Evaluation of Agenda 21 implementation in Brazil: Chapter 18 – Protection of Water Resources Focused on Drinking Water Supply and Sanitation Case

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Abstract: This paper will evaluate if Agenda 21 assumptions and goals for drinking water supply and sanitation were accomplished by Brazilian Government from 1992 to 2015. The procedures adopted are to analyze documents of environmental and infrastructure institutions and compare sustainable development indicators. Finally, it is possible to conclude that the Brazilian Agenda 21, regarding the topic of water supply and sanitation, has been improving since 1992. However, it is necessary more investments to achieve the goals of services in quantity and quality for all regions.
Key words: Agenda 21, Drinking Water, Sewage.

1. Introduction

This paper will evaluate if Agenda 21 assumptions and goals for drinking water supply and sanitation were accomplished by Brazilian Government from 1992 to 2015. The main criteria used through this evaluation was the set of sustainable development indicators calculated by IBGE. The paper was motivated by the 25 years since the publication of the Agenda 21 baseline documents. Also, because Agenda 21 is an important environmental policy mark, it is necessary to discuss how the indicators of drinking water and sewage improved since this mark.

The methodology adopted is to analyze the data provided by environmental and infrastructure agencies from the Brazilian government and sketch a diagnose of Brazil's situation regarding sanitation and drinking water supply. First, the chapter 18 of the Agenda 21 is analyzed to understand why drinking water and sewage disposal are key components in the environmental policies (section 1.1). Then, a brief analysis of the existing historical data for drinking water and sewage disposal services in 1992 is made, in order to show a panorama of these services in the publication of the baseline documents of the Agenda 21 (section 2). After this, it will be presented the evolution of the indicators from 1992 to 2015 (section 3). Finally, the future of the Agenda 21 is assessed, discussing if the Brazilian government is in the right way to accomplish its own goals for drinking water supply and sanitation (section 4).

1.1 Drinking water supply and sanitation as protection actions for quality of water resources

Agenda 21 is an action program in order to promote a global partnership for sustainable development. It was the product of the United Nations Conference on Environment and Development held in Rio de Janeiro in 1992. The Global Agenda

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21 has four sections, the second one refers to the conservation and management of resources for development. Within this topic, the Chapter 18 is dedicated to guiding countries and communities on the application of integrated criteria in the development, management and use of water resources as a way to protect their quality.

Chapter 18 emphasizes importance of water resources as an indispensable component in terrestrial ecosystems and how the water resources are necessary in all aspects of life. The objective of Chapter 18 is to ensure an adequate supply of water and a minimum quality, preserving the functions of water in ecosystems (U.N., 1992).

The existing scenario is: pollution, contaminations, scarcity and lack of environmental policies and of demand management are the usual situations around the world. In order to achieve the aforementioned objectives, the integrated planning and management of water resources is essential to their preservation, especially because it's a multisector and multiple interest issue (U.N., 1992). To overcome this situation, the Chapter 18 is divided into seven specific areas, one of them being devoted to water supply and sanitation. Each of those areas presents guidelines to programs and policies, to help the countries improve their indicators.

The specific section about supply of drinking water and sanitation is based on the fact that drinking water and quality and sanitation actions are essential in the environment, in health and to overcome poverty. Water-borne diseases and deterioration of water quality are problems resulting from the inadequate disposal of human excreta and sewage. Despite efforts such as the Mar del Plata Plan of Action for access to drinking water, one in three people in regions such as Africa and Latin America do not have safe drinking water and sanitation (U.N., 1992).

The activities suggested by the Agenda 21 document deal with the environment and public health; People and institutions; National and community management; and awareness, information and public participation. As far as environment and health are concerned, the most important activities are protecting the sources of water for supply and providing sewage treatment and the expansion of these services. About people and institutions, the encouragement of user participation in water development and management, influencing the decision making and planning, is advised, as well as the development of human resources, especially women, is encouraged. For national and community management activities, great importance is attached to the management, participation, and support for local communities to manage their water systems in an integrated manner with other policies and to pay more attention to the peripheries and encouraging waste reduction and rational use of water (UN, 1992). Within this set of activities, it is possible to perceive that community participation, not only as an advisory body, but also in planning, decision making and management is strongly encouraged.

