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Regional aspects of scientific production from the national solid waste policy in Brazil

The main scope of this research focuses on the identification and interpretation of scientific papers dealing with the National Solid Waste Policy (PNRS) or Law 12.305/2010, which was created to guide government and society actions regarding the effective management of urban solid waste encompassing the generation, collection and final disposal of leftover consumption produced by public and private companies or by individuals. In this sense, the analyzes and reports presented throughout this manuscript have an important and even innovative proposal to gather and interpret the results from the regional perception within the scope of the Brazilian continent. As for the specific objectives: to list relevant aspects of national legislation that contribute to the management of urban solid waste; to map the published scientific works that deal with the issue of solid waste, between the period 2010 to 2020, and, from the results obtained in the second objective, to extract key concepts used by the authors that denote the reality of construction of scientific studies. This is a research with a qualitative approach, with bibliometric and content analysis technical procedures. The analyzed textual body, consisting of 60 articles, was instrumented using the IRaMuTeQ software, which enabled the reading of the equivalent of 10,003 words (sum of the words that make up the abstracts of the selected scientific articles). Among the results, four (4) key concepts were identified, which are selective collection, waste, sustainability and environmental. These results, when analyzed by region, show guiding trends for the studies, pointing to the specific predominance of key concepts for this or that region. The connotation for this can be credited to the breadth of the PNRS, which is treated (regionally) based on the reality (difficulty/challenge) experienced.

Keywords: Sustainability; Sustainable cities; Local development; Bibliometric analysis.

Aspectos regionais da produção científica a partir da política nacional de resíduos sólidos no Brasil

O escopo principal desta pesquisa concentra-se na identificação e interpretação de trabalhos científicos que tratam da Política Nacional de Resíduos Sólidos (PNRS) ou Lei 12.305/2010, que foi criada para orientar as ações do governo e da sociedade em relação ao gerenciamento eficaz dos resíduos sólidos urbanos abrangendo a geração, coleta e destinação final das sobras de consumo produzidas por empresas públicas e privadas ou por pessoas físicas. Nesse sentido, as análises e os relatos apresentados ao longo deste manuscrito têm uma proposta importante e até inovadora de reunir e interpretar os resultados da percepção regional no âmbito do continente brasileiro. Quanto aos objetivos específicos: elencar aspectos relevantes da legislação nacional que contribuam para a gestão dos resíduos sólidos urbanos; mapear os trabalhos científicos publicados que tratam do tema resíduos sólidos, entre o período de 2010 a 2020, e, a partir dos resultados obtidos no segundo objetivo, extrair conceitos-chave utilizados pelos autores que denotam a realidade de construção de estudos científicos. Trata-se de uma pesquisa de abordagem qualitativa, com procedimentos técnicos bibliométricos e de análise de conteúdo. O corpo textual analisado, composto por 60 artigos, foi instrumentado por meio do software IRaMuTeQ, que possibilitou a leitura do equivalente a 10.003 palavras (soma das palavras que compõem os resumos dos artigos científicos selecionados). Entre os resultados, foram identificados quatro (4) conceitos-chave, que são coleta seletiva, resíduos, sustentabilidade e meio ambiente. Esses resultados, quando analisados por região, mostram tendências norteadoras dos estudos, apontando para a predominância específica de conceitos-chave para esta ou aquela região. A conotação disso pode ser creditada à abrangência da PNRS, que é tratada (regionalmente) a partir da realidade (dificuldade/desafio) vivenciada.

Palavras-chave: Sustentabilidade; Cidades sustentáveis; Desenvolvimento local; Análise bibliométrica.

Topic: **Planejamento, Gestão e Políticas Públicas Ambientais**

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INTRODUCTION

The treatment given to urban solid waste is the theme of this research, especially at a time when the issue of sustainability of cities has become so important for modern societies. Sustainable cities are understood as the balanced harmony between environmental protection and city cleanliness, in order to produce health for the inhabitants, without harming their development. The connection of these relationships is directly related to Local Development, which takes into account any and all indicators (Human Development Index and Sustainable Development Index, for example), which consider the human needs of health, education and human development, social, political and cultural, among others.

This research is justified by the need to awaken the Brazilian society to the urgency of urban solid waste management in the Brazilian territory. The research is also justified by the possibility of directing governments, both nationally and regionally, towards the creation and implementation of public policies aimed at solid waste management and environmental sustainability.

To achieve this research, a general objective and three specific objectives were outlined. The general objective is to analyze the scientific approaches regarding the National Solid Waste Policy in the regions of Brazil, in order to identify predominant writing characteristics in scientific texts. As for the specific objectives, the first is to list relevant aspects of national legislation that contribute to the management of urban solid waste; the second map the published scientific works that deal with the issue of solid waste for cities, and, from the results obtained in the second objective, extract key concepts used by the authors that denote the reality of construction of scientific studies.

