

## Diagnosis of the Simplified Municipal Plan for Integrated Solid Waste Management in 16 small municipalities in the western region of the State of Paraná, Brazil

Diagnóstico do Plano Municipal Simplificado de Gestão Integrada de Resíduos Sólidos em 16 municípios de pequeno porte na região oeste do Estado do Paraná, Brasil

**Cristhiane Michiko Passos Okawa<sup>1</sup>**

### ABSTRACT

Brazilian municipalities are responsible for the management of urban solid waste generated in their territories; When this management is performed improperly, it generates environmental, social, economic and health problems. The National Solid Waste Policy (PNRS) instituted the Simplified Municipal Plan for Integrated Solid Waste Management (PMSGIRS) for municipalities with less than 20,000 inhabitants. Thus, this article aims to diagnose PMSGIRS from 16 municipalities with less than 20,000 inhabitants in western region of Parana, verifying that they satisfactorily meet the PNRS content. For this, a checklist was prepared containing 282 items, by consulting the manuals of the Ministry of the Environment and Brazilian Laws on the subject. As a result, it was found that only one municipality does not have its PMSGIRS and another has the Intermunicipal Plan for Integrated Solid Waste Management, four have Municipal Basic Sanitation Plan that includes the solid waste axis and only ten have PMSGIRS. Most plans (78%) do not satisfactorily meet the PNRS content, achieving less than 70% of the required content. Only three plans (22%) obtained a rate considered satisfactory. It is concluded that these plans should be urgently reviewed, with a view to including missing content.

**Keywords:** Municipal urban management; Small municipalities management; Urban solid waste

### RESUMO

Os municípios brasileiros são responsáveis pela gestão dos resíduos sólidos urbanos gerados em seus territórios; quando essa gestão é realizada de maneira inadequada, gera problemas ambientais, sociais, econômicos e de saúde. A Política Nacional de Resíduos Sólidos instituiu o Plano Municipal Simplificado de Gestão Integrada de Resíduos Sólidos (PMSGIRS) para municípios com menos de 20.000 habitantes. Assim, este artigo tem por objetivo diagnosticar oPMSGIRS de 16 municípios com menos de 20.000 habitantes do oeste Paranaense, verificando se atendem de forma satisfatória o conteúdo previsto na PNRS. Para isso, foi elaborada uma lista de verificaçãocontendo 282 itens, por meio de consulta aos manuais do Ministério do Meio Ambiente e Leis brasileiras sobre o tema. Como resultado, constatou-se que somente um município não possui seu PMSGIRS e outro possui o Plano Intermunicipal de Gestão Integrada de Resíduos Sólidos, quatro possuem Plano Municipal de Saneamento Básico que contempla o eixo de resíduos sólidos e dez possuem o PMSGIRS. A maioria dos planos (78%) não atendem de forma satisfatória os conteúdos previstos na PNRS, obtendo menos que 70% do conteúdo exigido. Somente três planos (22%) obtiveram índice considerado satisfatório.

<sup>1</sup> Universidade Estadual de Maringá, pr, Brasil - crisokawa@gmail.com



Conclui-se que esses planos devem ser revisados com urgência, visando a inclusão dos conteúdos faltantes.

**Palavras-chave:** Gestão municipal urbana; Gestão de pequenos municípios; Resíduos sólidos urbanos

## 1 INTRODUCTION

Increased population density and the economic growth result in larger production of urban solid waste, resulting in a problem worldwide, extrapolating environmental aspects. Moreover, the absence of linear cycle production sustainability and the inadequate consumption and disposal of materials drain natural reserves and degrade natural environment, affecting population health (COSTA, 2011; MENDEZ; MAHLER, 2018).

With respect to human health problems, Gouveia (2012) reports that the disposal of residues into soil constitutes a cause of human exposure to toxic substances, not only by the spread of these in polluted soil and air, but also by slurry leaching and percolation, leading to the persistence of contamination even after the site deactivation. The author also quotes the health risks to professionals directly involved in waste management that, in their majority, do not have appropriate minimum measures of prevention and occupational security. The generated residues and not collected, disposed in irregular manner in streets, rivers, streams and vacant lots, cause silting up of rivers and streams, manholes clogging and consequently the increase of floods in rainy season. Besides this, the problematic also aggravates the destruction of green areas, urban bad odor, flies, cockroaches and rats proliferation (JACOBI; BEZEN, 2011).

The problems experienced by municipalities regarding Urban Solid Waste (USW) also cover the low coverage and inadequate pickup services, open disposal and not controlled burns, increasing water and air pollution, and also the informal waste handling (CETRULO et al., 2018; DALL'AGNOL et al., 2019). As a result of bigger perception and concern regarding to adequate solid waste management, the National Solid Waste Policy (PNRS) was instituted by Federal Law n. 12.305/2010 in 02 August

2010 in Brazil, including the topic of solid waste in the country public policies from a systemic view (PEREIRA; FERNANDINO, 2019).

In Brazil, each municipality owns the responsibility of solid waste management generated in its respective territory, and this operation must be guided by the non-generation, reduction, reuse, recycling, treatment and final disposal of solid waste in an environmentally adequate manner. It is estimated that in 2017, approximately 78,4 million tonnes of urban solid waste, with the Brazilian population average of 1,040 kg.hab<sup>-1</sup>day<sup>-1</sup>. From this total, 6,9 million tonnes were not collected (8% of the whole amount), and 41,6% had its final disposal in an inadequate manner in dumps and controlled landfills (ABRELPE, 2018).