To accomplish the activities proposed by Agenda 21, it is necessary to develop the scientific, technological, and human resources, and to strengthen the institutions. The document also emphasizes that training in equipment, water resources management and special sanitation for women should be available, reflecting the importance of women in sanitation actions. Finally, focusing exclusively on institutional development, the Global Agenda 21 reinforces the need for a higher degree of community participation, especially for women, in water supply and sanitation projects. The document also highlight that this is a national responsibility,

where technical cooperation among developing countries is essential and effective in terms of experience and cost (U.N., 1992).

At the end of the chapter 18, it is possible to see how the participation of communities in all steps is essential for the protection of quality and the supply of water resources. To the Agenda 21, the community should be consulted, but also trained and involved in the planning, implementation, processes of continuous improvement and monitoring of all projects involving the supply of drinking water. All these statements must be integrated through a national policy, since drinking water and sewage services are a national responsibility.

2. Basis for actions on drinking water supply and sanitation in 1992

The first act that corroborated with Agenda 21 in Brazil, in the 1990s, was the creation of the Commission for Sustainable Development Policies and the National Agenda 21 (CPDS). The CPDS purpose was to leading how Brazilian Agenda 21 will put in practice. However, the Agenda 21 base document was only published in March 2000. The first edition of the set of documents "Brazilian Agenda 21: Priority Actions" and "Brazilian Agenda 21: Results of the National Consultation" were also published in March 2000. Finally, the "Indicators of Sustainable Development", published by Brazilian Institute of Geography and Statistics (IBGE) in 2002, is classified by the author as a basic document for the discussion on actions in drinking water supply and sanitation since the focus of the book is close to Agenda 21 principles.

2.1 Document "Brazilian Agenda 21: Basis for Discussion Document"

The "Brazilian Agenda 21: Basis for Discussion Document" demonstrate that the population service levels for sanitation services are very low. Also, there was high social inequality between metropolitan areas in all regions of Brazil (CPDS, 2000).

It was possible to recognize in 2000 that the universalization of the water supply and sanitation services was the biggest challenge, especially when it is assumed that universalization concept includes the guarantee of supply and compliance with quality standards (CPDS, 2000). The large waste of potable water on public supply systems is emphasized by the baseline document: the loss is around 2.08 billion m^3 per year, approximately 45% of the volume supplied to the population (CPDS, 2000).

The privatization of sanitation services is considered an alternative among sanitation entities. The baseline document discusses the tendency of privatization of sanitation services although there was a big lack of mechanisms that would regulate sanitation services (CPDS, 2000, p.39). About this issue, one solution indicated by the document as being of great importance is the creation of mixed sanitation companies: the public power holds the controlling shareholder and the regulation, and the private entity takes part of the building and operation of the sanitation services (CPDS, 2000).

2.2 Framework of water supply and sanitation services through sustainable development indicators.

IBGE´s surveys in 1992 and throughout the whole 1990s did not give details about water supply and sanitation services in Brazil. According to Saiani and Tonedo Júnior (2010), the volume of households with access to water decreased and sewage service collection increased during the 1990s.

In 1995, the Ministry of Health demonstrate that 30% of the population is supplied by water from inadequate sources, and even when it supplied by the public network, there is no guarantee that water meets the quality and quantity daily. It also indicates that the Brazilian sanitation sector does not have a clear definition of the obligations of each federative entity, although the Union and State play an important role in sectors such as planning, financing and articulation of sanitation services (Ministério da Saúde, 1995).

In 1996, the Commission for Sustainable Development (CDS), which is part of the United Nations, published the well-known Blue Book. It is a handbook of sustainable development indicators with their respective methodologies and guidelines (IBGE, 2002). Based on this document, the IBGE built the study "Indicators of Sustainable Development", and its first publication in the year 2002, which brings data on Sewage Collection and Water Supply in its environmental dimension chapter.