Regarding the approach, this research is qualitative, with bibliometric and content analysis technical procedures. The analyzed textual body, consisting of 60 articles, was instrumented using the IRaMuTeQ software.

As for the organization, in addition to the introduction and conclusion, this research has four other topics, the first of which presents an overview of solid waste in Brazil and the second outlines an approach to Brazilian environmental legislation. As for the third and fourth, the affinity that unites them is the materials and methods, which made it possible to extract the data and analyze the results.

THEORETICAL REVIEW

Panorama of solid waste in Brazil

Law No. 12,305 published on August 2, 2010, defines solid waste as any material, substance, object or good discarded resulting from human activities in society. The law provides guidelines relating to the integrated management and management of solid waste, including hazardous waste, responsibilities of generators and the government, and applicable economic instruments, in order to avoid damage to public health and environmental safety (BRASIL, 2010).

However, contrary to what is established by current legislation, many cities still lack adequate and healthy infrastructure. According to data from the Panorama of Solid Waste in Brazil, collected by the

Brazilian Association of Public Cleaning and Special Waste Companies (ABRELPE, 2020), the 19% increase in the generation of such waste in the last ten years in the country was accompanied by a deficit in regular collection of these services and inadequate final destination.

Despite the institutionalization of the PNRS dictates the competences of managing these wastes in the federation, there are still obstacles for the law to be actually applied at the local level, such as the need to raise awareness of the population in generating less waste, the implementation of reverse logistics of products and the correct disposal of waste (ABRELPE, 2020). The consequences of an unbridled level of consumption increasingly show these problems. It is necessary to think of the contemporary city from the perspective of urban sustainability in favor of the planet and future generations.

The City Statute (BRASIL, 2001) - one of the Brazilian laws for territorial planning - was created to organize urban social functions and defend cooperation between public and private authorities and the population in general to guarantee sustainable cities that guarantee environmental balance. Another form of incentive to sustainable development arising from global practices and adequate to the needs of each country are the Sustainable Development Goals (SDGs) created by the United Nations (UN). Among them is the objective of reviewing consumption and production patterns by the year 2030. This concern with responsible consumption and production aims to promote 'information, coordinated management, transparency and accountability of actors who consume natural resources as tools key to achieving more sustainable patterns of production and consumption'. To verify the progress of these proposals and actions in the Brazilian territory, it is necessary to map the relevant aspects of national legislation on the management of urban solid waste and carry out an approach to the review of scientific literature to understand this discussion in Brazilian cities about a development site from the National Solid Waste Policy (PNRS).

For this, in addition to the survey of the national legal basis that regulate the environmentally correct management of urban solid waste, a research and subsequent description of studies related to the theme were carried out, this stage made it possible to highlight key concepts that guided such scientific trials.

Approach to environmental legislation

According to the Constitution of the Federal Republic of Brazil, enacted in 1988, the municipal, state and federal levels have the necessary powers to propose public policies related to environmental protection with regard to the survival and maintenance of fauna and flora, protection of Brazilian history, heritage, among others (BRASIL, 1988).

According to art. n º 225 of the same Constitution (BRASIL, 1988), is entitled to all Brazilian citizens access to the common quality and in order to ensure the preservation of species and ecosystems, as well as the control activities that can cause damage to the environment, such as the exploration of natural resources and works of different types.

Environmental guidelines that were already standardized by National Environmental Policy of 1981 ruling on the guarantee of socio-economic development, national security and the protection of life in

Brazil. Among its goals is the rationalization of the soil from the protection of ecosystems, as well as the mastery of the spatial distribution of activities in urban land, which can become polluting depending on the location and its implementation (BRASIL, 1981).

For the best management and application of this law, there is a hierarchical distribution in different instances, from the superior agency (federal government) to the local agency (municipality) (BRASIL, 1981). In the federal area, it is up to the National Environmental Council (CONAMA) to define criteria for the licensing of activities that may generate some type of pollution to the environment. Such instruments of the National Environmental Policy have management over the environmental zoning, the assessment of environmental impacts and the licensing of activities that can be polluting (BRASIL, 1981).

Two decades after the creation of the National Environmental Policy, the institutionalization of the City Statute (BRASIL, 2001) evidenced the regulation on the impacts of different activities in the urban space. Among them, the guarantee of environmental balance based on the preparation of a previous environmental impact study (EIA) in potentially polluting places, such as the assessment and insertion of landfills.

