

# Diagnosis of the Selective Collection Practice in the Northern Region of Brazil

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Abstract: The Brazilian National Solid Waste Policy established the premise of environmentally proper disposal of solid waste, for which it is necessary to provide an efficient service that considers the generation of the material. For the correct management of these wastes, selective collection plays a key role, but public administrations still largely disregard it. The improvement and greater coverage of this service depend on a pertinent analysis of the current situation, observing the regional differences and peculiarities existing in Brazil. The results of studies based on research from reputable and consolidated organizations such as the SNIS, ABRELPE, and CEMPRE, in addition to revealing a discrepancy between the data, show that there is still undersized regional information in the selective collection and that in the North region of the country, the existing data is precarious, and the scope of the service is incipient. This study offers a preliminary diagnosis on the offer of selective collection in the North of Brazil, pointing to the need for improvement since the number of municipalities that offer the service is far from the data presented in the South and Southeast national regions.

Key words: solid waste, selective collection, management

# **1. Introduction**

The management of urban solid waste is currently one of the biggest challenges to be faced by Brazilian municipalities. The search for solutions to the waste problem has become urgent due to increasing consumption among the population and, consequently, materials discarded in the environment. The inappropriately accumulated or deposited waste also creates dangers to public health.

Given this scenario, one of the alternatives to subsidize the proper disposal of waste, promoting the reuse of resources, is the selective collection. The National Solid Waste Policy (PNRS) has as its principle the recognition of reusable and recyclable solid waste as an economic and social value, generator of work, income, and promoter of citizenship [1]. Therefore, this activity has gained notoriety for its contribution to the correct management of different types of waste.

The PNRS is considered a legal framework for the solid waste sector in Brazil, and this year completed a decade of its enactment. However, in line with the thinking of Eigenheer [2], when he states that, in Brazil, there are difficulties in establishing a broad and systematic overview of the issue of urban cleaning because it is a continental country that has developed very unevenly, and that their cities still maintain profound regional, cultural and income differences. Due to this, it is necessary an evaluation whether public policies showed efficient results, considering the demands and specificities of the different realities in distinct country regions. The North region, which has an extensive territorial area, some of them with difficult access and a small population density, may not share the situation of the Southeast region, for instance, which has the highest population density in the country and which the large urban centers are concentrated.

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National data or data from the most frequently cited regions in the media, where the preponderance of studies concentrate, such as the Southeast region of Brazil, may not be consistent with the reality of other national regions. The improvement in selective collection services in the North region is related to the regional evaluation of quantitative and qualitative elements offered. Therefore, municipal administrators and others involved can visualize the current panorama and thus understand where they need to invest more.

In this context, we sought to draw a diagnosis of the practice of selective collection in the North of Brazil. The base of the diagnosis is the assessment of data collected in the National Sanitation Information System (SNIS), of the Brazilian Association of Public Cleaning Companies and Special Waste (ABRELPE), and in the materials made available by the Business Commitment to Recycling (CEMPRE), to assist in decision-making and promote the improvement of selective collection in this region.

#### 2. Literature Framework

According to Gonçalves Dias [3], the contemporary world has a voracious appetite for resources and energy that has been relentlessly increasing to fulfill established production and consumption patterns. Therefore, waste disposal also grows, accelerated by the programmed obsolescence of manufactured products and by the multiplication of new models and versions constantly made available to the public, assuming uncontrollable proportions and making the management of this waste an environmental challenge of unprecedented dimensions.

The inadequate management of urban solid waste relates to crucial environmental and health impacts on the population [4]. Thus, the PNRS [1] determines to observe the following priority order: non-generation, reduction, reuse, recycling, solid waste treatment, and environmentally appropriate final disposal of waste. Consequently, it is necessary several steps before the final waste disposal. Thus, reducing the mass and use of materials, preserving natural resources, protecting the population's health, and reducing the burden of services to be provided by public administrations.

The waste management process starts with the pre-consumption intention, related to the need and type of material chosen (whether recyclable or not). After consumption, the product gains numerous possibilities for reuse or recycling, which consists of the transformation of the object into raw material to be reinserted in the production process. When exhausted with all these possibilities or rejected the material, the waste should be sent to the landfill.

Therefore, the efficient selective collection service is essential not just as a differentiated collection of the garbage but a cycle that begins with the generation and disposal of waste and gets complete with the recyclable material being re-used in a new production process [5]. Thus, selective collection can occur with the waste generated and disposed of in front of houses, public places (for door-to-door collection), or Voluntary Delivery Points (PEVs). The materials must be pre-selected and packaged to guarantee the integrity of potentially usable materials.

There are several ways to carry out the integrated management of solid waste. It is necessary to know the reality in which it is inserted for decision-making and quality public service. Due to being efficient, it must meet the demand and characteristics of territorial areas of the municipalities and their regions.

