

POSSIBILITIES AND CHALLENGES FOR THE SHARED MANAGEMENT OF SOLID WASTE IN THE METROPOLITAN REGION OF NATAL (RN) CONSIDERING FEDERAL LAW N° 12.305/2010

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Abstract

The National Solid Waste Policy emerged as a guideline for an environmental problem that was observed in Brazilian municipalities: the generation of solid waste combined with a prevalence of landfills. These problems largely became evident in metropolitan regions, which were characterized, among other aspects, by population concentration. Federal Law No. 12,305/2010 explicitly highlighted the issue of metropolitan management. The proposed study aimed to investigate the challenges for achieving the shared management of solid waste in the Metropolitan Region of Natal (RMN). To this end, documentary research and the systematization of secondary databases were undertaken, which enabled diagnostic research into the management of solid waste in the fifteen municipalities that make up the RMN. The study has revealed the difficulties in forming agreements between the municipal entities in the studied spatial profile, thereby influencing the outreach of an integrated management program in the RMN.

Keywords

Metropolitan Management; Integrated Solid Waste Management; National Solid Waste Policy; Metropolitan Region of Natal; Shared Management.

POSSIBILIDADES E DESAFIOS PARA A GESTÃO COMPARTILHADA DE RESÍDUOS SÓLIDOS NA REGIÃO METROPOLITANA DE NATAL (RN) À LUZ DA LEI FEDERAL Nº 12.305/2010

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Resumo

A Política Nacional de Resíduos Sólidos surgiu como diretriz voltada a uma problemática ambiental que se evidenciava nos municípios brasileiros: a geração de resíduos sólidos combinada com a prevalência dos lixões. Tais problemas se mostravam evidentes principalmente em regiões metropolitanas, as quais se caracterizam, dentre outros aspectos, pela concentração populacional. A Lei Federal nº 12.305/2010 destaca explicitamente o tema da gestão metropolitana. A pesquisa proposta teve como objetivo investigar os desafios para concretizar uma gestão compartilhada dos resíduos sólidos na Região Metropolitana de Natal (RMN) e contou com a realização de pesquisa documental e sistematização de banco de dados secundários. Isso possibilitou a criação de um diagnóstico sobre a gestão dos resíduos sólidos nos quinze municípios que compõem a RMN. O estudo revelou as dificuldades de pactuação entre os entes municipais no recorte espacial estudado, influenciando o alcance de uma gestão integrada na RMN.

Palavras-chave

Gestão Metropolitana; Gestão Integrada de Resíduos Sólidos; Política Nacional de Resíduos Sólidos; Região Metropolitana de Natal; Gestão Compartilhada.

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Introduction

The National Solid Waste Policy (PNRS)³ (BRASIL, 2010) brought to Brazilian municipalities numerous social, economic and environmental challenges related to facing the historically inadequate management of solid waste. Federal Law No. 12,305 (BRASIL, 2010) provides clear direction for formulating state and municipal plans for solid waste, with the active participation of social agents directly involved in the waste sector. If at a municipal level, achieving an integrated waste management program according to set standards faces multiple obstacles, including those of a political nature, within the metropolitan context, the technical aspects, and often the unavailability of financial resources, come up against the insubstantial discussion between the cities.

Thus, the objective herein is to obtain an understanding of the challenges involved in achieving the shared management of solid waste in the Metropolitan Region of Natal (RMN). Accordingly, the starting point for the study was an investigation of secondary data for which the main source was the Rio Grande do Norte State Plan for Solid Waste (PERS) (SEMARH, 2017), which enabled a

1. We would like to express our thanks to the Administration for Postgraduate Studies at the Universidade Federal do Rio Grande do Norte (UFRN), and to the Postgraduate Program in Urban and Regional Studies (PPEUR/UFRN) for supporting the research.

2. This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brasil (CAPES) - Finance Code 001.

3. The acronyms and abbreviations used throughout this article have remained in Portuguese.

diagnostic research of solid waste in the RMN, concerning the elements related to management, household collection, selective collection, the existence of a municipal plan for integrated waste management and the final disposal of the collected material. Based on these support areas, it was possible to map out the challenges and obstacles for implementing the PNRS in the RMN.

In addition to this introduction and the final considerations, the article is organized into two main items and their respective subitems. The first presents a theoretical discussion on the main designs of the PNRRs and the Statute of the Metropolis (EM) for the metropolitan entities. Thereafter, the text presents the results of the diagnosis and mapping performed in the RMN, indicating the obstacles to enforcing Federal Law No. 12.305 (Brazil, 2010).

1. The PNRS and the EM: guidelines for the metropolitan entities

The 1970s were marked by the creation of the first Brazilian metropolitan regions (RMs), instituted by the Union during the military government. At the time, productive and economic development was designed to be achieved through integrating the activities that occurred within these areas. With the 1988 Federal Constitution (CF/88), the function of instituting the RMs was attributed to the state entities.

The period following this constitutional change was marked by a growth in the number of RMs throughout Brazil, and was reflected in the waning of the metropolitan theme, and the fragmentation and weakening of metropolitan management and governance with the process of institutional metropolization (SANTOS, 2018). This context, in turn, was accompanied by the emergence of new challenges for municipalities, which, as a result of the decentralizing process of public policies, were moved up to federative entities with the CF/88. A scenario was thereby defined, in which “the largest local autonomy in an extremely unequal country required greater support and intergovernmental performance from the two other levels of government” (SEGATTO; ABRUCIO, 2016, p. 415).⁴

Thus, while the Brazilian federative structure was being reconfigured, within the process of globalization, cities were seen as a political actor, promoting agreements and associations, assuming responsibilities with regard to society and public authorities and positioning themselves as a link between civil society, private agents and public interest (CASTELLS; BORJA, 1996).