In order to assist the municipalities in the management of its solid waste, the PNRS instituted instruments, highlighting: consortiums; sectoral agreements; selective collection; reverse logistics; creation and development of collectors cooperatives and associations; solid waste plans and environmental education (BRASIL, 2010a). The solid waste plans must be elaborated in many levels: federal, state, microregional, in metropolitan regions or urban agglomeration areas, intermunicipal, municipal and corporate. For this paper, the municipal level plan is considered, denominated the Municipal Plan for Integrated Solid Waste Management (PMGIRS), which consists in a document containing the current situation of urban cleaning services, with pre-selection of the most viable alternatives and establishment of integrated actions and guidelines for all phases of the solid waste management, from generation to final disposal (BRASIL, 2005a, p. 19).

The PMGIRS is mandatory and must attend the minimum requirements envisaged in art. 19 of PNRS for municipalities with more than 20.000 inhabitants. For smaller municipalities, the plan has its content simplified, according to art. 51 of Decree n. 7.404/2010 and is nominated Simplified Municipal Plan for Integrated Solid Waste Management – PMSGIRS (BRASIL, 2010b). Pinho (2011) reports that the PMGIRS have been used as the main instrument in waste municipal management, considering social and environmental dimensions, technical and economical principles. Pupin and Borges (2015), when assessing the PMGIRS of six municipalities of the microregion of

Jaboticabal – SP, concluded that none of the plans met the requirements of PNRS, with significant discrepancy in text, lack of concision and clarity regarding attributions from clauses and paragraphs of the Law, expired legal deadlines and insufficient diagnosis.

According to Moraes (2017), it is common that in most cases, due to legal provisions and pressure from organized communities, the municipalities elaborate their own PMGIRS, even if they do not intend to apply, whether by lack of interest by municipal administrators or deficiency of a control and planning agency, focused on solid waste management.

Within this context, the purpose of this paper is to diagnose the PMSGIRS of 16 municipalities with less than 20.000 inhabitants of the west of Paraná, verifying the satisfactory fulfillment of mandatory contents of PNRS.

## **2 METHODOLOGICAL PROCEDURES**

For the drafting of analysis methodology for PMSGIRS, a bibliographic search was carried out, starting from Federal Law n. 12.305/2010 – National Solid Waste Policy (BRASIL, 2010a); Federal Decree n. 7.404/2010 – that establishes the National Solid Waste Policy (BRASIL, 2010b); the guidebooks: Guideline for the preparation of Ministry Management Plans for Solid Waste (BRASIL, 2011), Solid Waste Management Plans: Orientation Guidelines (BRASIL, 2012) and Guidelines to elaboration of the Simplified Plan for Integrated Solid Waste Management – PSGIRS for municipalities with population of less than 20 thousand inhabitants (BRASIL, 2016). Based on these readings, the fundamental contents of a PMSGIRS were identified, according to art. 51 from Federal Decree n. 7404/2010.

This paper separates the PMSGIRS in three analysis threads: 1. Diagnosis; 2. Aims, programs and actions; and 3. Review. The diagnosis subsidize the action prognosis; therefore, including more information leads to better understanding. It initiates with a general lifting of municipal characteristics and, subsequently, the

topics regarding to solid waste management and urban cleaning. The aims, programs and actions establishment is the second line of analysis, and must be elaborated upon a critical analysis of the diagnosis, formulating necessary actions and programs to the accomplishment of the plan, considering a gradual consolidation, according to the availability of necessary resources, following legal requirements (OLIVEIRA; GALVÃO JUNIOR, 2016). The review is the last aspect to be analyzed and must be compatible with the Municipal Multiannual Plan. This item also considers the existence of social mobilization for the elaboration and approval of the plan. Thereafter, a checklist was developed, in order to review the municipal plans. A checklist allows the labelling of items which do not conform the directives of the plan, and facilitates the outline of corrective actions for the adequation of the analyzed requisites (GENTA; MAURÍCIO; MATIOLO, 2005). In this paper, the checklist will be used to evaluate the fulfilment of the minimum requirements of PMSGIRS according to PNRS.

The list was designed with the interpretation of each of the normative demands, based on the cited public agencies guidelines, cataloguing the essential items for each plan, containing 282 items divided by categorization: diagnosis (219 items); aims, programs and actions (58 items); and review (5 items). For quantification, for each item found in the plan, 1 (one) point will be granted, while 0 (zero) points will be granted when there is no approach regarding the theme. The most punctuated plans are considered the most complete ones.

## **2.1 Sample Group**

The sample group for this research is composed by municipalities located in western Parana, in administrative área of Environmental Institute of Parana, Toledo, which covers 22 municipalities and a population of 367.633 inhabitants, comprising Toledo, Assis Chateaubriand, Diamante do Oeste, Entre Rios do Oeste, Formosa do Oeste, Guaíra, Iracema do Oeste, Jesuítas, Marechal Cândido Rondon, Maripá, Mercedes, Nova Aurora, Nova Santa Rosa, Ouro Verde do Oeste, Palotina, Pato Bragado, Quatro Pontes, Santa Helena, São José Das Palmeiras, São Pedro do Iguaçu, Terra Roxa andTupãssi.

As the main goal of this research is to analyze the PMSGIRS of the municipalities with less than 20.000 inhabitants, the studied municipalities are: Diamante do Oeste, Entre Rios do Oeste, Formosa do Oeste, Iracema do Oeste, Jesuítas, Maripá, Mercedes, Nova Aurora, Nova Santa Rosa, Ouro Verde do Oeste, Pato Bragado, Quatro Pontes, São José Das Palmeiras, São Pedro do Iguaçu, Terra Roxa and Tupãssi, totaling 16 municipalities (Table 01).