According to IBGE (2002), the percentage of residents of private households with access to water supply system was in the range of 90% for the urban population and slightly more than 10% in the rural area. It should be noted that for the research, adequate access means access to the general supply network. In Figure 1, below, it can see the evolution between 1992 and 1999 of drinking water supply. The y axis is showing the percentage of houses with drinking water supply and the x axis is showings the years. About sewage, in 1992, 45.5% of urban population were connected to the sewage collection network, 20.4% had a septic tank, 27.8% adopted another type of sanitary sewage disposal, and 6.3% did not have defined disposal (open defecation disposal) (IBGE, 2002). In Figure 2, it is possible to observe the evolution of the numbers of sewage collection between 1992 and 1999: the y axis is showing the percentage of each kind of sewage disposal and the x axis is showing the years.
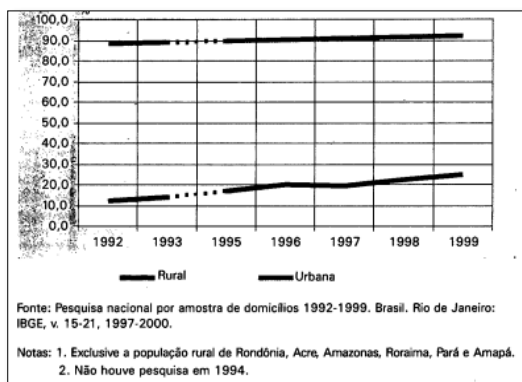

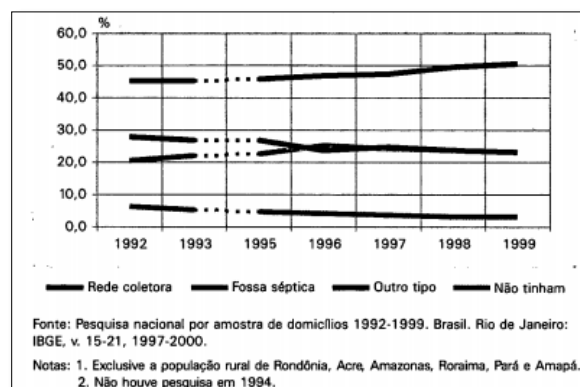**Figure 1 -** Drinking water supply in Brazil between 1992 and 1999 (IBGE, 2002).

Figure 2 – Sewage Collection in Brazil between 1992 and 1999. (IBGE, 2002).

Figure 1 shows a positive percentage of water access in the urban environment, since it shows that in 1992 the universalization of access to the service was close. Analyzing Figure 2, it is possible to identify that the collection sewage

scenario is far from desirable, especially because it is about the collection of sewage, not its treatment. It is also an urban area framework. The same study shows that 49% of the rural population in 1992 did not have any type of sewage disposal, and 40.7% disposed their sewage in another way than a collection network or septic tank (IBGE, 2002).

The study also indicated significant differences in the coverage of services between the regions of Brazil. While the urban population of the Northeast region appears with only 33.4% of sewage collection network, the urban population of the Southeast region already achieved 78.4% of sewerage network coverage (IBGE, 2000). Regarding drinking water supply, 63% of the urban population in the North Region had water supply through the general network, while in the Southeast 94% of the urban population already had this kind of service (IBGE, 2000).

3. Evolution: from 1992 to 2015

Based on the framework of the sanitary sewage and water supply detailed in the previous topic, a set of plans and programs were written from 1992 to 2015, as well as the regulatory base for sanitation services.

At the first half of the 1990s, the most outstanding program in financing sanitation activities was called "Pró-Saneamento", whose goal was to improve the sanitation conditions for low-income families (Saiani and Tonedo Júnior, 2010). The purpose of this program was to promote the integration of sanitation with other policies, and had as its operator and financial agent a public bank called Caixa Econômica (Rezende and Heller, 2008). From 1995 until the early 2000s, investments in the Sanitation Sector Modernization Project (PMSS), which together with the Concessions Law, supported the participation of private capital in sanitation (Rezende and Heller, 2008). In 1996, the first Publication of the Basic Sanitation Research Program (PROSAB), funded by institutions like Finep, CNPq and CAPES, was to promote the development of research in sanitation technologies (Saiani and Tonedo Júnior, 2010).