In addition to this context and the new competences instituted constitutionally, the municipalities that began to compose the RMs were forced to comply with the recommendations established by the infra-constitutional legislation that

4. This and all non-English citations hereafter have been translated by the authors.

rewrote sectoral policies. By way of example, the PNRS (BRAZIL, 2010) emerged as a guideline aimed at seeking solutions for a socio-environmental problem, which was evidenced in Brazilian municipalities: the generation of solid waste combined with a prevalence of landfills as the solution adopted by the municipalities for the disposal of collected waste. Such problems were mainly apparent in metropolitan regions, since these sites were characterized, among other aspects, by the concentration of people who occupied them and generated income from the collection and subsequent sale of recyclable materials found in the mountain of waste that was formed.

The cited norm was aimed at dealing with the social, economic and environmental consequences of the inadequate management of solid waste in Brazil (SILVEIRA; FIGUEIREDO; ALMEIDA, 2019). One of the most outstanding concepts was the change of perspective regarding management, which began to require the establishment of what was termed *integrated solid waste management*, comprising a set of actions aimed at seeking waste solutions within the political, economic, environmental, cultural and social dimensions, with social control and under the premise of sustainable development (Art. 3º, XI, Law No. 12.305/2010).

In order to understand the breadth of the concept, Besen et al. (2014, p.261) emphasized that:

The concept of integrated, sustainable waste management infers a hierarchy of objectives that include: minimizing the generation of waste; reducing the negative impacts of waste; maximizing reuse, recycling and composting; energy recovery; promoting environmentally safe treatment and disposal (KLUNDERT et al., 2001; ADEDIPE et al., 2005; IPCC, 2007). It also includes maximizing the coverage of urban cleaning services and selective collection.

These authors emphasized the understanding of Günther and Grimberg (2006), who organized the concept anchored in the following fundamental elements for integrated management to exist: i) the need to predict the stages of the operation (generation, packaging, collection, transportation, treatment, reuse of recyclables and biomass and the final disposal with energy recovery); ii) seeking inter-sectoriality, so that the different areas of the government involved in solid waste management are aligned in the various spheres; and iii) the involvement of social agents that make up the waste sector.

1.1 The shared management of solid waste

In addition to creating a new model for waste management in Brazil, Federal Law No. 12,305 (BRASIL, 2010) explicitly emphasizes the theme of metropolitan management. Thus, based on this standard, “the management process must be

shared, and needs to be centered on the adoption of models based on the prevention of waste generation and the treatment of recyclable materials” (SILVEIRA; FIGUEIREDO; ALMEIDA, 2018, p. 515). Moreover, in Article 11 of the aforementioned law, the competence of state entities is highlighted in promoting the integration of the organization, planning and execution of public functions of common interest related to solid waste management in metropolitan regions, urban agglomerations and micro-regions (BRAZIL, 2010).

The same norm requires that each state must act with a view to supporting and prioritizing consortium or shared solutions between two or more municipalities. This element is one of the points that constitutes the minimum content of the state solid waste plans, which will cover the entire territory of the state, with an action time period of twenty years, being reviewed every four years (BRASIL, 2010, art. 17, VIII, PNRS).

Similarly, the minimum content of municipal plans should also include identifying possibilities for implementing consortium or shared solutions with other municipalities, considering, within the criteria of economy of scale, the proximity of established locations and ways of preventing environmental risks (BRASIL, 2010, art. 19, III, PNRS). Thus, by legal imposition, “the management of solid waste is, therefore, one of the urban issues that requires shared planning between local entities” (SILVEIRA; FIGUEIREDO; ALMEIDA, 2018, p. 515).

For Heber and Silva (2014, p. 915), with regard to shared management and to regulating the stimulus for forming inter-municipal consortia, the federal normative starts from the premise that “the small management capacity and the low budget volume of the municipalities, especially the smaller ones, render any effective actions of urban cleaning and the final destination of technically and socially adequate waste, unfeasible”. In this regard, the authors highlight that, with the PNRS, Brazil implemented the reform of the solid waste sector with the support of policies based on shared management, which were combined with a comprehensive regulatory framework. This scenario expanded and complexified the variables managed in the regulatory activity of public entities and at the time of decision-making, so that sectoral governance started to depend, above everything else, on the political capacity to articulate commitments around common objectives (HEBER; SILVA, 2014).

From this perspective of sharing, regionalization emerges as a recurrent instrument for the establishment of an integrated management. In a study conducted in the Metropolitan Region of Aracaju, Heber and Silva (2014) highlighted regionalized management as a fundamental instrument for solving part of the problems related to solid waste management, drawing attention to the reduction of operating costs generated by economies of scale.

In addition to the budget reduction resulting from cost rationalization, the instrument has other potentials, ranging from the possibility of building a potentially aggregated scenario for promoting development and social inclusion through recycling, including selective collection and reverse logistics.

However, it is still possible to note challenges, since regionalization requires taking into account the peculiarities of each municipality that may be part of a consortium. Furthermore, its operationalization demands compliance with structuring and strategic issues, “insofar as it represents the permanent adherence of the municipality, actions that must be authorized by the Municipal Councils” (HEBER; SILVA, 2014, p. 935), which includes political debates on a theme that only superficially presents itself as technique. In other words, as analyzed by Binner, Quincho and Kiyán (2016, p. 22), “[...] it is essential to define jointly realistic long-term goals and scaled plans so that they may become realized”.

Shared management, added to the concept of integrated management, represents one of the great challenges imposed by the PNRS, because, in addition to the various public entities and the respective providers of public services for urban cleaning and solid waste management, the scenario demands that the effort of planning and management should incorporate the market, represented by manufacturers, importers, distributors and traders. Furthermore, consumers and cooperatives or other forms of association of reusable and recyclable material sorters formed of low-income individuals should also be considered. It is, therefore, a complex, broad institutional design, which requires the concertation of a wide diversity of interests, attributions and differentiated capacities.

For Demajorovic, Besen and Rathsam (2004), it is vital to recognize the importance of various social actors in being co-responsible for solid waste management, aimed at valorizing recycling and promoting educational actions in order to stimulate a change in the values and habits of society, as some of the central elements for an integrated, decentralized and shared management. A similar interpretation is developed by Sánchez-Muñoz, Cruz-Cerón and Maldonado-Espinel (2019) in their study on the integrated management of solid waste in a number of Latin American cities, according to which, municipalities should create citizen awareness strategies so as to reduce solid waste generation at its source.