Table 01 presents the population of the municipalities, the final disposal measure in place and the presence or absence of a PMSGIRS according to the survey carried out by IBGE in 2014. The identification of the PMSGIRS, firstly it was searched online, as compliance of the transparency and publicity of environmental documents and information; where the PMGIRS was not found online, phone contact was conducted to municipal environmental secretaries or technicians.

Table 01– Research participating municipalities, population, disposal measures and existence of PMGIRS

Municipalities	Disposal of Solid Waste				
	Population (hab.)	Landfill	Controlled Landfill	Sanitary Landfill	PMSGIRS availability
Diamante D'Oeste	5.027		X		X
Entre Rios do Oeste	3.926			X	X
Formosa do Oeste	7.541	X			X
Iracema do Oeste	2.578			X	
Jesuítas	9.001			X	
Maripá	5.684			X	X
Mercedes	5.046			X	X
Nova Aurora	11.866		X		X
Nova Santa Rosa	7.626			X	
Ouro Verde do Oeste	5.692		X		
PatoBragado	4.822			X	
Quatro Pontes	3.803			X	X
São José das Palmeiras	3.830			X	X
São Pedro do Iguaçu	6.491			X	X
Terra Roxa	16.759		X		X
Tupãssi	7.997		X		
<b>Total</b>	<b>107.689</b>				

Font: adapted from IBGE (2014); Paraná (2017)

### 3 RESULTS AND DISCUSSIONS

Out of the 16 municipalities covered by this research, Formosa do Oeste is the only one that has not a PMSGIRS developed yet. Diamante D'Oeste has not an individual PMGIRS, though has a Intermunicipal Plan for Integrated Solid Waste Management (PIGIRS), since it is part of the Intermunicipal Consortium for Sustainable Rural Development of West Region of Parana State (CIDERSOP), and as it is not part of the scope of this research, it will not be evaluated. The other 14 municipalities present a PMSGIRS, with four of them integrated in the Municipal Plan of Basic Sanitation (PMSB) – Table 02. Also presented in Table 02 is the year of conception of the analyzed and its validity.

It can be noted that in the last years the municipalities that had not elaborated its PMGIRS yet, formulated it, and Formosa do Oeste, even declaring the existence of the plan in 2014, when requested, alleged the non-existence. Therefore, from the analyzed municipalities, 93,7% have a Plan, and 6,25% do not have it.

Table 02–PMSGIRS diagnosis checklist

Municipality	Do not have PMSGIRS	PIGIRS	PMSB	PMSGIRS	Elaboration year	In validity
Diamante D'Oeste		X			2018	Yes
Entre Rios do Oeste			X		2016	Yes
Formosa do Oeste	X				-	-
Iracema do Oeste				X	2015	Yes
Jesuítas				X	2015	Yes
Maripá			X		2017	Yes
Mercedes				X	2014	No
Nova Aurora				X	2010	No
Nova Santa Rosa			X		2017	Yes
Ouro Verde do Oeste		X		X	2013	Yes <sup>1</sup>
PatoBragado				X	2008	No
Quatro Pontes				X	2015	No
São José das Palmeiras		X		X	2018	Yes
São Pedro do Iguaçu		X		X	2018	Yes
Terra Roxa			X		2015	No
Tupãssi				X	2013	N
<b>Total</b>	<b>1</b>	<b>1</b>	<b>4</b>	<b>10</b>	<b>-</b>	

1 - The existing plan is the PIGIRS, and not the PMSGIRS. However, as the objective is to analyze the PMSGIRS, this will be reviewed even out of legal deadline.

Font: authors

The checklist will be presented partially, according to the three main threads analyzed. The Charts 01 and 02 present, respectively, the diagnosis checklist and the obtained plan punctuation. The general line: the diagnosis is composed by six analysis items, each divided in many sub-items; by having the bigger number of items, presented a great discrepancy regarding the substance of the plans, with attendance from 17% to 83%.

In many plans, it was not found any information regarding some types of residues, being the lesser quoted: cemeteries waste – not cited in 11 plans, sanitation and bulky waste – not cited in 10 plans, and transport waste, not cited in 6 plans.

Chart 01– PMSGIRS Diagnosis checklist

Item	Analyzed Aspects	Sub-Items
<b>1</b>	<b>Diagnosis</b>	<b>219</b>
<b>1.1</b>	<b>Diagnosis: municipalities general aspects</b>	<b>28</b>
1.1.1	Location aspects: localization (with map), neighboring municipalities, total area, land-use planning – Master Plan, territorial characteristics (metropolitan region, indigenous areas, frontier areas);	5
1.1.2	General aspects – physical environment: climate, soil, terrain, altitude, water balance, water basin;	6
1.1.3	General aspects – demographic and economic characteristics: total population, rural/urban population, population estimative (20 year horizon), demographic density, HDI, municipal GDP, per capita GDP, dominant economic activities;	8
1.1.4	Basic Sanitation: water and sanitary sewage systems: coverage ratio, previous treatment for water, existence of sewage treatment and responsibilities; storm water: existing drainage systems, problems and responsibilities;	9
<b>1.2</b>	<b>Diagnosis: solid waste</b>	<b>174</b>
1.2.1	Federal, state and municipal legislation regarding solid waste; existence of behavior adjustment or judicial proceedings terms; contracts and accords regarding solid waste; municipality participation in Sanitation National Information System (SNIS); existence of municipal councils and conferences regarding solid waste;	7
1.2.2	Organizational structure of solid waste and urban cleaning management services; gravimetric characterization, generation per capita and waste generation estimative;	4
1.2.3	Waste collection (recyclable, organic and rejects), collection coverage percentage (in rural, urban and neighborhood area), frequency, stowage (door to door, voluntary handover points, recycling bins); quantification methods (weighing); distance to temporary storage, if available; distance to final treatment and destination;	7
1.2.4	Methods of final destination: location, service life, environmental license, operation (municipality, autarchy, public company); composting plants initiatives: location and structure, environmental license, operation system;	8
1.2.5	Characterization (provided services: sweeping, manual weeding and rubbing, pruning, manholes cleaning, among others), generation, collection, transport, destination and	7



