulate the WSS provider and not the entire municipality; and as the WSS provider does not include the vulnerable areas in its scope of action, this ends up being a void. To evaluate the attribution of pro-poor regulation in Brazil, we analyzed the law that created the existing 72 WSS regulatory agencies to identify which kind of treatment each one adopts for the services in rural and informal areas, considering the WSS universalization for the most vulnerable population. The results displayed in Figure 3 put social tariffs at the core of regulatory action. This is acknowledged by 36 regulatory agencies although the subsidy policy defined by the WSS provider just includes households registered with low-income social programs. Only 18 regulatory agencies assume some responsibility for the regulation of services in rural areas and have some kind of regulatory action in these areas, at least in the scope of their attributions. The subnational legislation that creates each regulatory agency follows the assumptions established in the federal law, among which all the agencies analyzed highlight the principle of affordable tariffs and regulation encompassing only the coverage area of the main WSS provider while the remaining areas are neglected.



**Figure 3.** Regulatory Agency in Brazil by scope, with regulatory instrument for social tariff and regulation in rural areas.

Only 3 agencies have specific regulatory guidelines for informal settlements. ARSESP, the state regulator of São Paulo, adopted social tariffs for low-income families and instituted an informal settlement tariff for informal areas. Additionally, it monitors the actions for universalization conducted by the provider (SABESP) through the program *Água Legal*, which made access to WSSs possible in informal settlement areas. In the federal district, its regulator ADASA defined in its statutes the need for regulation to participate in the coordination of urban and rural development housing, anti-poverty and poverty eradication policies by means of social inclusion, environmental protection, health promotion, and other actions of relevant social interest aimed at improving the quality of life, where the provision of WSSs is a determining factor. In Ceará, the regulatory agency, ARCE, must establish periodic targets for universal coverage which are included in a specific plan approved by the executive power. This plan should include the availability of facilities for collective or individual use, for disabled people and public or social institutions, for rural or poorly urbanized areas, and for distant regions.

In the WSS regulation of rural areas, the role of ARCE in Ceará also stands out since it began to regulate rural areas and small towns after the enactment of complementary law no. 162, of 20 June 2016. For this purpose, it developed a proposal for performing sunshine regulation in rural WSSs, including comparing, discussing, and disclosing WSS performance based on information on technical regulation and economic regulation, while complying with the adoption of affordable tariffs [42]. In Minas Gerais, in 2018, its state regulatory agency, ARSAE, established WSS municipal funds and stressed that the available resources could be used to improve the service quality in rural areas since these actions do not presume large investments but can have transforming effects in the communities in which they are applied.

The data presented reveal a failure of regulation for vulnerable areas and for the most disadvantaged population in Brazil. Only 4 regulatory agencies develop some kind of more specific activity to universalize the WSSs in those areas. The existence of a possible social tariff contributed very little to the universalization of WSSs because the benefits are only available to those who are connected to the network. Furthermore, there is no assessment of its impact or even of the effectiveness of the eligibility criteria by the regulatory agencies. Regulatory agencies focus on the efficiency but not the effectiveness of WSS providers, particularly regarding the scope of universalization and, above all, compliance with the SDGs. Regulatory agencies need to increase the level of pro-poor regulation and establish specific rules to promote WSS universalization while assessing the effectiveness of WSS providers in this scope.

#### 4. The Recent Reform of the Sector

##### 4.1. Contributions to Universalization and Improved Regulation

As mentioned, on July 15, 2020, the new basic sanitation law was passed, and it changed and updated the current regulatory framework. The main objective of law no. 14.026 is to accelerate WSS universalization, thus making important changes for this purpose, and, above all, encouraging private sector participation to achieve the necessary investments. The main changes concern the creation of financial conditions and legal confidence for providers, reducing the risk involved and thereby making private sector participation attractive. Hence, the creation of regional blocks involving the entire state or several municipalities was encouraged so that providers could have a financially sustainable sized market. The law established goals and the need to make concession contracts for service provision, made it mandatory to hold public tenders where both public or private entities would be able to participate, “created” a federal regulator by extending the competencies of ANA to also include WSS regulation in its scope. The aim of this last point of the reform is to level and organize subnational regulation and thus ensure the stability and predictability of the rules of the game, which are fundamental to legal certainty and the involvement of the private sector.