Thus, despite the idea that the problem of solid waste is often considered from the viewpoint of cleaning engineering, focused on increasing the fleet of trucks, expanding the number of employees and improving final disposal systems, it is necessary to place integrated and shared management in the forefront. This depends on constructing a broader vision (DEMAJOROVIC; BESEN; RATHSAM, 2004).

The shared management required by the PNRS also presupposes links between a wide diversity of elements that make up the concept of integrated waste management. For Berticelli, Pandolfo and Korf (2017, p. 713), this type of management “has emerged with a different approach, and is represented by a set of environmentally and economically appropriate management principles, in a sustainable and socially acceptable manner”. Integrated management has a holistic connotation that includes all the flows of different types of waste.

Furthermore, these authors also highlight that, as a result of the new assumption of management integration, “the best functioning solid waste management systems involve all stakeholders in the planning, implementation, and monitoring of changes” (BERTICELLI; PANDOLFO; KORE, 2017, p. 713). Two main stakeholder groups are cited: i) service providers, including the local authority; and ii) users and external agents, including the federal government and local public administrations. Integrated management, therefore, presupposes another concept contained within the PNRS: shared responsibility, which may be understood as a set of individualized and linked attributions of manufacturers, importers, distributors and traders, consumers and holders of public services of urban cleaning and solid waste management, in order to minimize the volume of solid waste and tailings generated, as well as reducing the impacts caused to human health and environmental quality (BRASIL, 2010, art. 3, XVII, PNRS).

The diversity of actors indicated by the PNRS and their responsibilities and the breadth of the concept of integrated management denote that “environmental management must be a multilateral approach, considering that environmental problems and their solutions are determined by technological factors, and economic, social, physical, cultural and political issues” (BERTICELLI; PANDOLFO; KORE, 2017, p. 714).

The recommendations of the Brazilian policy for waste came in the wake of the public policies implemented in several developing and emerging countries. When analyzing the policies aimed at integrated waste management in some Latin American countries, Sánchez-Muñoz, Cruz-Cerón and Maldonado-Espinel (2019, p. 321) have stated that countries “have adopted policies and promulgated normativity that has led to the prohibition of open dumps, incorporating recyclers into the management process and attempting to reduce the amount of waste generated”.

Given the normative innovation and the resulting complexity, the new concepts introduced into the Brazilian legal system by the PNRS require attention when the implementation process is observed in metropolitan contexts.

1.2 Law No. 12,305/2010 and metropolitan management

Despite the existence of specific policies that offered special attention to metropolitan contexts, the lack of specific actions of shared management brought about the emergence of Federal Law No. 13.089 / 2015 (BRASIL, 2015), responsible for instituting the Statute of the Metropolis. This norm establishes a set of guidelines for the planning, management and execution of public functions of common interest in metropolitan regions, urban agglomerations and integrated regions of development.

The aforementioned law is based on the need to create inter-federative governance understood as the sharing of responsibilities and actions between federal entities, when considering the organization, planning and execution of public functions of common interest, through the execution of integrated, articulated systems of planning, projects, financial structure, implementation, operation and management of these policies (BRASIL, 2015).

In view of these guidelines, any policy or strategy for urban well-being must focus on “the territorial context into which they have been inserted and the need for their entities to be configured as political actors capable of promoting and achieving inter-federative governance” (SILVEIRA; FIGUEIREDO; ALMEIDA, 2018, p. 517). This, in turn, covers coordination and cooperation processes that aim to facilitate the construction of shared planning actions (GARSON, 2009). Through coordination, it is the responsibility of one of the entities to recommend strategies viewed as being a priority in a territory. Cooperation may be understood as the voluntary adhesion of local administrations to shared planning.

In order to study these elements, it is necessary to understand that “federalism comprises a special combination of autonomy and interdependence between the levels of government” (SEGATTO; ABRUCIO, 2016, p. 414). This is reflected in the negotiation and bargaining in the formulation and implementation of public policies, as well as differentiated forms of more or less cooperative relationships.

According to Garson (2009), although they may be key to reducing inequalities and improving economic efficiency in metropolitan regions, cooperation mechanisms among federal entities are still scarce. For this reason, it is essential to understand the mechanisms that contribute to or constrain the configuration of cooperation arrangements and the metropolitan management of policies considered as public functions of common interest.

By virtue of the two impacts caused by the generation and disposal of waste and the cross-border nature of the environmental issue that characterizes the management of solid waste, and based on the fact that “urban cleaning services may assume, for technical or economic reasons, a configuration that exceeds the

limits of the territory of a municipality” (JUSTEN FILHO; PEREIRA, 2000, p. 280), we highlight this policy as a public function of common interest to be executed jointly with neighboring municipalities. This acknowledgment, in turn, is expressly stated in article 11 of the PNRS (BRASIL, 2010), cited above.

Given the two assumptions of these normatives, it is therefore of great importance to study the challenges presented to metropolitan municipalities as a result of the relationship between the PNRS and EM. This investigation should be attentive to the capacity installed in the municipalities to formulate and implement a municipal policy of integrated management of solid waste, as well as their capacity to articulate, with the aim of promoting shared management. As a locus of analysis, we have selected the Metropolitan Region of Natal, in the state of Rio Grande do Norte (RN).

2. The RMN and the obstacles to enforcing Federal Law No. 12,305/2010

The RMN was created in 1997, through State Complementary Law (LCE) No. 152 (RN, 2015). Located in the eastern portion of the state of Rio Grande do Norte, most specifically along the occupied coastline, it covers an area equivalent to 3,555.7 km² (representing approximately 7% of the state territory). The population of the RMN is around 1,631,016 (890,480 of whom live in the city of Natal), which corresponds to 46% of the state’s population (IBGE, 2020).⁵

Initially, the RMN consisted of six municipalities: Natal, Parnamirim, São Gonçalo do Amarante, Macaíba, Ceará-Mirim and Extremoz. Currently, the arrangement has fifteen entities, with the addition of São José de Mipibu, Nísia Floresta (RN, LCE No. 221/2002); Monte Alegre (RN, LCE No. 315/2005), Vera Cruz (RN, LCE No. 391/2009), Maxaranguape (RN, LCE No. 485/2013), Ielmo Marinho (RN, LCE No. 540/2015), Goianinha and Arez (RN, LCE No. 559/2015) and, most recently, Bom Jesus (ALMEIDA et al., 2019).