In 2010, the National Solid Waste Policy (PNRS) aimed to define guidelines for an integrated management and solid waste management by generators and public authorities (BRASIL, 2010). According to the law, it is necessary to manage the process throughout the product cycle, especially its final destination.

After checking the chronology of laws that support the protection of the environment from different goals and objectives, it is worth observing the consequences and the effective application of the PNRS at the local level. Numerous works were developed with the aim of correlating the PNRS to local development in different Brazilian cities. For Ribeiro et al. (2016), the interconnection between global and local governance is extremely necessary so that public policies are really effective and encourage care for the environment with the agents involved. For the authors, this relationship between the public sphere and civil society generates a collective consciousness in the opposite direction, from the local to the global, ensuring sustainability and development in the territory.

Although the PNRS has clear guidelines on how to proceed with solid waste management at the local level, it is necessary to engage the population. Amid cities that still lack basic public health conditions such as basic sanitation and even illiteracy, the PNRS is still a challenge to be overcome (GODOY, 2013; SOARES et al., 2018).

The improper management of solid waste, especially in large cities, generates negative consequences to public health. One of the ways to resolve this situation is to integrate social, environmental and economic policies in order to ensure “healthier development, in a socially just, environmentally sustainable, sanitary correct and economically solidary perspective” (GOUVEIA, 2012).

One of the ways to ensure the improvement of solid waste management is to promote environmental education. It is essential that the population rethink their habits, basing them on an interdisciplinary perspective and on a global and integrated dimension, avoiding individuality and actually acting as a society (CARTAXO, 2018). In practice, interdisciplinary environmental education can instigate

human creativity in order to foster new forms of sustainable and integrated management, collaborate to change the behavior of individuals and provoke reflection among urban planning professionals in order to propose solutions to environment (PRIETO et al., 2019).

Another way to involve the social perspective is to welcome waste collectors throughout this process and to raise awareness among the population about the separation of solid waste in their respective homes (NASCIMENTO et al., 2015). Among the benefits generated by the collection of waste by cooperatives is the generation of income and the destination of the recycled product to the local economy (SOUZA et al., 2012).

MATERIALS AND METHODS

The study has a qualitative approach, where the presence or absence of certain content characteristics or even a set of characteristics is observed and considered (BARDIN, 2016). Thus, the literature review for this research aims to carry out a survey of published scientific works. The aim is to contribute to the expansion of debates surrounding environmental issues in Brazil.

From this perspective, a bibliometric study was carried out[1] of the scientific production on the theme of urban solid waste in Brazil, instrumentalized through the IRaMuTeQ software (R interface for Multidimensional Text and Questionnaire Analyzes) and using the method of content analysis[2].

For this, the scientific production database of the Coordination for the Improvement of Higher Education Personnel (CAPES) was accessed. In this phase, search words were defined to obtain the respective results. They are: i) solid waste ii) cities iii) local development[3], which served as keywords used in the consultation of the CAPES database. Such words were applied with the operators (OR/AND) in the search journal mentioned above. Complementing the filtering, publications registered in the period from 2010 to 2020 were chosen, considering 'peer-reviewed' articles.

From the pre-established parameters, the search in the CAPES database resulted in 302 (three hundred and two) articles, which were later accessed individually so that the following information could be collected: title of the article; resume; year of publication and location of the study (defined by region of the country).

Once tabulated s information and performed as readings of their summaries were necessary some exclusions articles in order to keep only those that deal with the theme of 'solid waste' in areas urban. From this, the number of 60 (sixty) reference bases to be analyzed was reached. Once the information was tabulated and read from their abstracts, some exclusions of articles were necessary in order to keep only those dealing with the topic 'solid waste' in urban areas. This is because many of the other articles dealt with waste of other natures, such as hospital, chemical and radioactive waste. From this, the number of 60 (sixty)

[1] It consists of analyzing the scientific activities of publications, through this approach 'quantitative data are calculated from the statistical counts of publications or elements that bring together a series of statistical techniques, seeking to quantify the processes of written communication' (SILVA et al., 2011).
[2] Bardin (2016) defines content analysis as a research technique that aims to objectively, systematically and quantitatively describe the manifest content of communication.
[3] The keywords used for this research were searched in Portuguese as the research was carried out in the database of the Coordination for the Improvement of Higher Education Personnel (CAPES) in Brazil. However, for this article, the words were translated into English for a better understanding of the results.

reference bases to be analyzed was reached.

It is noteworthy that, in a qualitative research based on a large number of scientific publications, we seek to highlight the lines followed by the most distinguished authors on a given subject. In this case, having a 'robust' database, it is necessary to use computer programs that support data analysis in qualitative research.