Regarding rural sanitation, in 1996 a program called Integrated System of Rural Sanitation (SISAR) started in Ceará State, which is one of the best experiences in rural sanitation in Brazil. The SISAR goal is to maintain and operate small systems of treated water and sewage disposal under the guidance and training of the state sanitation company (for Ceará State, Cagece), in a self-sustaining and community-operated way (Rezende and Heller, 2008, Cagece, 2016). There is macromediation of water production and micromediation in each household, and the bill is below the usual urban water bill. In addition, each SISAR has a Main Assembly, Board of Directors, Fiscal Council, Technical Audition and Executive Management Team, where members of the participating resident's associations (Rezende and Heller, 2008) are part of the General Assembly.

In 2005 the National Water Agency (ANA) published the Atlas of Urban Water Supply. The Atlas can be consulted on the Internet[2] and includes data about the total number of municipalities studied, the forecast demand of water, number of sources and systems, supply and demand assessment, and the investment needed for an adequate supply of water.

In 2007, Law No. 11,445 / 2007, after regulated by Decree No. 7,217/2010, designed the political-institutional framework of sanitation services. These set of laws

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[2] http://atlas.ana.gov.br/Atlas/forms/Home.aspx

established the national guidelines for basic sanitation. Some important definitions and goals are in this law:

- the definition that the term "sanitation" incorporate drinking water supply, sewage collection and treatment, urban drainage, and solid waste management;
- the ownership of the services is of the municipality;
- the incentive to reduce water consumption and waste;
- and the establishments of the National Sanitation Plan (PLANSAB), which will guide investments in sanitation services and infrastructures in the next 20 years.
  About Law No. 11,445 / 2007, other points earn mention, such as:
- The fundamental principles of sanitation in Brazil would be: universal access, integrality, the provision of the four services, articulation between policies, efficiency and economic sustainability, social control, among others;
- Establishment of the Federal Sanitation Policy (PFSB), whose guidelines are social and territorial equity, regulation of services, use of indicators in planning and evaluation, adoption of the watershed basin as a planning unit, stimulate cooperation between municipalities, among others;
- Requirement of the Municipal Plan of Basic Sanitation, covering at least diagnosis of the situation; Short, medium and long term goals; Programs, projects and actions to achieve these goals; Actions for emergencies and contingencies; Mechanisms for evaluating efficiency and effectiveness.

From an operational point of view, it is worth highlighting as a mark in 2011 the approval of Ministry of Health Ordinance nº. 2,914/2011, a revision of Ordinance Nº. 518/2004, which brings the most recent regulation on procedures for the control and surveillance of drinking water standards. Some of the innovations were the change in the turbidity standard, the obligation to evaluate saxitoxin, and to establish a set of actions that health secretariats should take in cases of fecal-oral transmission diseases (Ribeiro, 2012).

PLANSAB was developed in 2013 and published in 2014. Its diagnosis brought innovations because it redefined the characterization of access and access deficit for water supply, sanitary sewage and solid waste management (Ministério das Cidades, 2013).

For water supply, it is considered adequate supply of drinking water (according to the ordinance of the Ministry of Health in force) with internal piping and without intermittency. Regarding to sewage service, it is considered appropriate to collect the sewage and treat it (or use of septic tank). Regarding the solid waste management, it is assumed "adequate" the direct collection in the daily or alternated and landfills as final destination in urban areas. About the rural areas, indirect collection is also accepted as adequate service (Ministério das Cidades, 2013).