Its composition is characterized by differences in population size, size of the territory of the municipalities and access to public policies, which reflects the planning and management efforts carried out by local entities. Thus, the RMN takes in municipalities with a land surface area of between 724 km² (Ceará-Mirim) and 71 km² (Monte Alegre). In terms of access to public policies, it should be mentioned that there are municipalities with 5% (Natal and Parnamirim) and 29% (Ielmo Marinho) of the population living in extreme poverty (Table 1).

5. The Brazilian Institute of Geography and Statistics (Instituto Brasileiro de Geografia e Estatística – IBGE)

Municipalities	Population (thousand inhab.)	Surface area (km ²)	Urbanization rate (%)	Population in extreme poverty ^{*,6} (%)	Illiteracy rate (%)	MHDI
Natal	803,739	167,264	100	5	8.04	0.763
Parnamirim	202,456	123,471	100	5	7.6	0.766
São Gonçalo do Amarante	87,668	249,124	84	10	13.93	0.661
Macaíba	69,467	510,771	61	12	21.04	0.640
Ceará-Mirim	68,141	724,38	52	16	20.46	0.616
Extremoz	24,569	139,575	64	12	16.34	0.660
São José de Mipibu	39,776	290,331	45	19	22.91	0.611
Nísia Floresta	23,784	307,841	39	17	20.75	0.622
Monte Alegre	20,685	71,946	43	24	26.92	0.609
Vera Cruz	10,719	83.89	43	14	29.04	0.587
Maxaranguape	10,441	131,316	37	17	19.78	0.608
Ielmo Marinho	12,171	312,029	12	29	25.79	0.550
Goianinha	22,481	192,279	68	18	21.67	0.638
Arez	12,931	115,505	62	22	23.73	0.606
Bom Jesus	9,440	122,038	71	21	29.56	0.584

Table 1. Disparities in the RMN

Note: * monthly per capita family income of up to R\$ 70.00.

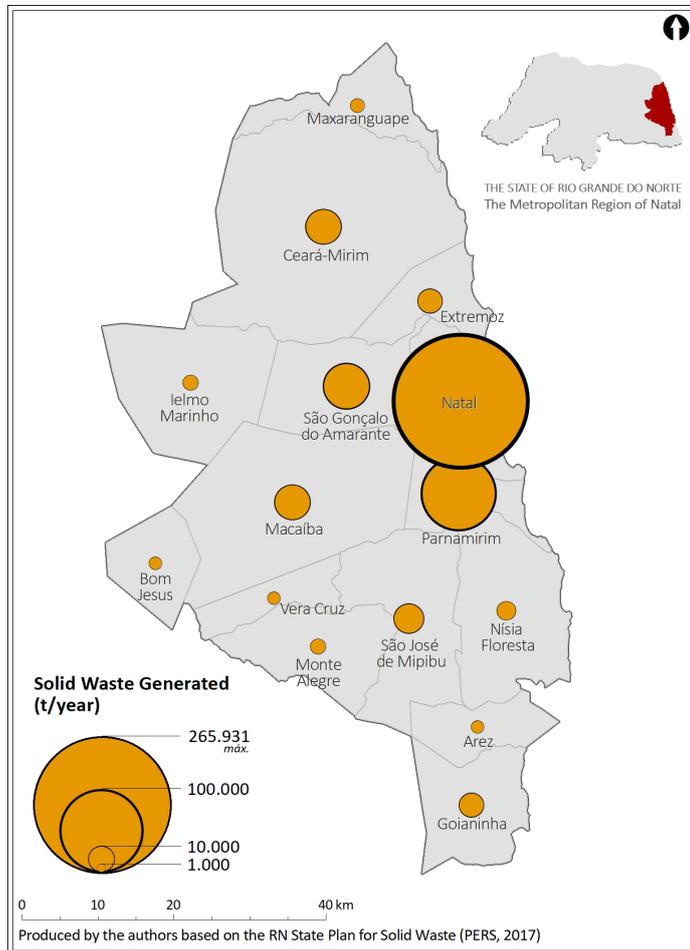
Source: Produced by the authors based on IBGE (2010).

In addition to the population scale, which varies between Bom Jesus, with a population of 9,440, and Natal, which has 803,739 inhabitants, the urbanization rate demonstrates that the interests between the cities in the RMN are quite different. From this perspective, Natal, the urban area of which is fully populated, contrasts with municipalities such as Ielmo Marinho (12%) and Nísia Floresta (45%). Hence, considering urban policies for such different municipalities requires skills that the technical staff of local entities often lack. The percentage of the population in extreme poverty demonstrates that the needs are equally conflicting. The Municipal Human Development Index (MHDI) also highlights this dissonance: the municipality of Parnamirim presents the highest index (0.766), in contrast to Ielmo Marinho, with 0.55.

The RMN is characterized by different degrees of integration as a municipal hub, which is the capital of Natal. The municipalities of Parnamirim, São Gonçalo do Amarante and Extremoz present high integration, while Macaíba has medium

6. At the time of writing the exchange rate of the US dollar was equivalent to R\$5,65.

integration. The remaining municipalities are classified as either low or very low integration (OBSERVATÓRIO DAS METRÓPOLES, 2012).