For this study, a database with a total of 10.003 words was obtained, distributed in 60 abstracts of scientific articles. The analysis was performed using the free software IRaMuTeQ using words originating in the Portuguese language.

The analysis in IRaMuTeQ precedes some parameterizations necessary for the database, which: 1) compound words must be separated by underscore (_) or instead of hyphen (-) (example: *quarta_feira* instead of *quarta-feira*); so also for words that are aimed at (2) highlighting (example: *resíduos_sólidos*; *desenvolvimento_local*, instead of *resíduos sólidos* and *desenvolvimento local*);(3) in addition to changes in the positioning of the verb-pronominal inflections, making use of the low stroke (_), example: *se_buscou*; *se_observou*; *se_optou*, rather than *buscou-se*; *observou-se*, *optou-se*.

From this, each of the 60 abstracts is divided by IRaMuTeQ into text segments or text excerpts, also called elementary context, which consist of abstracts with approximately 46 (smallest) and 249 (largest) words. Next, the second step consists of the lemmatization of the corpus[4], that is, it is the reduction of words in their simple forms (the root of the word), from the structure of word formation, conditioned to the database that the software offers. The construction of a lexicographic analysis constitutes the third step, which is performed from the structuring of a contingency table of the matrix of reduced forms, explained in the previous steps, in this step the software crosses the elementary context units.

One of the analyzes performed is the Descending Hierarchical Classification (CHD). As a result, lexical classes were obtained, which are arranged and characterized by vocabulary and text segments that share the same vocabulary. This treatment precedes the fourth step, which results in the description of the accumulated classes (each class is presented with a list of words) where each word and its percentage frequency in the text is observed, in addition to presenting the association value of the word with this class (X^2).

> To create a word dictionary, the program uses the chi- square test (X^2)[5], which reveals the associative force between words and their respective class. The associative strength is analyzed when the test is greater than 3.84 representing p>0.0001. The smallest of the chi- square represents a smaller relationship between the variables. (SOUZA et al., 2018)

The analysis made use of the returns given by the IRaMuTeQ software, namely, the elementary context units notably characteristic in the corpus text, in which the words that stood out the most denote the theoretical inclinations adopted by the authors in their productions.

[4] It is a set of texts constructed by the researcher, being the object of analysis. Example: a set of articles in the medical field, published in a given period of the health session in a newspaper or a set of interviews about a research object in case studies, or even the compilation of a composite of open responses from a given study in some kind of open poll.

[5] It is applied when one wants to study the dependence between two variables, through a double-entry table or also known as a contingency table. Formula: $x^2 = \Sigma \left(\frac{(observed - expected)^2}{}\right)$

Next, a content analysis was carried out, correlating the identified elements (lexical classes) and the keywords (previously mentioned), which are considered as analysis categories, allowing to understand how the obtained results converge or not with the categories of suggested analysis.

Presentation of data and analysis of results

From a previous reading, the base that makes up the textual corpus was divided according to the region of study of the article: North (N), South (S), Southeast (SE), Northeast (NE), Midwest (CO) and Brazil (BR), the latter for generalist studies, with the publication date also being broken down, as shown in Table 1. Some of the publications shown in the table were used throughout this article.

Table 1: Description of production of articles published in Brazil (BR) and by region.

Region	Year [(1)]	Total Amount	% (percentage)
BRAZIL (BR)[1]	2012; 2013; 2014; 2015; 2016; 2017; 2018; 2019; 2020.	19	31,67%
SOUTHEAST (SE)	2011; 2012; 2013; 2014; 2016; 2017; 2018.	14	23,33%
SOUTH (S)	2011; 2013; 2014; 2015; 2017; 2018; 2019; 2020.	13	21,66%
NORTHEAST (NE)	2011; 2014; 2015; 2017; 2019.	07	11,67%
NORTH (N)	2011; 2017; 2019	04	6,67%
MIDWEST (CO)	2016	03	5,00%
TOTAL		**60**	**100%**

[1] Scientific productions involving the PNRS nationwide, without specifying location.

This being the basis of the text that Corpus induced to the IRaMuTeQ software, which initially brings in the 'Corpus Description Test' 287 text segments, with occurrences of 10,003 words. There is a use of 73.95% of text segments, according to the software configuration, in a clear indication of the consistency and adequacy of the content used in the analysis. Among the 14 (fourteen) main 'active' words found by IRaMuTeQ in the textual corpus (Table 2).

Table 2: Main active words of *the* textual *corpus* found by IRaMuTeQ.