Based on these concepts, and crossing data from IBGE, National Information System on Sanitation (SNIS) and PNSB, PLANSAB identified that only 59.4% of the population has adequate water supply; 39.7% in terms of sewage disposal, and 58.6% have adequate solid waste management (Ministério das Cidades, 2013). These values are lower than those verified in 1992. However, the values of the 1992 survey consider as adequate service conditions broader than those stablished by PLANSAB. One of the major reasons that make water supply inadequate from the point of view of PLANSAB is the intermittence, as we can see in Figure 3 below.
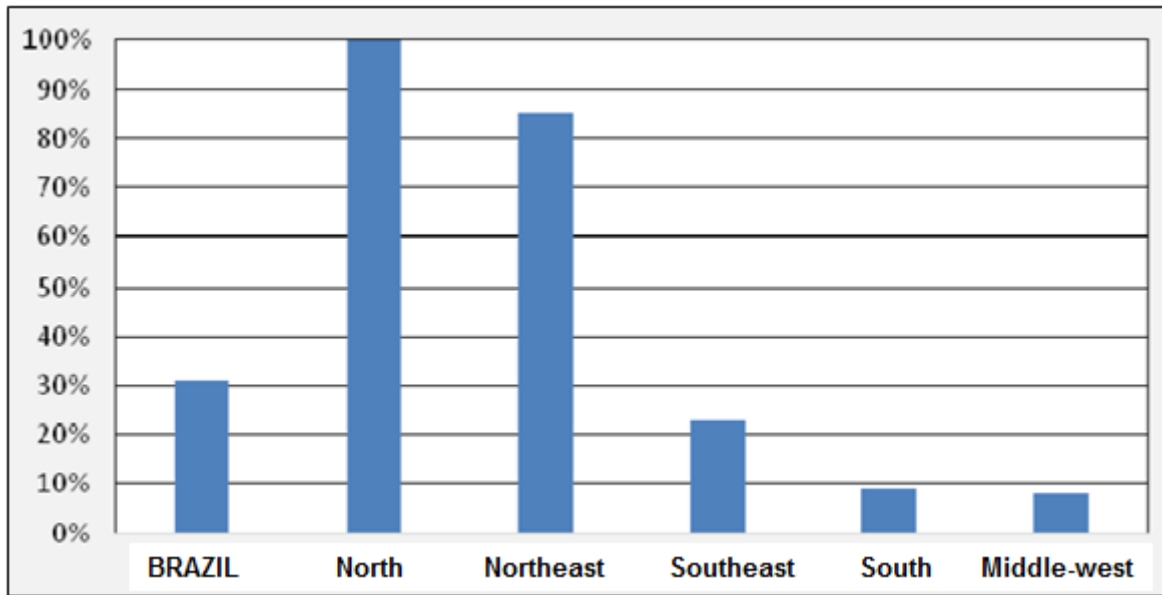
Figure 3 – Percentage of houses that experiences intermittency in Brazil and Regions North, Northeast, Southeast, South and Middle-West, from left to right (Ministério das Cidades, 2013).

Analyzing figure 3, it is possible to notice that the North and Northeast regions are the most affected by intermittency, reaching the point in the north that all residences suffer with intermittency in different ways. The figure and also PLANSAB data show that although the numbers above show a wide range of drinking water services, the fact is that most of Brazil has a supply service that is frequently hit by intermittency and whose drinking water standard of quality is not always achieved.

Regarding the sewage disposal, an important data to be analyzed is the referring to their disposal, in figure 4, below.
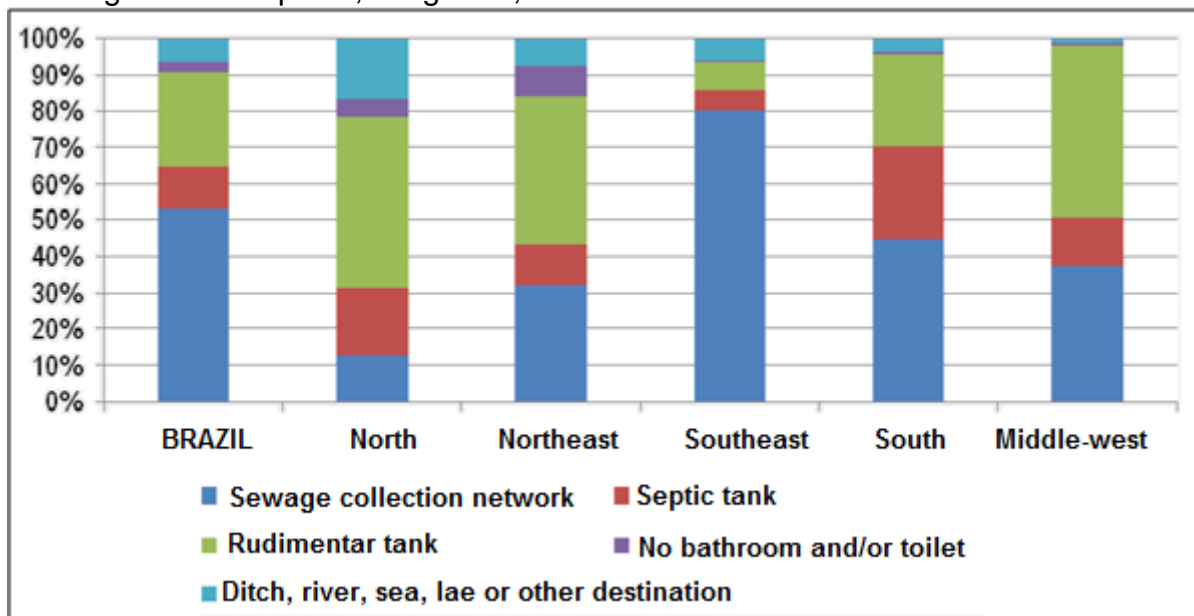