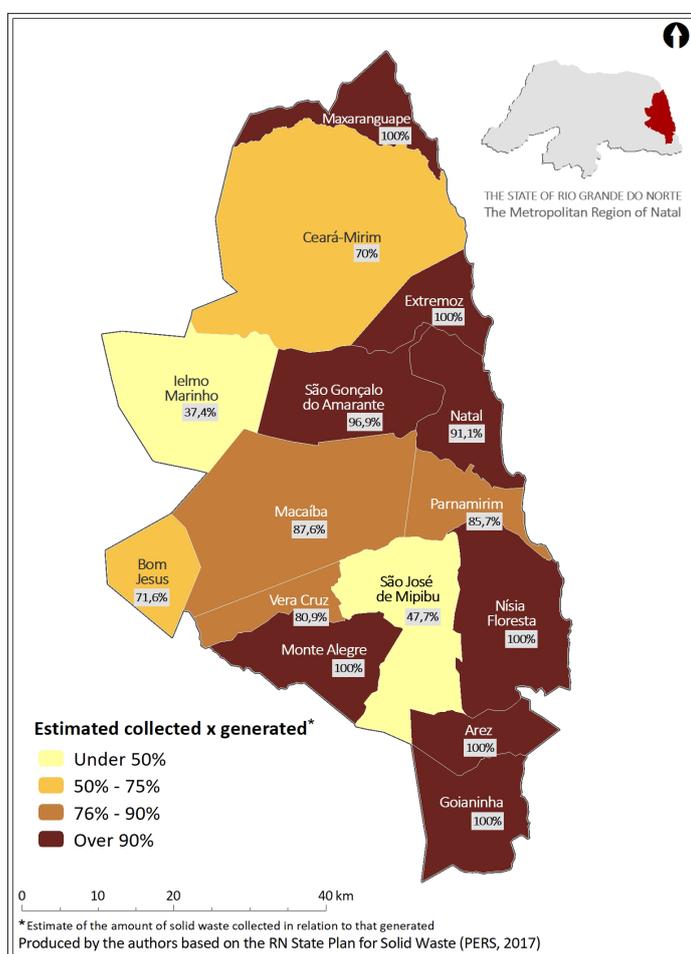
Map 1. Solid waste generation per municipality (t/year)

Source: Produced by the authors based on the RN State Plan for Solid Waste (SEMARH, 2017).

The population disparity and the differences in the levels of urbanization are reflected in the generation and collection of solid waste, although not due to the high levels presented in Natal and Parnamirim. Map 1 demonstrates that solid waste generation is a reflection of the relationship between the population and the level of urbanization in the municipality, taking into account that the most populous, urbanized cities correspond to those with higher quantities of waste generated in tons per year (t/year). The numbers registered were: Natal, 265,931.50; Parnamirim, 82,350.96; São Gonçalo do Amarante, 31,371.18, and Macaíba, 18,070.93. In the case of Bom Jesus, for example, the level of urbanization is 71% and the solid waste generation is 2,517.11 t/year for a population of 9,440 people.

According to Sánchez-Muñoz, Cruz-Cerón and Maldonado-Espinel (2019), the generation of solid waste is related to aspects such as the levels of economic activity, consumption patterns, urban-rural relationship and also the degree of population density.

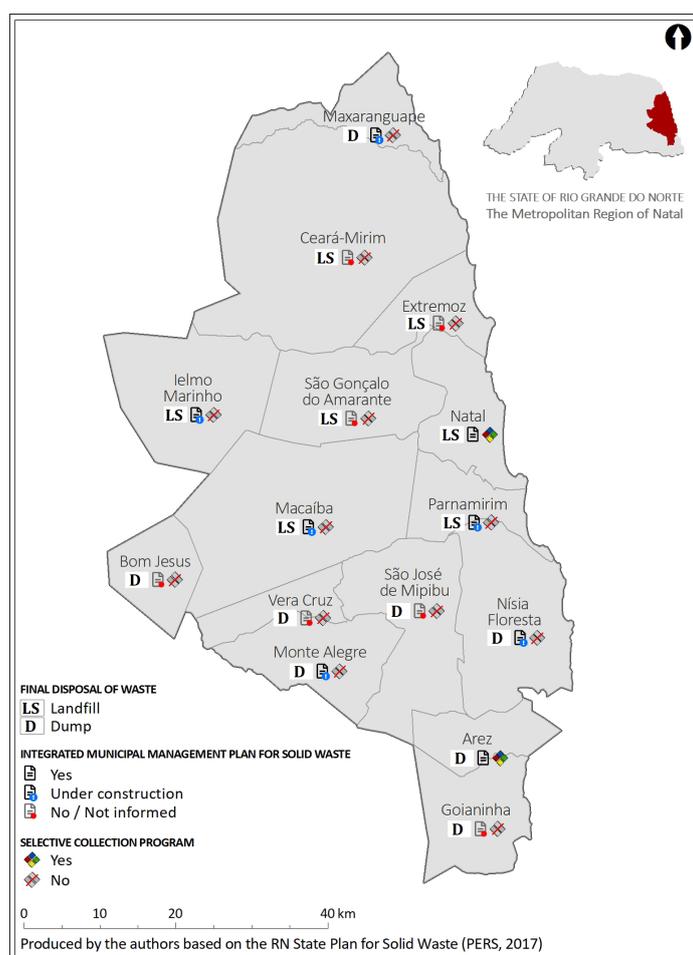
The disparities in the RMN are not only seen from the viewpoint of solid waste generation, but equally, of its management. This statement is based on the proportion of the solid waste generated to that which is collected. The bigger cities, in which integration with Natal is higher (São Gonçalo do Amarante, Macaíba, Parnamirim and Extremoz), the solid waste collection is at least 76%. The disparity becomes more serious in municipalities such as Ielmo Marinho (37%) and São José de Mipibu (47%), which collect less than 50% of all solid waste (Map 2).



Map 2. The proportion of solid waste generation to solid waste collection

Source: Produced by the authors based on the RN State Plan for Solid Waste (SEMARH, 2017).

The data indicate the lack of solid waste management sharing in the RMN. However, apart from the factors related to the volume of generated waste, it is essential to observe the data related to final disposal and to the existence of a municipal plan for integrated solid waste management and a selective collection program.