	Word	Amount
1.	Ambiental	69
2.	Resíduos sólidos	62
3.	Realizar	33
4.	Social	32
5.	Urbano	30
6.	coleta seletiva	29
7.	Público	25
8.	meio ambiente	22
9.	Qualidade	22
10.	Empresa	22
11.	Gerar	21
12.	Gerenciamento	22
13.	Ação	20
14.	Cidade	20

For these text clippings, 971 (9.71%) occurrences of 'hapax' (words that appear only once in the text) were obtained. In the next step, the reading of the Dendrogram (Figure 1) was performed, which distributes the analyzed texts into 4 (four) classes.

Two subbodies are observed, on the one hand, Class 2 with 16.30% of the words, and Class 3, which concentrates 20.90% of the analyzed words. At the other extreme, Class 1 with 14.80% which presents a subdivision that includes Class 4 (24.50%) and Class 5 with 23.5% of the words contained in the textual corpus.

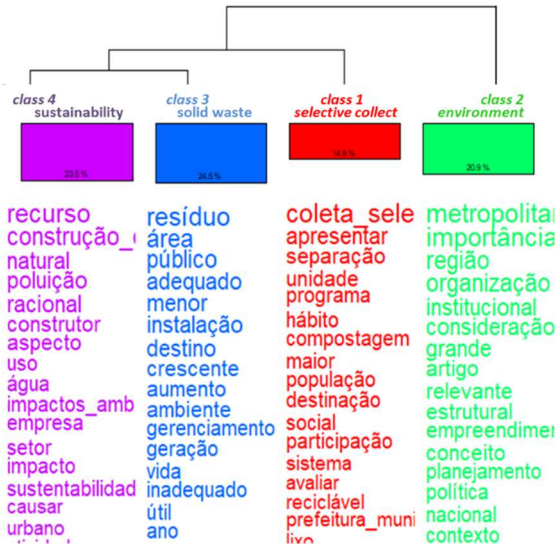

Figure 1: Dendrogram of lexical classes provided by the IRaMuTeQ software.

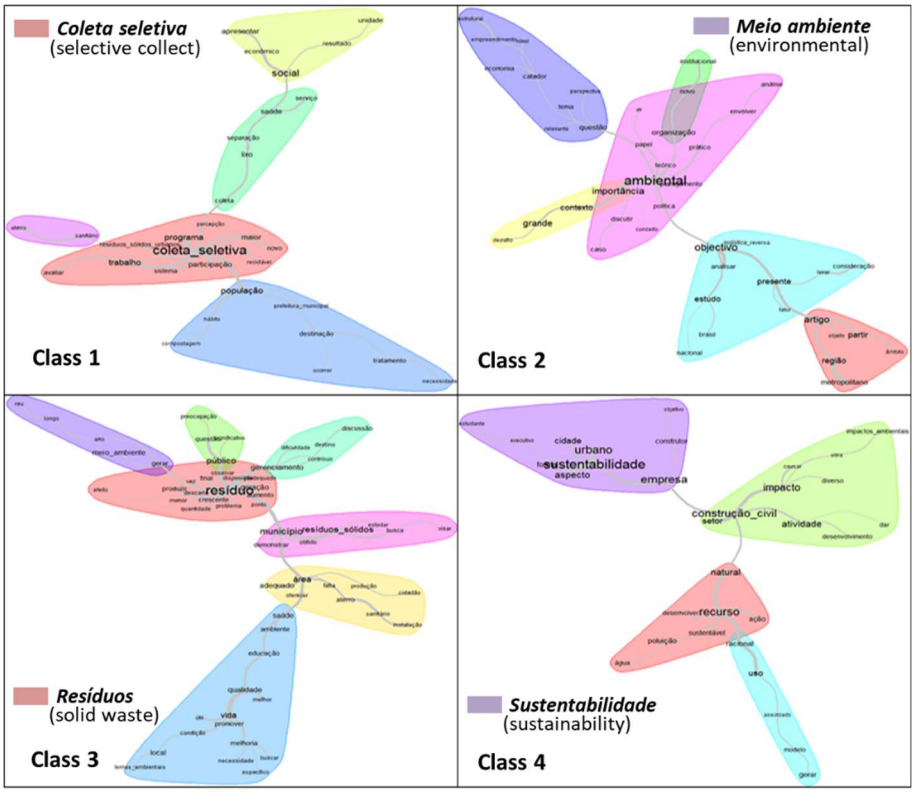

Figure 2: similarities charts of grammatical classes 1, 2, 3 and 4.