Figure 4 - Practices used to evacuate sewage, in percentage of population, by region and whole Brazil (Ministério das Cidades, 2013).

It is detected that a significant part of Brazil (around 25%) still uses rudimentary septic tank as a way to sewage disposal, where the North, Northeast

and Middle-west regions destine around 50% of their sewage in rudimentary pits. Sewage service in these regions, although not being classified as open defecation, has as final destination a technique that does not reduce the organic loads of its sewage.

Regarding investments in sanitation, the National Information System on Sanitation (SNIS) provides the most updated data referring to investments. Among the various data available, the one chosen by the authors of this article to be presented was the investment framework according to the origin of the application: own resources (generated by internal cash), costly (financing resources), and non-expensive (non-repayable) resources.

Table 1 – Investments in sanitation infrastructure in 2014, according to SNIS (information provided by sanitation services providers) (SNIS, 2016).

Region	Own Resources	Costly Resources	Non-expensive resources	Total	
	(R$ mi)	(R$ mi)	(R$ mi)	(R$ mi)	(%)
North	105.5	142.6	164.5	412.6	3.4
Northeast	835.8	195.1	1,065.9	2,096.8	17.3
Southeast	4,008.3	1,906.9	712.9	6,628.1	54.7
South	1,027.3	655.7	101.5	1.784,4	14.7
Middle-West	411.1	642.2	131.8	1,185.0	9.8
Brazil	**6,387.9**	**3,542.4**	**2,176.6**	**12,106.9**	**100%**
	52.8%	**29.3%**	**18%**	**100%**	

The Southeast region received the largest investments by own resources and costly. The Northeast region was the one that received more investments of non-expensive resources. Analyzing the whole Brazil, more than half (52.8%) of the invested resources are owned. The research highlight that the providers provide the data presented in SNIS which can result in a misrepresentation of the data source (SNIS, 2016). Despite the fact that it presents the highest rate of sewage withdrawal due to rudimentary septic tank and the region with the largest number of economies affected by intermittent water supply, the North region was also the one that received the least amount of investments, according to the SNIS survey (Table 1, above).

There is also a large application of non-expensive resources in the Northeast, which may mean two possibilities: the first one, in 2014 there was a priority in the application of direct resources from the Federal Government and without any counterpart in this sector; the second one, the sector is so deficient in the region that it cannot keep up without the help of non-costly resources. On the other hand, the Southeast region received more investments from onerous resources and from own investment. This region has high water supply and sewage treatment rates and well-developed systems, which may justify the source of the investment resources, since the system can maintain itself and therefore does not require non-expensive resources.

Below, in Figure 5, the evolution of total investments for water and sewage services, according to SNIS data, between 2004 and 2014 follows.
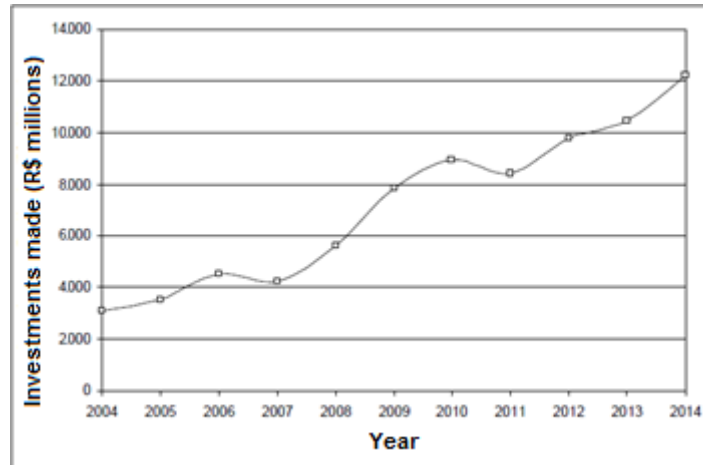
Figure 5 – Evolution of total investments done in drinking water and sewage from 2004 to 2014 (SNIS, 2016)