Item	Analyzed Aspects	Sub-Items
	final disposal of public cleaning waste; sweeping coverage ratio (central areas and districts);	
1.2.6	Characterization, generation, stowage/collection, transport, destination and final disposal of Civil Construction and Demolition Waste (RCC); garbage collectors identification;	7
1.2.7	Characterization, generation, stowage/collection, transport, destination and final disposal of bulky waste;	6
1.2.8	Characterization, generation, stowage/collection, transport, destination and final disposal of green waste (pruning);	6
1.2.9	Characterization, generation, stowage/collection, transport, destination and final disposal of health services waste;	6
1.2.10	Characterization, generation, stowage/collection, transport, destination and final disposal of industrial waste;	6
1.2.11	Characterization, generation, stowage/collection, transport, destination and final disposal of sanitation waste;	6
1.2.12	Characterization, generation, stowage/collection, transport, destination and final disposal of transport waste;	6
1.2.13	Characterization, generation, stowage/collection, transport, destination and final disposal of mining tails;	6
1.2.14	Characterization, generation, stowage/collection, transport, destination and final disposal of agroforestry waste;	6
1.2.15	Characterization, generation, stowage/collection, transport, destination and final disposal of edible oil waste;	6
1.2.16	Characterization, generation, stowage/collection, transport, destination and final disposal of cemetery waste;	6
1.2.17	Characterization, generation, stowage/collection, transport, existence of reverse logistic in town, destination and final disposal of electric-electronic waste;	7
1.2.18	Characterization, generation, stowage/collection, transport, existence of reverse logistic in town, destination and final disposal of batteries;	7
1.2.19	Characterization, generation, stowage/collection, transport, existence of reverse logistic in town, destination and final disposal of tires;	7
1.2.20	Characterization, generation, stowage/collection, transport, existence of reverse logistic in town, destination and final disposal of fluorescent bulbs;	7
1.2.21	Characterization, generation, stowage/collection, transport, existence of reverse logistic in town, destination and final disposal of lubricating oil, packaging materials and waste;	7
1.2.22	Characterization, generation, stowage/collection, transport, existence of reverse logistic in town, destination and final disposal of containers of agrochemicals;	7
1.2.23	Recyclable Materials Collectors Association/Cooperatives: existence, location, structure, environmental license, freelance collectors and amount of material collected; recyclable material buyers, waste destination, percentage of recyclable waste recovered related to household solid waste;	9
1.2.24	Operational, compliance and management structure, with qualitative and quantitative registration of human resources and equipment for solid waste management;	3
1.2.25	Operational, compliance and management structure, with qualitative and quantitative registration of human resources and equipment for urban cleaning public services;	3
1.2.26	Diagnosis of environmental education initiatives; diagnosis of health family program and health community agents; relevant initiatives/projects in waste management and urban cleaning;	4

Item	Analyzed Aspects	Sub-Items
1.2.27	Economical aspects: ecological state tax (ICMS) existence; existence of public cleaning and solid waste management charging, charging systems, charging strategies; costs related to the services, amount estimated, percentage from municipal budget;	8
1.2.28	Critical review: shortcomings and deficiencies of the management; waste disposal spots; universality in public services provision; Prognosis: estimation of waste generation in a 20 year horizon (according to populational growth estimative), dimensioning of necessary equipment for the process of recycling, composting and sanitary landfill;	5
<b>1.3</b>	<b>Diagnosis: waste final disposal favorable areas</b>	<b>1</b>
1.3.1	Identification of favorable areas for waste environmental adequate final disposal; accordance to Master Plan and environmental zoning; conditions of art. 15 from CEMA Resolution n. 94/2014.	1
<b>1.4</b>	<b>Diagnosis: consortium solutions</b>	<b>3</b>
1.4.1	Identification of consortium or shared solutions with neighbor municipalities for waste management; identification of the proximities for final destination; existence of waste management regionalization plan.	3
<b>1.5</b>	<b>Diagnosis: solid waste specific management plans</b>	<b>7</b>
1.5.1	Characterization of smaller and bigger generators; identification of solid waste generators bounded to Solid Waste Management Plan (PGRS);	3
1.5.2	Identification of specific waste generators subject to the conception of PGRS;	1
1.5.3	Identification of obligation for producers, importers, distributors and sellers of reverse logistic products subject to the conception of PGRS;	1
1.5.4	Which institution validates and supervises the waste management plan and reverse logistic system.	2
<b>1.6</b>	<b>Diagnosis: identification of environmental liabilities</b>	<b>6</b>
1.6.1	Existence of garbage dumps or controlled landfills, RCC disposals in operation or not; contaminated sites and sanitation measures.	6