From this analysis, we elaborated a similarity graph for four (4) class are words (we opted not analyze the Class Grammar 2 (two), which carries only indications related to research methodology used in the studies analyzed). The words are graphically grouped, allowing to understand and name them according to the lexical classes highlighted by the program. For this stage, the analysis of words that presented a value greater than 3.84 and $p<0.0001$ is considered.

Through the organization of Lexicon Classes, we sought to highlight key concepts (words that stand out in the figure). Which are understood as guiding words of the analyzed studies, are surrounded by other words that are interrelated in the context of the studies. As a result, the following key concepts were obtained: *resíduos, coleta seletiva, sustentabilidade* and *ambiental*, which means in English: solid waste, selective collection, sustainability and the environment.

Once evidenced, such concepts were analyzed using the IRaMuTeQ software in order to identify the usual frequency in scientific works, considering the regional productions (BR, CO, N, NE, S and SE) (Figure 3).

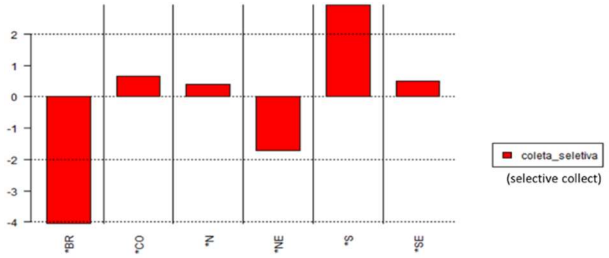

Figure 3: Frequency of the word 'selective collect' for regions.

The word under analysis (selective collect) is predominantly present in scientific works carried out in the South (S) region, contrary to publications grouped in the BR region, which denotes generalized environmental approaches in its lexical structure. Very focused on works related to selective collection, the South region related this theme to integrated municipal management and, fundamentally, to environmental education.

Based on the analysis of plans in the microregions of Rio Grande do Sul, Carbonai et al. (2020) highlighted as essential the insertion of local instruments that help in the selective collection of solid waste based on participatory management. Likewise, Nagashima et al. (2011) presented the implementation of an urban solid waste management model for the municipality of Paranavaí, state of Paraná, with a focus on selective collection, aiming to rationalize existing resources and reduce the amount of solid waste generated. Still in the same state, Januário et al. (2017) carried out a behavioral analysis of the population of Wenceslau Braz, state of Paraná, regarding the promotion of selective collection through an organized partnership between the university and the local city hall. The results showed greater disinterest in those with less education, which justifies the need for investment in the population's environmental education.

Failure et al. (2017) also proposed methods for solid waste management, but in the municipality of Sananduva, state of Rio Grande do Sul, which resulted in the need to adopt composting procedures, selective collection juxtaposed to environmental education and changes to more sustainable habits. A problem that was also evidenced in Santa Maria, state of Rio Grande do Sul, from the existence of a large volume of waste that has not been separated by the population, which requires the encouragement of selective collection and environmental education (ALMEIDA JÚNIOR et al., 2015).

Likewise, Poli et al. (2014) emphasize the importance of selective collection in the city of Lages, state of Santa Catarina, due to the irregular conditions of the municipal landfill. The beginning of the solution to this problem is the correct separation of waste based on constant environmental education.

Finally, Almeida et al. (2020) highlight the ineffectiveness of the PNRS for the municipality of Santa Cruz do Sul, state of Rio Grande do Sul, due to the incorrect disposal of waste resulting from the lack of interest from the local community.

One of the existing forms of reuse from selective collection is reverse logistics. According to a study developed by Krupp et al. (2017), practices of a cooperative in the municipality of Esteio, state of Rio Grande

do Sul, that collect recyclable materials, give them a new use and sell them were evidenced.

It can be seen that the studies showed almost unanimously the importance of environmental education combined with a public policy resulting from an integrated management between the government, society, companies and universities throughout the process. In this way, it increases the possibility of meeting the requirements established by the PNRS (Figure 4). As for the frequency of the word 'solid waste', we have the results shown in figure Figure 4.

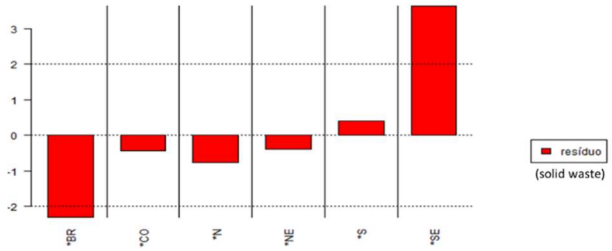

Figure 4: Frequency of the word 'solid waste' for regions.

Regarding the studies focused on the Southeast region, which most frequently received the word 'solid waste', different approaches could be observed, but focused on the selective collection of solid waste and the management process.