From Figure 5, it is possible to conclude that the period between 2004 and 2014 was marked by the increase in total investments in sanitation, except for the years of 2007 and 2012, when there was a drop in investments when compared to the respective previous years. PLANSAB indicated between 2014 and 2018 that 87,466 million Reais in drinking water and sewage disposal must be invested to reach the goal established by the plan (Ministério das Cidades, 2013). This represents around 17,493 million Reais each year, which means around 5 million more than was invested in 2014, the year of the largest investment in the sector in the last decade. Even with successive increases in investments, the deficit in sanitation, in order to reach PLANSAB's targets, needs a greater increase in the total amount applied to drinking water and sewage services.

Finally, the most recent program for the development of the water sector is called Interáguas, a partnership between the World Bank, Ministry of Environment, Ministry of National Integration and Ministry of Cities. The program aims to strengthen water management as a way to increase the efficiency of its use, increase its supply in quantity and quality, and collaborate with the application of public resources in the water sector. The program aims to invest US $ 143,110 million by 2016 in five components: water resources management; Water, irrigation and civil defense; Water supply and sanitation; Intersectoral actions and integrated planning; and management, monitoring and evaluation (Ministério do Meio Ambiente, 2010).

4. How will be the future?

According to Law No. 11,445/2007, PLANSAB should establish the goals for all sanitation services, with these goals being in short (2018), medium (2023) and long (2033) term. Based on 13 indicators, progressive targets were established for each of the regions, and also for Brazil. Long-term targets for water supply are expected to universalize urban households, reduce the loss rate by 8%, and expand the percentage of supply services that charge a fee for the service to 100%. As for sanitary sewage, the goal is that, in terms of Brazil, 93% of the sewage collected is treated, and that 100% of urban and rural households with incomes of up to 3 minimum wages have hydrosanitary units

PLANSAB also surveyed the investment needs for expansion and replacement (for existing infrastructures) of drinking water and sewage services, identifying actions and nature of investments. A total of 34,938, 73,457 and 122,149 million Reais are expected to be invested in water supply by 2018, 2023 and 2033 respectively. In terms of sewage disposal, there is a need for 52,528 (for 2018), 94,736 (for 2023) and 181,893 (for 2033) million Reais respectively, (Ministério das Cidades, 2013). In Figure 6, following, the need for investments in terms of structural actions according to nature is made explicit, as well as the percentage of the total investment that PLANSAB recommended.
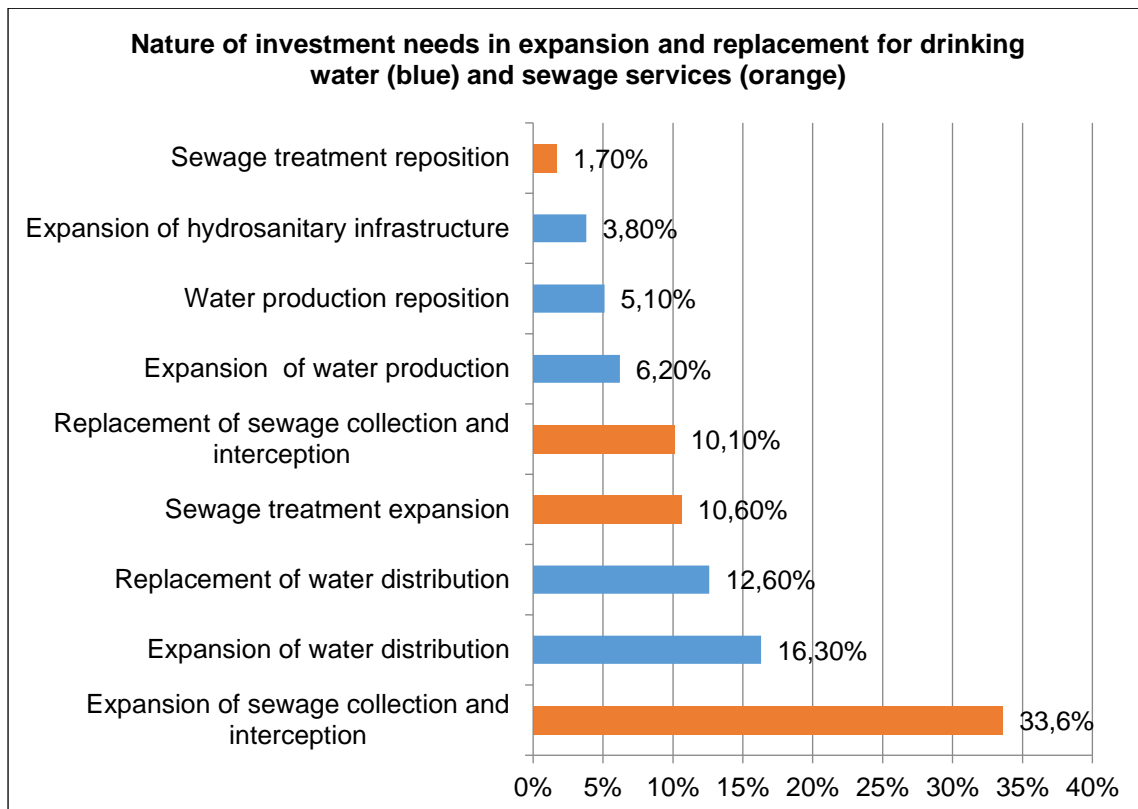