Font: authors

Chart 02- PMSGIRS Diagnosis Punctuation

Items	Amount of criteria by item	Municipality - Number of fulfilled sub-items in PMSGIRS															
		Entre Rios do Oeste	Iracema do Oeste	Jesuítas	Maripá	Mercedes	Nova Aurora	Nova Santa Rosa	Ouro Verde do Oeste	PatoBragado	Quatro Pontes	São Pedro do Iguazú	das Palmeiras	Terra Roxa	Tupãssi		
1.1	28	28	01	02	21	12	12	28	11	5	18	25	25	27	7		
1.2	174	136	36	36	11	81	52	82	43	39	73	135	135	26	47		
1.3	1	0	0	0	0	01	0	01	0	0	0	01	0	0	01		
1.4	3	3	0	0	0	3	0	1	0	0	0	3	3	0	2		
1.5	7	5	0	0	0	7	3	1	1	2	4	7	5	2	1		
1.6	6	6	0	0	0	6	6	1	0	0	0	6	6	0	0		
<b>1. Diagnosis</b>	<b>219</b>	<b>178</b>	<b>37</b>	<b>38</b>	<b>32</b>	<b>110</b>	<b>73</b>	<b>114</b>	<b>55</b>	<b>46</b>	<b>95</b>	<b>181</b>	<b>181</b>	<b>55</b>	<b>58</b>		
<b>Percentage of</b>	<b>100</b>	<b>81</b>	<b>17</b>	<b>17</b>	<b>15</b>	<b>50</b>	<b>33</b>	<b>52</b>	<b>25</b>	<b>21</b>	<b>43</b>	<b>83</b>	<b>83</b>	<b>25</b>	<b>24</b>		

Items	Amount of criteria by item	Municipality - Number of fulfilled sub-items in PMSGIRS													
		Entre Rios do Oeste	Iracema do Oeste	Jesuítas	Maripá	Mercedes	Nova Aurora	Nova Santa Rosa	Ouro Verde do Oeste	PatoBragado	Quatro Pontes	São Pedro do Iguacu	das Palmeiras	Terra Roxa	Tupãssi
attended items (%)															

Font: authors

Besides the absence of the diagnosis of important clauses of Art. 51, from Decree 7.404/2010, such as II and III, it was perceived that many municipalities do not have quantitative data of generation of waste, what impacts the effective elaboration of aims, programs and actions. Therefore, the diagnosis of these plans must be improved, so the reality of these municipalities can be truly known, facilitating a better management.

In Charts 03 and 04, it is approached the line of analysis, aims, programs and actions, composed by eight items, divided into sub-items. This section of PMSGIRS provides the directives to the implementation of the PNRS in the municipality and to a proper operation of the plan. Five out of the fourteen analyzed plans obtained less than 50% of attendance.

Chart 03- Checklist regarding aims, programs and actions for PMSGIRS

Item	Analyzed Aspects	Sub-Items
2	<b>Aims, programs and actions</b>	<b>58</b>
2.1	<b>Operational proceedings and minimum specifications adopted in urban cleaning public services and solid waste management, including adequate environmental final disposal of waste</b>	<b>13</b>
2.1.1	Operational improvements to waste management with inadequate destinations, defining: intervention objectives, programs, actions in short, medium and long term for each new measure and monitoring indicators;	7
2.1.2	Operational proceedings for household waste management and urban cleaning services: stowage, transport, temporary storage, reuse/recycling and final disposal; service provision quality standards;	6
2.2	<b>Regulations for transport and other stages of waste management from art. 20</b>	<b>15</b>
2.2.1	Regulations for stowage, collection, transport, treatment and final disposal for: civil construction waste, health services waste, hazardous waste and other significative waste;	15
2.3	<b>Definition of responsibilities of implementation and operation, including phases of solid waste management plan referred in art. 20 regarding to Public Power</b>	<b>7</b>

Item	Analyzed Aspects	Sub-Items
2.3.1	Identification of shared responsibilities in solid waste management: public power, private generator, public generator, producers/importers, distributors, sellers and household generator;	7
<b>2.4</b>	<b>Programs and actions of environmental education promoting non-generation, reduction, reuse and recycling of waste</b>	<b>4</b>
2.4.1	Environmental education programs aiming non-generation, reduction and reuse of waste in formal and non-formal environment; the environmental communication of these programs; initiatives for the environmental agenda in public administration;	4
<b>2.5</b>	<b>Programs and actions for the participation of recyclable material collectors cooperatives or associations composed by low-income population</b>	<b>5</b>
2.5.1	Hiring of collectors cooperatives and associations, collectors registry; existence of social inclusion programs, capacitation and technical advisory; courses of waste valorization (reuse of edible oil, as example);	5
<b>2.6</b>	<b>Costs calculation system</b>	<b>3</b>
2.6.1	Investments of short, medium and long term to the goals (physical infrastructure, equipment, administrative capacity) according to the multiannual plan;	3
<b>2.7</b>	<b>Aims for selective collection and recycling</b>	<b>8</b>
2.7.1	Aims, programs, actions and deadlines to the improvement of selective collection and organic waste management;	8
<b>2.8</b>	<b>Description of the forms and boundaries for participation of local public power in selective collection and reverse logistic, and other actions related to shared responsibility of products life cycle</b>	<b>3</b>
2.8.1	Mechanisms for the integration of national sectors agreement for reverse logistic; mechanisms for the promotion of selective collection; mechanisms for the integration of selective collection in the public and private sectors.	3

Font: authors

Chart 04–PMSGIRS Aims, Programs and Actions Punctuation

Items	Amount of criteria by item	Municipality - Number of fulfilled sub-items in PMSGIRS													
		Rios do Oeste	Iracema do Oeste	Itaipava	Maripá	Mercedes	Novo Auro	Santa Maria	Veredeto	Itaperiçu	Itaipava	Pontal	São Pedro do Sul	São José das Palmeiras	Terra Roxa
2.1	13	13	1	1	2	13	9	7	4	5	6	13	13	6	1
2.2	15	15	15	15	0	15	15	15	10	15	15	15	15	15	1
2.3	7	7	0	0	0	7	0	7	0	7	7	7	7	7	0
2.4	4	4	0	0	0	1	3	0	1	2	1	3	3	0	0
2.5	5	5	0	0	0	4	1	2	0	0	0	5	5	0	0
2.6	3	3	0	0	0	3	0	3	0	0	0	3	3	0	0
2.7	8	8	1	1	1	4	1	0	0	6	2	8	8	2	0
2.8	3	3	0	0	0	3	2	3	0	0	0	3	3	0	0
<b>2. Aims, programs and actions</b>	<b>58</b>	<b>38</b>	<b>17</b>	<b>17</b>	<b>03</b>	<b>50</b>	<b>31</b>	<b>37</b>	<b>15</b>	<b>35</b>	<b>31</b>	<b>57</b>	<b>57</b>	<b>30</b>	<b>02</b>
<b>Percentage of attended items (%)</b>	<b>100</b>	<b>65</b>	<b>29</b>	<b>29</b>	<b>5</b>	<b>86</b>	<b>53</b>	<b>64</b>	<b>26</b>	<b>60</b>	<b>53</b>	<b>98</b>	<b>98</b>	<b>52</b>	<b>3</b>