Along these lines, the study by Gonçalves et al. (2013) in the city of São Paulo - SP, showed the importance of an integrated management in terms of the engagement of public authorities, the population and companies in the waste recycling process.

So too Marques et al. (2017) evidenced selective collection at the Pampulha Campus of the Federal University of Minas Gerais (UFMG) from an environmental and social point of view. This is because the collection of recyclable material, in addition to ensuring sustainability, promotes income generation for collectors. And this problem in the growing production of solid waste highlights the importance of promoting behavioral changes based on community reflection (MARQUES et al., 2017).

As for civil construction waste, Medeiros et al. (2018) point to the need to encourage waste recycling, considering that the correct disposal of Civil Construction Waste (RCC) in the municipality of Macaé, state of Rio de Janeiro, has been falling absurdly.

And these problems are often due to faulty management. In the case of the municipality of Rio Pomba, state of Minas Gerais, it is still necessary to prepare a municipal plan for integrated solid waste management, imposed by the PNRS, in order to ensure the correct disposal of solid waste in the city (SILVA et al., 2016). So, too, Zambra et al. (2016) point to the need for engagement of local agents to ensure the correct disposal of waste in a city in São Paulo, state of São Paulo, requiring greater optimization of processes in the local Sorting Center. It can be seen, therefore, that the Southeast region promoted results related to environmental concern and the need to create efficient municipal administrations for selective collection.

The results for this key concept indicate the predominance of the word 'solid waste' for the Southeast (SE) region. This result is clearly justified for being the Brazilian region with the highest

industrial and population concentration, and consequently for its high number of production and consumption of goods and services.

It is noteworthy that for the purpose of study, we differentiated the words solid waste (analyzed in IRaMuTeQ as a composite word – solid-residue) from the word waste (alone) by noticing that the latter invariably appeared as: civil construction waste (RCC); waste from radiology services and waste, hospital waste and waste from electrical and electronic equipment. The key concept 'sustainability' is presented and analyzed in Figure 5, which has the following interpretation.

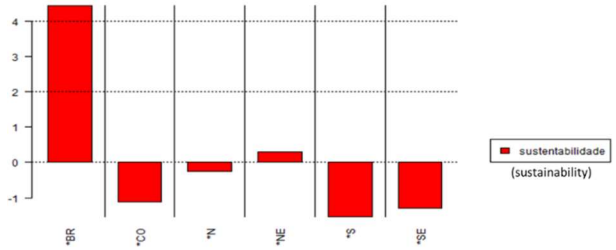

Figure 5: Frequency of the word 'sustainability' for regions.

Notably among the regions, the word 'sustainability' is more present in the works grouped for the region identified by BR (or Brasil), as it is a systematic analysis of the legal systems (eg Law 12 .305/2010 National Policy of Solid Waste) and its effectiveness in the search for 'sustainability'. The indication of the supremacy of this key-concept for national-level work is clearly justified, since the PNRS subtexts show possible paths for achieving sustainability, designed in actions aimed at different environmental issues.

The results demonstrate, for example, the research developed by Demajorovic et al. (2015), who assess reverse logistics and the issues of conflicts in the reverse chain in relation to cost distribution, in addition to the lack of regional solutions for recycling activities. In others, they show the importance of the activity developed by recyclers, which in addition to providing possibilities for efficient waste management, promote social inclusion (FERRAZ et al., 2012; NASCIMENTO et al., 2015; SILVA, 2017).

Other works discuss the finitude of natural resources and awareness of the importance of environmental preservation combined with rational use, with a focus on sustainability (MOURA et al., 2019). The multiple actors and the challenges of global governance in place, to the detriment of the increase in the production of solid waste, are remembered by Ribeiro et al. (2016).

The term 'sustainability' is the guide for the works grouped for the 'BR' region (Brazil). These works evaluate the National Solid Waste Policy, highlighting its distinct possibilities for implementations with a focus on sustainability (VILANI, 2014; VIANNA, 2015).

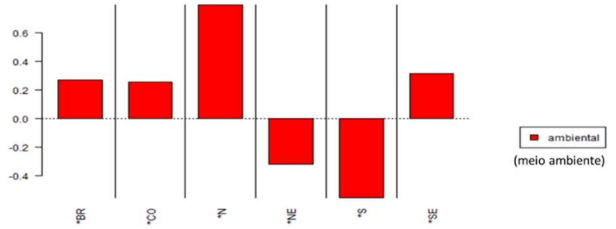

Figure 6: Frequency of the word 'environmental' for regions.