Brazil is territorial extensive, and its five regions have very distinct environmental, cultural and economic characteristics. The North region, composed of seven states (Acre, Amapá, Amazonas, Pará, Rondônia, Roraima, and Tocantins), has the most considerable territorial extension, according to IBGE, it comprises an area of 3,853,676,948 km, about 45% of the national territory. However, it has the lowest demographic density in the country. Its population is approximately 18,182,253 million inhabitants, and the demographic density is 4.72 inhab./km<sup>2</sup>, while the Southeast region has the highest demographic density, 92.025 inhab./km<sup>2</sup>.

It is essential to know the diagnosis of the current waste management process for suggesting improvements in selective collection practices, as well as the environmentally sound management of solid waste in this region.

## 3. Material and Methods

The research on selective collection had as a source of information the 17th Diagnosis of Urban Solid Waste Management 2018 by the SNIS, the Panorama of Solid Waste in Brazil 2018/2019 by ABRELPE, and the data shown in the research Ciclosoft 2016 by CEMPRE. Credible institutions in the solid waste area, and consolidated research works, created the selected instruments for analysis.

The National Sanitation Information System (SNIS) is a database created in 1996 on the operations, management, finances, and quality of water, sewage, and solid waste disposal services in Brazilian municipalities, linked to the federal government by the Ministry of Regional Development. The selective collection is evaluated annually in the Urban Solid Waste Management Diagnosis [6].

ABRELPE is an association founded in 1976 by pioneering entrepreneurs in the solid waste collection and transport activities field. It carries out studies and publications, for instance, the Panorama of Solid Waste in Brazil, established in 2003, producing data on generation, collection, final disposal, and many other aspects of solid waste management in the country, including selective collection [7].

The Business Commitment to Recycling (CEMPRE), created in 1992, just as ABRELPE, is a private non-profit organization dedicated to promoting recycling within the concept of integrated waste management. CEMPRE develops publications such as manuals, technical guides and holds seminars. The CICLOSOFT survey, used in this analysis, makes a biannual survey started in 1994 and dedicated exclusively to waste selective collection [9]. Although there is a study for 2018, the content is not available on the CEMPRE website, so this research analyzed the 2016 survey.

For investigation, this paper used regional data for Northern Brazil, including some national data as a comparison for discussion. The surveys were not all carried out in the same year. Nevertheless, they have temporal proximity, allowing a parallel for the intended diagnosis creation.

# 4. Results

Research sources represent the results of selective collection in Northern Brazil. First, the elements obtained from the SNIS [8] are expressed, then the data from ABRELPE [7], and finally from CEMPRE [9].

The SNIS considers only selective collection carried out by companies with some relationship with the City Hall. Information about "autonomous" associations in the sector, scrap dealers, and independent collectors are not included due to the lack of data and formalization of their activities with the municipality [6].

The North region has 450 municipalities, but only 233 participated in the study. For the indicators presented, only five of them have components per region.

This indicator refers to the number of municipalities that carry out selective collection relating to the population served. Concerning the existence of the mentioned service under any modality (door-to-door, voluntary delivery stations, or other modality), of the 233 municipalities that are part of the sample, only 33 perform the service (14.2%). There are only 24 municipalities that carry out the collection in the door-to-door modality, serving a population of 1,271,743 people (Table 1).

Regarding the amount of waste collected in the 33 municipalities that carry out the selective collection in the North region, the general mass was 51,174.4 tons per year. The amount collected on average was 1,550.7 tons per municipality per year. On the other hand, the

per capita mass was 8.0 kg per inhabitant per year (Table 2).

Concerning the executing agent of the selective collection service in the North region, 49.9% of the municipalities it is carried out by companies contracted by the city halls, 44.3% by collectors with the support of the city hall, 5.4% is made by the city hall itself and 0.4% by agents in partnership with the city hall (Table 3).

In the North region, according to SNIS, there are 53 cooperatives and associations of collectors that carry out the selective collection in the municipalities. These cooperatives correspond to 4.3% of entities in Brazil,

with 1,685 members, representing 6.2% from all over the country. Thus, the average number of members per cooperative is 31.8 (Table 4).

According to data presented by ABRELPE in 2018, of the 450 municipalities that make up the North region, 286 have selective collection initiatives. This number points to an increase compared to the previous year, 2017, and 164 do not have any initiatives regarding selective collection (Table 5).

According to CEMPRE in the Ciclosoft 2016 survey, 14 municipalities in the North region carry out selective collection, corresponding to 1% of the share of cities in Brazil (Fig. 6).

Table 1Scope of the RDO (Domiciliary Waste) selective collection service in the municipalities, by modality, according to<br/>geographic macro-region.

Macro region	Number of municipality in the sample (with or without selective collection)	Urban population of the sample	Municipalities selective colle under any mod	with ction alities	Municipalities with door-to-door selective collection carried out by the City Hall or contracted company or by collectors with support from the City Hall			
		municipalities		Absolute value		Relative value (%)		
		(with or without selective collection)	Number of municipalities	(%)	Number of municipalities	Urban population served	Number of municipalities	Urban population served
North	233	10,767,373	33	14.2	24	1,271,743	10.3	11.8

Source: 17th Diagnosis of Urban Solid Waste Management [6].