Font: authors

Major shortcomings in some of the plans were identified, such as: absence of the approach of how the environmental education will be carried out in the application of the PMSGIRS in 9 out of the 14 plans; absence of planning of the investments of short, medium and long term, in 9 out of the 14 plans; lack of operational improvements for the waste management with inadequate disposal, as the interventional objective, programs, actions of short, medium and long term, with monitoring indicators, in 8 out of 14 plans. The plans of São Pedro do Iguaçu and São José das Palmeiras exhibit excellent definition in their programs, divided in 12 thematic axes, and for each one, delimited projects, actions and aims, with defined deadlines in immediate (3 years), short term (4 to 9 years), medium term (10 to 15 years) and long term (16 to 20 years).

The last general line of analysis, regarding review, is composed by one item, subdivided in 5 sub-items, as showed in Chart 05. Chart 06 presents the punctuation obtained in this aspect.

Chart 05- Checklist regarding Review for PMSGIRS

Item	Analyzed Aspects	Sub-Items
<b>3</b>	<b>Review</b>	<b>5</b>
<b>3.3</b>	<b>XIX -Periodicity of review, primarily observed the period of validity of the multiannual municipal plan</b>	<b>5</b>
3.3.1	Proof of social mobilization for elaboration of the plan; proof of implementation of approval public audience	2
3.3.2	Mention of acting horizon; mention of periodicity of review; current plan.	3

Font: authors

Quadro 06- Pontuação em relação a revisão dos PMSGIRS

Items	Amount of criteria by item	Municipality - Number of fulfilled sub-items in PMSGIRS													
		Entre Rios do Oeste	Iracema do Oeste	Jesuítas	Maripá	Mercedes	Nova Aurora	Nova Santa Rosa	Ouro Verde do Oeste	Pato Bragado	Quatro Pontes	São Pedro do Iguaçu	das Palmeiras	Terra Roxa	Tupãssi
3	5	4	1	1	4	2	0	3	0	0	1	2	2	5	0
<b>3. Review</b>	5	4	1	1	4	2	0	3	0	0	1	2	2	5	0
<b>Percentage of attended items (%)</b>	<b>100</b>	<b>80</b>	<b>20</b>	<b>20</b>	<b>80</b>	<b>40</b>	<b>0</b>	<b>60</b>	<b>0</b>	<b>0</b>	<b>20</b>	<b>40</b>	<b>40</b>	<b>10</b>	<b>0</b>

Font: authors

In the analyzed plans, only one has identified the social participation by means of public audience for the plan approval, and in none of them it was identified the participation in formulation and elaboration. Therefore, it is necessary that the public power retake the population interest in social control over solid waste management, using environmental education for this regard. Machado (2013, p. 513) emphasizes that “so that the participative management is not dismantled and do not become ineffective, the social control must find practical ways of continuous and organized information”.

Social control may be understood as the citizen participation in public management, and to an effective performance, the citizens must be engaged and oriented in how to be an inspector (CONTROLADORIA GERAL DA UNIÃO, 2012). In PNRS the social control is the set of mechanisms and proceedings that grant to the

society information and participation in processes of formulation, implementation and evaluation of public policies related to solid waste (BRASIL, 2010a).

The population engagement is essential during the elaboration and approval of PMSGIRS, in an intensive and direct participation. However, Fonseca (2015) identified that this participation is, in most cases, generic, insufficient, and sometimes purely formal, a result also attested in this paper. With respect to the validity of these plans, 57% (8 plans) are found up to date, while the other 6 plans must obligatorily be renewed.

In Chart 07 the final punctuation of the plans analysis is identified, among the percentage of attendance, and also subdivided in the three main analysis threads. It can be noted that only 3 plans obtained a punctuation over 70%, considering this percentage as the acceptable for the matter compliance. It also shows that 11 of the plans did not attend in a satisfactory way the legislation, with a rate below 70%, representing almost 80% of the analyzed plans.

Moraes (2017) states that in places where there is no culture of planning, the PMSGIRS is flawed, with no indication of which of the public policies must be adopted in the course of a municipal management, resulting in a large number of isolated, spare and disconnected actions and that do not present relations among them, factors that result in waste of public resources, complicating the results verification and management evaluation, as the absence of planning results in the lack of short, medium and long term targets, without the orientation for the implementation of public waste management measures.

Part of the analyzed plans, with fewer legislation accomplished scores, did not presented environmental programs consistent to the resolution of identified problems. These resolutions come from isolated actions, without monitoring indicators, and in most cases without incorporating environmental education, fact that will not provide advances in the management.