Map 3. Diagnostic research of waste management in the RMN

Source: Produced by the authors based on the RN State Plan for Solid Waste (SEMARH, 2017).

There is a landfill in the RMN that, until 2017, served seven metropolitan municipalities. Although it has been named the “metropolitan landfill”, the space, located in Ceará-Mirim, was implemented in 2004 through an agreement signed by the municipality of Natal, whereby, “because there was no place to implement a landfill, an understanding was reached with the adjacent municipality, by establishing a number of interchanges, such as: paying an environmental fee per ton deposited; paying service tax (ISS)”, in addition to exempting Ceará-Mirim

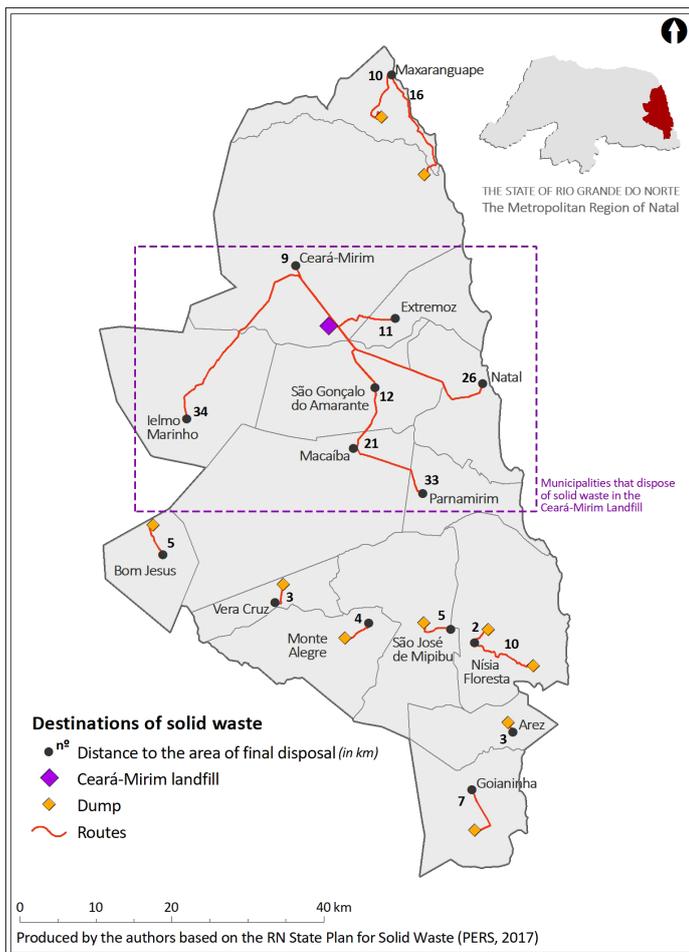
from any costs for depositing its waste there (SEMARH, 2012, p. 15). The landfill is managed by the concessionaire Braseco S/A, which is able to work in the area for a period of twenty years. The signed agreement, however, involves only the final disposal of waste, with each entity being responsible for collecting and transporting the materials.

Due to the lack of sharing, the RMN is marked by the inexistence of a municipal integrated management plan in thirteen municipalities, and by the existence of selective collection in only two of them.

Map 3 reveals that the municipalities that send their waste to the Ceará-Mirim landfill correspond to those closest to the site, except for Maxaranguape, which, despite its proximity, according to the State Plan for Waste Management (SEMARH, 2017), has maintained a dump in a neighboring municipality. On this same map, it is highlighted that only the municipalities of Natal and Arez reported having an integrated management plan and selective collection. This lack directly impacts the possibility of generating occupation and income for sorters of reusable and recyclable materials, which does not comply with chapter II (art. 6, item VIII) of the PNRS (BRASIL, 2010), which provides for the recognition of “reusable and recyclable solid waste as an economic good and social value, generating work and income and promoting citizenship” (BRASIL, 2010).

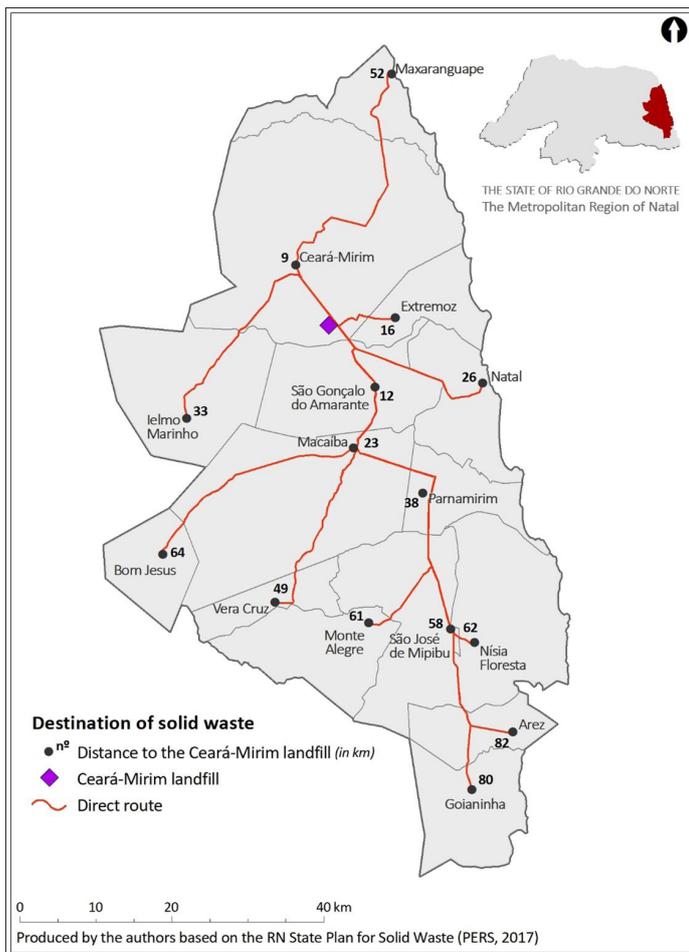
The importance of selective collection is evidenced by the economic potential of the recycling production chain. A study carried out by Calderoni (1999) in 1997 indicated that, if the waste sent to dumps and landfills was diverted to recycling, the activity could generate values of more than R\$ 5.8 billion throughout the entire material recycling production chain. On the other hand, the report produced by the Institute for Applied Economic Research (Ipea), cited by Sant’ana and Maetello (2016, p. 26), revealed that, “if all the recyclable waste sent to landfills and dumps in Brazilian cities were to be recycled, with the value of the 2007 Brazilian Real (R\$), it was estimated that the productive chain would generate R\$8 billion annually”. Similarly, a study by the Brazilian Aluminum Association (Abal), released in 2016, reported that the aluminum industry handled 0.6% of the Brazilian Gross Domestic Product, and aluminum recycling was responsible for two-thirds of this amount (ABAL, 2017).