Thus, after the enactment of law no. 14.026, ANA started to have an essential function in WSS regulation as it began to coordinate and implement reference standards for other subnational agencies. Therefore, the federal regulator proposed a regulatory agenda for the biennium 2021/2022 available for public consultation with 22 reference standards, which encompass provision and supervision standards, the minimum contents of contracts, economic, and financial capacities, performance indicators and targets, among other matters. However, no regulatory standard was found regarding social tariffs or other forms of subsidies in the regulatory agenda of ANA, indicating that at least in the next two years the current tariff subsidy policy of WSS providers will be maintained without any incentive to pro-poor regulation. The repeal of paragraphs 1 and 2 of art. 10 of law no. 11.445/2007 eliminates the provision of WSSs being performed by cooperatives or associations in small towns predominantly occupied by a population of reduced income and with low affordability, i.e., this repeal eliminates the possibility of simpler institutional arrangements in isolated communities, rural areas, and informal settlements. In contrast, the inclusion of art. 11-B in that law established that contracts should define universalization goals that ensure the provision of water supply to 99% of the population and of wastewater collection and treatment to 90% of the population by 2033 without differentiating urban or rural areas or informal areas. Thus, access to all services was expressly outlined, and everything indicates that it will be included in the universalization goals; however, the article does not say how or if there is any strategy and public policy for vulnerable areas. In addition, the pressure to increase the value of tariffs is clear, which, along with the mandatory connection, can put strain on the budgets of low-income households. Please note that the average tariff in Brazil is already high considering the context of the country and the reality of other regional countries, which constrains the affordability of the population [40].

Considering the new law, the National Bank for Economic and Social Development (BNDES), the country’s public investment bank, in line with the federal government strategy recently prioritized WSS sector and developed business models and public procurement documents of eight huge state projects under PPP/concession arrangements in Brazil. However, these projects are focused only on urban areas, only one of the projects plans investments in informal areas and, nonetheless, there are limitations. Let us examine two of these projects in more detail, the projects in the states of Rio de Janeiro and Alagoas.

The one that plans investments in informal areas is the concession of Rio de Janeiro. It is divided into four blocks with 63 municipalities, and there was a mandatory investment by the concessionaire of R\$ 1.79 billion for the expansion of the water supply and sanitation systems specifically in vulnerable areas. However, the global investment is R\$ 33.5 billion; therefore, only 5.3% is invested in informal settlements. Moreover, the population of informal settlements corresponds to 14.4% of the total; and unlike the rest, these areas

do not have infrastructure which means that a higher proportional investment would be expected there. In summary, investment is clearly insufficient, problems will not be solved and, as such, universalization will hardly occur.

The concession project in the state of Alagoas was divided into three blocks, and the first auction was held at the end of September last year. The first block, with a projected investment of R\$ 2.5 billion, was won with an offer of an upfront payment of R\$ 2 billion, a value significantly higher than the R\$ 15 million established as the minimum bid for BNDES modeling. The first block corresponded to the metropolitan area of Maceio, the capital, which is apparently the most attractive financial project of the three for obvious reasons. However, it is neither predicted nor defined how informal settlements will be served, although in this metropolitan area, approximately 18% of the population lives in these areas. Again, the objectives of universalization will be very difficult to achieve.

In both projects, as in the others, there was no coordination with the regulatory agencies, there was no participation from the regulatory agencies in the projects' development and the roles of the regulatory agencies were not properly established. Therefore, it is anticipated that the worst of both worlds may occur due to the lack of alignment between contractual regulation and agency regulation [33].

It is worth mentioning that in some of the analyzed projects, the WSS coverage area of the concession was previously defined, and any expansion of the planned coverage area is the sole responsibility of the grantor, which means that rural or informal areas converted into regular urban areas will not be part of the scope of universalization defined in the base project. Thus, even with the update of the legal framework, the standardization of the main regulatory actions at the national level by ANA, and the coverage target and incentives to attract the participation of private capital, it is necessary to make improvements to universalize WSSs in rural and informal areas to benefit those who need them the most.

#### *4.2. Discussion of the New Regulatory Model and Recommendations for Improvement*

The regulatory model of the WSS sector developed in Brazil is not directly responsible for the market and policy failures in the evolution of the universalization goals predicted for the country and in the SDGs. However, until now, its contribution has been very low or even null. The WSS sector in Brazil is characterized by a highly complex system, mainly due to the continental dimension of the country and to the diversity of the WSSs in aspects such as a very variable availability of water resources, the population density and concentration, the unbalanced income of the population, the scope and scale problems of the WSS providers, the lack of financial resources, and land tenure issues, among others [43]. According to MDR, there are approximately 12 million household units that are illegal in Brazil, located in the surroundings of regular areas and very often excluded from public programs [44]. Furthermore, Brazil as other federal countries, has a multilevel governance system, including the federation (union), states and municipalities with overlapping roles that penalize the efficiency and effectiveness of the public policies for the WSS [45]. Thus, the challenge of universalization is huge.

The participation of the regulatory agencies in the implementation of public policy for WSS universalization can increase synergies between actors and contribute to the development of projects and the drafting of more complete contracts for the expansion of these services to also include vulnerable areas and to be efficient and effective to promote effective public participation in decision-making processes [46]. This improvement can reduce information asymmetry, stimulate the operationalization of the development agenda and prioritize the allocation of investments in poor areas, whether through tariffs or public resources. The exclusion of vulnerable areas in the local public policy is clear when analyzing the plans for WSS universalization in cities, where it is common to observe the allocation of projects only for regular urban areas and for which the 8 projects of BNDES are evident.