Figura 6 - Nature of investment needs in expansion and replacement in Brazil, form 2014 to 2033, for drinking water and sewage services, %, (Ministério das Cidades, 2013).

From Figure 6 we see that, after almost twenty years of Rio-92, the need for investments in expansion of the collection and interception of sewage disposal is indicated as the activity that most needs investment between water supply and sewage activities. The second activity that most needs investments is the expansion and distribution of water, reinforcing the fact that the universalization of services is still the great challenge to be faced in relation to water supply and sanitary sewage.

As for Interáguas program, actions such as regular monitoring of river water quality, enough human resources in the watershed basin agencies, establishment of the institutional arrangement of the Tocantins-Araguai Basin, among others, must be completed and receive investments by the end of 2016 (World Bank, 2016).

5. Conclusions

The Global Agenda 21 topic on drinking water supply and sanitation was adequate to the Brazilian reality and a challenge needed to be faced by the country in 1992. In this way, it was of great importance the Brazilian Agenda 21, to put in practice the actions related to water supply and sanitation in investments and planning.

What can be seen from the evolution of sanitation activities from 1992 to 2015 is although total investment has progressively increased over the years, unequal conditions for sanitation and water supply between regions are the same identified in 1992. Since the signature of Brazilian Agenda 21, improvements in the legal and institutional framework, as well as new planning and diagnosis practices for the real situation of sanitation services (including data intermittent services, for example), have contributed to improve sanitation in Brazil and to make better investments in this sector. However, the need for investments in the installation, expansion and maintenance of water and sewage infrastructures in Brazil is urgent: the deficit and inequalities between the regions are big and it needs to be overcome. Although the data show a great need for structural measures, it is worth mentioning that structuring measures, i.e., those that aim to provide managerial and management support in the provision of services, must also be applied, in order to guarantee the sustainability of services and their organization.

Regarding rural sanitation, it is clear that the one wanted in the Global Agenda 21 in 1992 is still far from being met. There are few programs for rural sanitation, although SISAR's experience has been successful. PLANSAB has a specific program for basic sanitation actions for the rural population and traditional communities, but the National Rural Sanitation Program started only in September 2015.

It is also noted that the goals established in PLANSAB are of great importance to expand and provide quality sanitation services, as well as being the baseline for monitoring and supervising the building of the planned works. However, it is not yet possible to monitor the evolution of the indicators, since a new and more updated national survey on basic sanitation has not yet been launched, so it is still not possible to state whether the planned actions have gone out of print.

Finally, it is possible to conclude that the Brazilian Agenda 21, regarding the topic of water supply and sanitation, has been developing and growing up since 1992. This development happened not only about service and quality, but also from the institutional point of view, although more investments are needed to achieve the universalization of services in quantity and quality for all, in all regions.

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