Another negative aspect related to the lack of selective collection is that more potentially recyclable waste is sent to landfills and dumps, which increases the cost of final waste management, when transport and the final destination are taken into consideration. Map 4 lists the distances between the municipalities in the RMN and the locations of the final disposal of waste. This information is important because, based on this, it is possible to measure the rationality of transporting waste collected in the city and then sent to its destination.



Map 4. Distances between the center of the RMN municipalities and the final waste disposal site
 Source: Produced by the authors based on the RN State Plan for Solid Waste (SEMARH, 2017).

Map 4 presents the distance that waste has to travel in each municipality, and draws attention to the existence of ten public dumps in eight municipalities in the RMN. Among the services related to waste management (administration expenses, cleaning, conventional and selective collection, transport and final destination), it is exactly the final destination of waste that presents the highest budget value - which is why we highlight the need for shared management. In the case of Natal, which sends all its collected waste to the landfill, 19% of the budget available for municipal waste management is set aside for services performed by the landfill concessionaire, Braseco. Furthermore, this finding demonstrates the need for a more efficient selective collection plan, since its low efficiency signifies that, of the waste collected in the municipality, only 1.6% is diverted to recycling. Map 5 shows the distance between the center of each municipal entity and the so-called metropolitan landfill.



Map 5. Distance between the center of the metropolitan municipalities and the Ceará-Mirim landfill (RN), in kilometers

Source: Produced by the authors based on the RN State Plan for Solid Waste (SEMARH, 2017).

Maps 4 and 5 indicate that the management of municipal waste and the possibility of a metropolitan agreement depend on operational choices that often prevent achieving legal purposes. It should be mentioned that, when the Municipality of Natal presented the first feasibility study for the construction of a landfill in 1996, taking into account locational aspects of the landfill and of the cities in the RMN, as well as the capacity of soil sedimentation, the best location was deemed to be the municipality of Macaíba. However, incompatibilities between the city's municipal administration and politicians in Natal rendered the construction of the landfill in Macaíba unfeasible. Hence, it was built in Ceará-Mirim, as seen in Map 4. The maps show that the current location is not necessarily the best place, since it potentially generates higher transport costs for cities that dispose of their waste on this landfill (SILVA; GUIMARÃES; MORENO, 2005).

2.1 The difficult political-institutional links and public planning

The scenario that surfaced at the time of the debates on constructing the landfill may be explained by certain political-institutional and planning factors. The most outstanding features in the political-institutional sphere were the obstacles against establishing a metropolitan dialogue so as to construct a shared management in the most diverse areas of public policies (ALMEIDA et al., 2015). More specifically, this involved the inter-municipal cooperation strategies and the poor performance of the state administration regarding its coordinating actions.

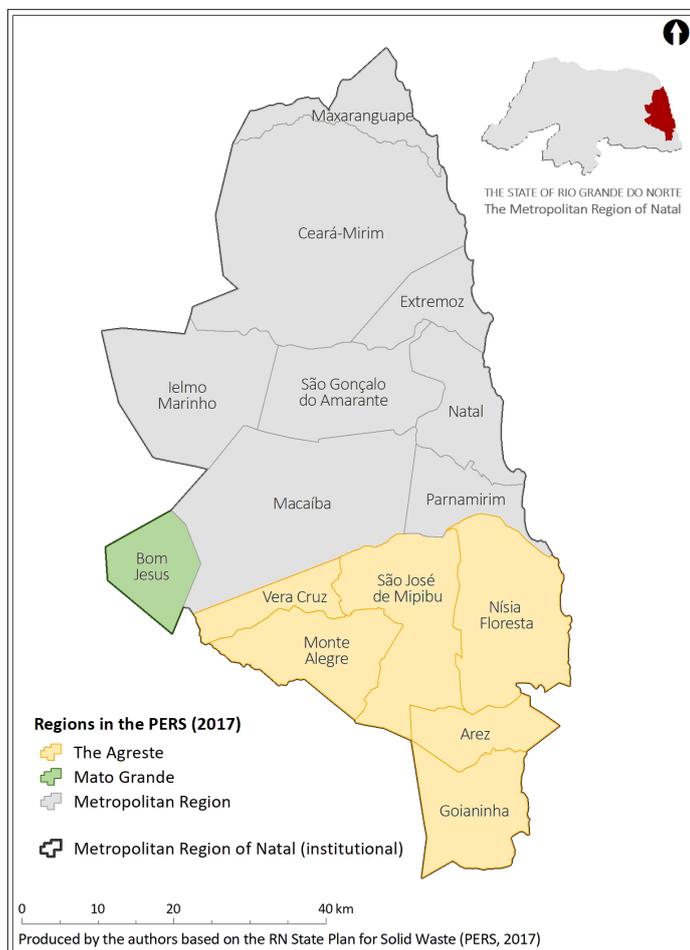
By maintaining the existence of public dumps in eight municipalities, in addition to the clandestine dumps, such as those in Natal (ALBUQUERQUE, 2013), the RMN faced challenges in meeting the deadlines set by the PNRS. The operation of the individual landfills, in addition to being territorially unfeasible for some municipalities, must be preceded by licensing procedures, and the preparation of an executive and implementation project, steps that require a well-prepared, fully-qualified bureaucratic department. Additionally, the financial and operational costs must also be considered, which in turn requires professionals that municipalities often do not have among their staff.