 Table 2
 Scope of the RDO (Domiciliary Waste) selective collection service in the municipalities, by modality, according to geographic macro-region.

Macro region	Quantity Collected (Ton./year)		Per capita mass collected in the municipal average selective collection (Ton./mun./year)	Per capita mass selectively collected (kg/inhabitant/year)	
North	51,174.4	33	1,550.7	8.0	

Source: 17th Diagnosis of Urban Solid Waste Management [6].

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Table 3 Scope of the RDO (Domiciliary Waste) selective collection service in the municipalities, by modality, according togeographic macro-region.
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Macro	Number of	By City Hall	By companies contracted by the	By collectors with support from the
region	municipalities	(%)	city (%)	city hall (%)
North	33	5.4	49.9	44.3

Source: 17th Diagnosis of Urban Solid Waste Management [6].

Table 4	Number of cooperatives	and associations of collect	ors operating in the n	nunicipalities partici	ipating in the SNI	S, by
geograph	nic macro-region.					

Macro region	Number of collectors' cooperatives/associations	Percentage of entities (%)	Number of members	Percentage of members (%)	Average number of members per cooperative/association
North	53	4.3	1,685	6.2	31.8

Source: 17th Diagnosis of Urban Solid Waste Management [6].

Selective collection	2017	2018
Yes	270	286
No	180	164
Total	450	450

Table 5	Number of	f municipalities	with selective	collection	initiatives	in the l	North Region.

Source: Overview of Solid Waste in Brazil (2018/2019).



**Fig. 1** Regionalization of municipalities with selective collection in Brazil. Source: Ciclosoft Research (2016).

### 5. Results Analysis

With the elements expressed in the surveys consulted, it is possible to verify that the North region has the smallest number of municipalities (33) that practice selective collection in Brazil, being ahead in percentage (14.2%), only the Northeast region that had a sample of 799 municipalities, of which 81 carry out the selective collection in any modality (10.1%). According to the SNIS, it is evident that the incidence of this service is higher in the South macro-region, where more than half of the municipalities (58.6%) participants declared having a selective collection, covering 74.0% of its urban population, followed by the Southeast macro-region, where this percentage is 42.3%. In an intermediate position is the Midwest region, with 28.4% of the municipalities practicing the selective collection. There is also a gap between the realities of the South and Southeast macro-regions and the others. In the North and Northeast macro-regions, the percentage of municipalities with selective collection corresponds to half the result of the Central-West macro-region (Table 7).

According to ABRELPE, the North, the region with the lowest population density in Brazil, generated during the year 2018 16,073 tons of municipal solid waste per day, collecting 81.31% of them. Of the total collected in the 450 municipalities in the region, more than 4 thousand tons per day ended up in dumps: a percentage of 35% — the highest rate among all analyzed territories. The municipalities in the North invested a monthly average of R\$ 8.16 per person in the collection of MSW and other urban cleaning services, moving almost R\$ 2 billion in the year and generating more than 24 thousand jobs. Compared to other regions, the North Region is ahead of the Northeast and Midwest in terms of the number of municipalities that have initiatives in the selective collection and are well behind the South and Southeast regions (Table 8).

The CEMPRE survey shows the smallest number of municipalities practicing selective collection in the North region, only 14, representing the lowest percentage in Brazil.

It is possible to notice a discrepancy between the data from the three sources of this research. It may occur due to the methodological differences of each analysis.

#### 6. Conclusion

The investigation and data analysis reveals that selective collection is still very incipient in Brazil, and in the country's northern region, the condition is even worse and far from the coverage numbers of the South and Southeast regions. Despite the importance of the correct solid waste management, which is a relevant generator of employment and income, municipal public administrations do not value it enough. Furthermore, a large amount of material that could be reused, transformed, and reinserted into the production chain ends up wasted.

When these inputs are not selected and collected efficiently, they are destined for landfills, reducing their useful life and increasing municipal expenses, not to mention when they are deposited in dumps or inappropriate places, causing damage to the preservation of natural resources and the population health. According to IPEA [10], by recycling the entire amount of recyclable material in Brazil instead of improperly sending them to landfills and dumps, the annual benefits generated range from almost R\$ 8 billion. Analyzing the North region specifically, we can see that this waste is even higher since the Brazilian averages of the data are above the reality of this region. The most significant selective collection initiatives concentrate in the South and Southeast regions.

Another conclusion obtained through this study is that the surveys are not satisfactory concerning regional data, as some include information only in the national scenario. For the improvement and development of the selective collection service and, therefore, the correct management and environmentally adequate disposal of solid waste as recommended by law [1], it is necessary that the investigation methods be improved and that they expose the regional specificities, to be able to contribute to the decision-making of government officials through the demonstration of a panorama that reflects the local reality to which they belong. As already mentioned, Brazil has continental dimensions, and its regions have very different characteristics in several aspects. Therefore, it is necessary to consider these peculiarities in studies and data production.

The operation of SINIR — National Information System on Solid Waste Management, one of the National Solid Waste Policy instruments, can implement the mentioned possibility in this paper.

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