The word '*ambiental*' is present in productions elaborated in four regions (BR, CO, N, SE), being

absent in the South and Northeast regions. In the BR region this word is associated with 'environmental sustainability', 'environmental importance of solid waste management', 'environmental impact' and 'environment pollution' and also 'environmental psychology'. The term 'environmental education' appear in the publications of the Central Region (CO) and N Region North (N), as well as the term 'environmental governance' (Region North-N). Publications registered in the northeast region (NE) cite the words: 'environmental issue', 'environmental preservation', 'environmental education', 'social and environmental contribution', 'environmental impact', 'environmental and human health', 'socioenvironmental' and 'urban environmental quality'.

Such words found in the bibliographic survey come from works that focus on the concern with environmental sustainability. Souza et al. (2011), for example, highlight the need to promote the reduction of waste through selective garbage collection in Mossoró, state of Rio Grande do Norte, which contributes to environmental preservation and income generation for collectors. A situation that is also evidenced by other authors. If Gundo Heber et al. (2014), there is a need to seek shared solutions in the Metropolitan Region of Aracaju, state of Sergipe, in order to reduce the high operational costs of PNRS and encourage effective participation of the population in involving all this process.

On the other hand, Pinto et al. (2015) suggest promoting integrated management between the government, specialized organizations and companies in the municipality of Parnamirim-RN. The purpose of this action is to incorporate recycling processes for civil construction materials in the city, as well as promoting environmental education actions with the local community (PINTO et al., 2015).

This view is also found in the work of Barbosa Filho (2014), in which they emphasize that the local management of environmental issues is extremely important to encourage selective collection and disposal of waste in a landfill in the municipality of Mamanguape-PB. Among the solutions found is the creation of waste collection cooperatives suitable for recycling, as well as the promotion of environmental education in schools (BARBOSA FILHO, 2014).

In the case of Serra Talhada-PE, the need to raise awareness of society in relation to the environment is also defended, as well as the reuse of waste in favor of generating income and benefiting from environmental issues (RODRIGUES et al., 2015). Thus, an attempt was also made to analyze the introduction of environmental education techniques in favor of raising awareness among civil servants in order to combat waste, in São Gonçalo do Amarante-RN (RÊGO et al., 2011).

Such studies strongly highlight the need for sustainability based on environmental education, a missing element in several of these municipalities. As solutions, integrated management between the different agents should be promoted in order to enforce the PNRS.

CONCLUSIONS

Brazil has excellent legal bases portrayed s in their laws and norms, once followed, can contribute significantly to corret the management of solid waste. In among them, the politic the National Solid Waste Policy (Law No. 12.305/2010) which is promoted as Principal Legal guiding, assisting in many actions aimed

at environmental management, sustainable and efficient.

However, it is observed that the incorporation of global objectives and legislation in the national territory is more effective if decentralized to the local level, in order to manage them according to the particularities of each location. In this sense, local participation is essential. It then refers to the importance of municipalities and local actors (companies and society in general) in a process of conversion, aimed at seeking sustainable actions (public, social, economic and environmental policies).

From this perspective, it clears up this survey bibliometric the scientific literature on the Law 12.305/2010 (National Solid Waste Policy - PNRS) when dissociated into regions (United States of America, North, South, East, North and Midwest) looking emphasize the negligence or environmental difficulties experienced in the region.

In addition, the main concepts identified (selective collection, waste, sustainability and the environment) originate from the keywords used in the research (solid waste, cities and local development) and contribute to the understanding of the importance of effective management of urban solid waste, acting as a mechanism for sustainable development and social promotion.

Furthermore, it is important to emphasize that such key concepts evidence the perception of researchers and scholars on the subject. These are scientific discussions in the light of the PNRS facing local/regional environmental problems.

It is considered that not only the amplitude of the PNRS and the National Solid Waste Plan, but mainly the Brazilian geographic continentality conditions adverse perceptions of the issue under analysis. In this regard, the need for further studies is endorsed here, which allows for the expansion of reading, interpretation and mobilization of positive actions, whether through academia or through public and private actions. So that the integrated management and solid waste management between the public, private and civil society, to assist in the effective search for improvements in the environmental balance, generating income and ensuring urban sustainability.

The innovative condition for the reports presented here refers to the interpretation of results from a regional perception, highlighting the key terms or concepts that guided the studies. And from them the emergence of new concerns (such as: why are the terms ‘waste’ and ‘sustainability’ rarely mentioned in studies carried out in the northern region?). Could it be that the supremacy of the term ‘environmental’ for this same region is an indication of the general concern for issues involving the environment?

How to highlight the unbalanced number of bibliographic productions by region, results obtained from the search for the scientific production database of the Coordination for the Improvement of Higher Education Personnel (CAPES) between 2010 and 2020.

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