With regard to the elements of management, municipalities need to be aware of certain aspects such as costs and the use of techniques and technologies. In a comparative study on solid waste management in Austria and Peru, Binner, Quincho and Kiyari (2019) indicated that waste management in rich countries incurs high costs, which, therefore, should be avoided in developing countries. They considered that one alternative for efficient waste management in developing countries would be to avoid copying the management of rich countries; the ideal would be to combine it with systems of local cooperation.

In light of the above, the existence of shared management involves instituting integrated management, as outlined in the PNRS. Implementing selective collection in all municipalities and paying attention to campaigns aimed at the non-generation of materials, as well as reducing, reusing and recycling them, should be introduced as common measures for all entities, since “waste management is extremely dependent on human behavior, and municipalities must use education and environmental awareness policies to affect changes associated with waste management elements” (BERTICELLI; PANDOLFO; KORF, 2017, p. 715).

It is a fact that shared waste management depends on the existence of effective metropolitan dialogue. The compartmentalization of solutions in waste management represents greater financial costs for each entity, while sharing, by reducing operating costs and streamlining integrated management, depends on overcoming political barriers.

In addition to political-institutional issues, there are also obstacles related to planning. Although there is an institutionalized metropolitan region, the planning and management of policies such as health and safety in Rio Grande do Norte follow their own logic, which ultimately conditions the availability of public facilities, the use of human resources and the planning and management efforts. Hence, each policy presents its specific regionalization, which is reflected in the fragmentation of municipalities in the RMN into different territories, and in weakening any dialogue that favors common solutions. This is also the reality of waste management. The regionalization of the State Management Plan for Solid Waste is based on territorial proximity, reducing the metropolitan regional waste to eight municipalities, which need to seek shared solutions (Map 6).



Map 6. Regionalization according to PEGRS (2017) and the division of municipalities in the RMN
Source: Produced by the authors based on the RN State Plan for Solid Waste (SEMARH, 2017).

Data relating to the RMN indicate yet another example of the Brazilian compartmentalized federalism, with a strong autarchic role of entities,

despite the existence of institutionalized ties between them (as is the case in metropolitan regions). Once again, it is evident that decentralization in a country as unequal as Brazil depends on the links between federative entities and that “compartmentalization directly (and negatively) affects the results of public policies” (ABRUCIO, 2007, p .70).

Data also reveal that the lack of a metropolitan identity in the management of urban solid waste, previously reported in studies from several areas, is an element which is responsible for disfiguring the RMN, thereby thwarting the cohesion of actions by the representatives from the municipalities of which it is composed (ANDRADE, 2015). Clementino (2018), based on a number of elements, stated that metropolitan planning and the search for implementing common actions in the RMN may still be described as fragile.

In addition, the presented scenario has confirmed that the reality of the municipalities in the RMN, with regard to solid waste, remains focused on the final destination, and not on the other elements that make up the integrated management of solid waste, such as the need to minimize the generation of waste at the source, to plan its transport and to prevent pollution, which substantiates the importance of selective collection programs with the participation of sorters and other social agents in the waste sector.

As Sánchez-Muñoz, Cruz-Cerón and Maldonado-Espinel analyzed (2019, p. 335), for a public policy focused on waste management to be efficient, “it requires clear-cut policies, normatives that encourage appropriate management, and citizens who aware of the need to change their habits in both the production and consumption processes”, which is precisely what the normatives relating to solid waste management in the municipalities of the RMN do not involve.

Final considerations

This article has indicated the lack of shared solid waste management in the Metropolitan Region of Natal. This finding comes from an investigation into the differences related to the generation of discarded materials, although mainly from the different collection percentages, the different waste disposal and final destination strategies and lack of both municipal and metropolitan planning.

Furthermore, the presented scenario confirms that the reality of the municipalities in the RMN, with regard to solid waste, is still focused on the final destination, and not on the other elements that make up the integrated management of solid waste, such as the need to minimize the generation of waste at source; the separation of reusable and recyclable materials; planning; transporting waste and preventing pollution, which includes implementing selective collection programs with the participation of refuse sorters.

This fragility, here, is directly reflected in higher costs for the operationalization of the integrated management of solid waste and in the non-compliance with PNRS deadlines and guidelines. Additionally, the context discussed reveals that compliance with this normative requires other elements, in addition to financial resources. In a metropolitan region, the predisposition to dialogue, which permeates political-institutional issues, is a key point, although it is also necessary, among the differences that mark the RMN, to investigate the state capacity of municipalities to enable dialogue and joint actions.

The possibilities for waste management in the RMN are related to the concept of shared solid waste management listed by the PNRS: seeking joint solutions for a common problem. It was evident in this article that solid waste is a public function of common interest, as the management of these materials is part of a public policy, the isolated implementation of which, by a single municipality, would either be unfeasible or would impact the municipality borderlines. The result is, concomitantly, a challenge and a possibility, and this requires reversing the political ties that impede agreements and pacts in the most diverse areas of public policies at a metropolitan level.

It should also be emphasized that the design of an inter-institutional dialogue to be developed between the municipalities of the RMN is difficult to implement. The perspectives indicate that each municipality will continue to carry out its solid waste management with no relationship with neighboring municipalities, which makes management costly for public finances, with low technical rationality and few practical results in terms of the efficient management of solid waste.

Prior to studying the context of the Metropolitan Region of Natal, understanding the expected institutional design, based on the relationship between the National Solid Waste Policy and the Statute of the Metropolis, is fundamental, considering the implications and challenges arising from these normatives.

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Submitted: March 3, 2021.

Approved: August 19, 2021.

How to cite: SILVEIRA, R. M. C.; FIGUEIREDO, F. F. Possibilities and challenges for the shared management of solid waste in the Metropolitan Region of Natal (RN) considering Federal Law nº 12.305/2010. *Revista brasileira de estudos urbanos e regionais*. v. 23, E202141en, 2021. DOI 10.22296/2317-1529.rbeur.202141en

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