Chart 07 – Punctuation of PMSGIRS and PMSB according to checklist

Items	of criteria	Municipality - Number of fulfilled sub-items in PMSGIRS and PMSB													
		Rios do Iraema do Oeste	Jesuítas	Maripás	Mercedes	Nova Aurora	Nova Santa Rosa	Verde do Parobragado	Ponte Pedro do Jussaras	Terra Roxa	Tupãsi				
<b>1. Diagnosis</b>	219	178	37	38	32	110	73	114	55	46	95	181	181	55	58
<b>2. Aims, programs and actions</b>	58	38	17	17	3	50	31	37	15	35	31	57	57	30	2
<b>3. Review</b>	5	4	1	1	4	2	0	3	0	0	1	2	2	5	0
<b>Total</b>	282	220	55	56	39	162	104	154	70	81	127	234	234	90	60
<b>Percentage of attended items (%)</b>	100	78	19	19	13	57	36	54	24	29	45	82	82	31	21
<b>Classification</b>	-	2	12	11	13	3	6	4	9	8	5	1	1	7	10

Font: authors

In this regard, it is questionable the divergencies between national legislation over the PMSGIRS and the real application of this instrument, mainly in small-sized municipalities. Marotti (2017) also questions: the promulgation of national legislations provoked the expected rupture in the municipalities inaction state, or this legal landmark is not enough for the necessary progress? Moreover, the author complements about the improvement in the implementation of the provisions of the law by means of wider actions, as the technical capacitation in municipalities and a closer alignment of obligations and legal contents.

Fonseca (2015) concludes that the faced constraints in 26 municipalities in the Administrative Central Region of São Paulo State are not caused by financial order, but by technical and administrative nature; with a staff without the necessary training and qualification to conduct the necessary duties in the elaboration of the plans, implicating in the hiring of business companies, with the risk of receiving a patterned plan, that does not fit in the local necessities.

It is noted the lack of technical knowledge by some consulting companies over the minimum required contents demanded by legislation, as from the 14 analyzed plans, 11 were found to be elaborated by consulting companies. Excluding the three



plans that obtained the percentage over 70%, the other 09 companies did not presented a technical report compatible with the environmental legislation.

The non-compliance of the minimum required contents demanded in PNRS to the PMSGIRS among other ways could be decreased by two ways: if the municipal technicians, when hiring companies to the elaboration of the PMSGIRS, knew the minimum content the plans should have, and in the case of gaps, promptly request corrections and the inclusion of studies and missing contents; and if the population had a greater awareness about the importance of the PMSGIRS and its minimum contents, in other words, if the population undertook social control, as according to PNRS: "it is assured wide publicity to the solid waste plans, as well as social control in its formulation, implementation and operation" (BRASIL, 2010a).

#### **4 CONCLUSIONS**

The objective of this study was to diagnose the PMSGIRS of 16 municipalities with less than 20.000 inhabitants in west region of Paraná, verifying the satisfactory attendance of the mandatory content defined in the PNRS. In this regard, the applied methodology for the plans analysis was created from examination of guidelines provided by the Ministry of Environment – Department of Water Resources and Urban Environment, assembling all the information and creating a checklist.

The checklist has proved to be effective, allowing the identification of missing items according to the three main analysis threads: diagnosis; aims, programs and actions; and review. This checklist can be replicated for the analysis of other Brazilian PMSGIRS, just observing if the municipality has less than 20.000 inhabitants.

It was found that the majority of the analyzed plans (78%) do not meet in a satisfactory way the minimum contents of the National Solid Waste Policy, more specifically of the art. 51 from Decree 7.404/2010, since obtained less than 70% of the required content. Only 3 plans (22%) obtained a satisfactory level of attendance, being the cities of São José das Palmeiras, São Pedro do Iguaçu and Entre Rios do Oeste, with percentages of 82%, 82% and 78% respectively. Thereby, the plans considered

unsatisfactory must not be considered valid in attestation to competent State and Federal organs.

Faced this situation, the main scientific contribution of this paper is the possibility of this diagnosis be used as a recommendation for an urgent verification and revision of these plans, aiming the inclusion of missing content, since a PMSGIRS that does not contemplate all the mandatory requirements, compatible with local circumstances, precludes the chain of urban cleaning and solid waste management, resulting in issues in environmental, social, economic and health areas. Furthermore, it is alarming the lack of responsibility of the municipal public organs for these matters.

A limitation in the carried analysis was that it was only considered the existence (or not) of the contents quoted in the Law, not the quality of these topics and neither the applicability of the plan, allowing further investigations for other papers. It can be recommended the investigation of the applicability of the plans, the analysis of bidding processes and the terms of reference used in the hiring of consulting companies, the search for the reasons of absence of social control, the evaluation of knowledge of the technical staff responsible by the solid waste management, and the examination of the control by the environmental authorities in the PNRS performance.

Moreover, for further research, it was verified that none of the plans had social participation in its elaboration, and only in one of the plans it was identified the social participation in a approval public audience. Facing this problem, aiming the insertion of environmental education as an alternative to the change of this reality, it is recommended the elaboration of an educational product formatted as a guide book. This option facilitates the spread of information to the population and public agents regarding the contents of the plan, and stimulates the social participation in formulation, implementation and evaluation of solid waste public policies. It is indispensable that municipal public agents know the contents of these plans, and also that population undertake the social control in this planning instrument.

Lastly, it is recommended the replication of the methodology described in this paper for all the small municipalities of Paraná State, just as for the municipalities of the whole country with less than 20.000 inhabitants, in order to obtain a national diagnosis of the existence of the minimum contents established by law in the PMSGIRS of the small municipalities, and also to know the percentage of the municipalities that possesses these plans.

## ACKNOWLEDGEMENTS

This present paper was carried out with the support of the Coordination for the Improvement of Higher Education Personnel (CAPES) and the National Water Agency (ANA).