In a country with more than 5000 cities, where 74% have less than 25,000 inhabitants and only 6% have a population of more than 100,000, the challenge of integrating the scale

and scope of the WSSs and universalizing their access to the poor requires solutions that address this diversity. Public policy should be integrated and create solutions to enable the fulfillment of universalization goals, even if it is necessary to create groups of neighboring cities through public consortia and grant this service to a private initiative.

To address the challenges of universalization, it will be necessary to develop hybrid arrangements that can break through the barriers of the current WSS expansion model. The approval of the new regulatory framework defined the creation of national reference standards for the regulation of the WSS sector and constrained the granting of public financial resources to those who adhere to such principles. Basically, each city will have to organize and develop a project to universalize its WSSs by 2033, which will involve guiding the necessary investments, operating costs, and the need for revenue that ensures the financial and economic sustainability while keeping affordable tariffs. Thus, it will be necessary to align the application of public policies including those related to water, sanitation, social, urbanization, housing, and land tenure issues, among others. Furthermore, accessibility to some of these services will only be possible by combining public resources with the generation of tariff revenue. Therefore, hybrid regulatory arrangements concentrate expertise to meet this challenge and achieve the SDGs; strengthen the necessary relationships between regulators, municipalities, WSS providers, and customers; raise the level of governance of the sector with a positive impact on the structure of contracts, risk mitigation and increased performance; and increase coverage, quality and human development indexes. In this way, the participation of regulatory agencies in the development of projects and in the drafting of contracts is of the utmost importance for achieving universalization and the SDGs.

## 5. Conclusions

This research analyzes the provision of WSSs in vulnerable areas in Brazil and contextualizes the main models of regulation and their contributions to WSS universalization. The results obtained provide interesting lessons to improve the Brazilian status quo and, at the same time, can constitute good practices that can be applied in other countries. As one of the main conclusions of this research, we highlight the important contributions that regulation can make to the universalization of WSSs, provided that the regulation is aligned with public policies for the WSS sector.

Current policies for universalizing WSSs in vulnerable areas are important, but best practices indicate that expanding access for poor residents, in informal settlements or in rural areas, requires more robust institutional arrangements. Poor households generally live in highly vulnerable areas with different conditions of access, which implies unconventional structural actions. Regulatory agencies can play essential roles in this scope, but they need to be more proactive in defining clear rules for the universalization of WSSs in vulnerable areas and by participating in WSS expansion projects and in their 'contractualization' from the beginning (design stage). These hybrid arrangements, putting together regulation by contract and regulation by agency, are positive and should be encouraged by establishing clear responsibilities for institutions, by defining specific situations in contracts, and by encouraging providers to expand WSS coverage in highly vulnerable areas.

Although WSS regulation in Brazil preserves the fundamental principles of accessibility, quality, and affordable tariffs, little has been done to transpose this situation, either because of legal obstacles or contractual limits. The public policy of WSSs is the prerogative of the various levels of government, but above all, each of the municipalities is responsible for organizing the provision of WSSs in urban and rural areas, either regular or not. In this way, the participation of regulatory agencies in the implementation of public policy for WSS universalization comprises the establishment of ex post and descriptive rules that positively discriminate the most vulnerable population, encouraging the inclusiveness. Furthermore, they must participate ex ante in the development of projects and in the preparation and design of concession or PPP contracts with WSS providers.

The universalization of WSSs in rural and informal areas requires a series of joint efforts, investments and public contributions that need to be allocated primarily in more

vulnerable areas with greater social impacts to promote positive externalities and added value to correct this market failure and prevent the poor from continuing to spend more and enjoy worse quality services.

As was possible to observe, in the past, neither the different Brazilian governments nor the regulatory agencies have favored inclusiveness and pro-poor policies. Apparently, either by prioritizing the regulatory agenda of ANA or the ongoing BNDES projects promoted by the federal government, this panorama remains the same. In this way, the economic and social cohesion of the population will not be fulfilled, and the universal access targets will not be met. The situation will remain quite far from the goal, and the ongoing reform will most likely be unsuccessful.

**Author Contributions:** D.A.N. Investigation, methodology, resources, writing—original draft preparation. R.C.M. Conceptualization, methodology, writing—review and editing, supervision All authors have read and agreed to the published version of the manuscript.

**Funding:** This research received no external funding.

**Institutional Review Board Statement:** Not applicable.

**Informed Consent Statement:** Not applicable.

**Data Availability Statement:** Not applicable.

**Acknowledgments:** The first author recognizes the help of the Intermunicipal Regulatory Agency—AGIR/SC in his studies.

**Conflicts of Interest:** The authors declare no conflict of interest.

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