## REFERENCES

ABRELPE – ASSOCIAÇÃO BRASILEIRA DE EMPRESAS DE LIMPEZA PÚBLICA E RESÍDUOS ESPECIAIS. **Panorama dos resíduos sólidos no Brasil: 2018. [Internet].** São Paulo: Abrelpe; 2018 [cited 2020 Jan 24] Available from: <http://www.abrelpe.org.br/Panorama/panorama2018.pdf>

BRASIL; Ministério do Meio Ambiente. **Gestão integrada de resíduos sólidos na Amazônia: a metodologia e os resultados da sua aplicação.** Brasília (Brasil): Ministério do Meio Ambiente, 2005.

BRASIL; Secretaria de Recurso Hídrico e Ambiente Urbano; Ministério do Meio Ambiente. **Guia para elaboração dos Planos de Gestão de Resíduos Sólidos.** Brasília (Brasil): SRHU/MMA, 2011.

BRASIL; Secretaria de Recursos Hídricos e Ambiente Urbano. **Orientações para elaboração de Plano Simplificado de Gestão Integrada de Resíduos Sólidos: PSGIRS para municípios com população inferior a 20 mil habitantes.** Brasília (Brasil): SRHU, 2016.

BRASIL; Secretaria de Recursos Hídricos e Ambiente Urbano. **Planos de gestão de resíduos sólidos: manual de orientação.** Brasília (Brasil): SRHU, 2012.

CETRULO T, MARQUES RC, CETRULO NM, PINTO FS. **Effectiveness of solid waste policies in developing countries: A case study in Brazil.** Journal of Cleaner Production. 2018; 205(20):179-187.

COSTA SL. **Gestão Integrada de Resíduos Sólidos Urbanos: aspectos jurídicos e ambientais.** Aracaju - Se: Evocati; 2011.

DALL'AGNOL ALB, LOEBENS L, DEMARCO CF, ARAUJO MMF, LEANDRO D, CASTRO AS, et al. **The perception of municipal manager on the management of urban solid waste.** *Ciência e Natura.* 2019; 31(19):01-08.

DECRETO nº 7.404, de 23 de dezembro de 2010. **Lex: Regulamenta a Lei nº 12.305.** Diário Oficial da União (Brasília) 2010 Ago 02.

FONSECA SA. **Planos municipais de gestão integrada de resíduos sólidos: Mito ou Realidade?** *Revista Brasileira de Desenvolvimento Territorial Sustentável.* 2015; 1(1):106-122.

GENTA TMS, MAURÍCIO AA, MATIOLI G. **Avaliação das boas práticas através de "check-list" aplicado em restaurantes "self-service" da região central de Maringá, estado do Paraná.** *Acta Sci Health Sci.* 2005; 27(2):151-6.

GOUVEIA, N. **Resíduos sólidos urbanos: impactos socioambientais e perspectiva de manejo sustentável com inclusão social.** *Ciência & Saúde Coletiva.* 2012;6(17):1503-1510.

IBGE - INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA. **Pesquisa de Informações Básicas Municipais: Perfil dos Municípios Brasileiros.** Rio de Janeiro: IBGE; 2014 [cited 2020 Jan 24] Available from: [ftp://ftp.ibge.gov.br/Perfil\\_Municípios/2013/munic2013.pdf](ftp://ftp.ibge.gov.br/Perfil_Municípios/2013/munic2013.pdf)

JACOBI PR, BEZEN GR. **Gestão de resíduos sólidos em São Paulo: desafios da sustentabilidade.** *Estudos Avançados.* 2011;25(71):135-158.

LEI nº 12.305, de 02 de agosto de 2010. **Lex: Institui a Política Nacional de Resíduos Sólidos.** Brasília, DF, 2010a.

MENDEZ GP, MAHLER CF. **Evolution of integrated solid waste management systems in Brazilian cities under the national solid waste management.** *Ciência e Natura.* 2018;40(11).

MORAES JL. **Os planos municipais de gestão integrada de resíduos sólidos e sua implantação em municípios da região centro sul do Ceará [thesis].** Rio Claro: Departamento de Geografia/Instituto de Geociências e Ciências Exatas da Universidade Estadual Paulista "Júlio de Mesquita Filho"; 2017.

OLIVEIRA TB, GALVÃO JUNIOR AC. **Planos municipais de gestão integrada de resíduos sólidos.** In: TONETO JUNIOR R, SAIANI CCS, DOURADO, J. (Org.) *Resíduos Sólidos no Brasil: oportunidades e desafios da Lei Federal nº 12.305 (Lei de Resíduos Sólidos).* 1st ed. São Paulo: Manole, 2014.

PARANÁ; Instituto Ambiental do Paraná. **Relatório da situação da disposição final de resíduos sólidos urbanos no estado do Paraná**. Curitiba (Paraná): IAP, 2017.

PARANÁ; Secretaria de Meio Ambiente e Recursos Hídricos. **Plano de Regionalização da Gestão Integrada de Resíduos Sólidos Urbanos do Estado do Paraná**. Curitiba (Paraná): SMRH, 2013

PEREIRA TS, FERNANDINO G. **Evaluation of solid waste management sustainability of a coastal municipality from northeastern Brazil**. *Ocean&Coastal Management*. 2019;179(1):104839.

PINHO PM. **Avaliação dos planos municipais de gestão integrada de resíduos sólidos urbanos na Amazônia Brasileira**. [thesis]. São Paulo: Departamento de Ciências Ambientais/USP; 2011.

PUPIN PLF, BORGES ACG. **Acertos e contradições na interpretação da lei 12.305/10 nos planos municipais de gestão integrada de resíduos sólidos da microrregião de Jaboticabal – SP**. *Ver. Nac. de Gerenc. de Cidades*. 2015;03(15): 158-175.