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Practical Implementation: Waste Management for Sustainable Development

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Summary

A documentary review was carried out on the production and publication of research papers related to the study of the variables Waste Management and Sustainable Development. The purpose of the bibliometric analysis proposed in this document was to know the main characteristics of the volume of publications registered in the Scopus database during the period 2017-2022 by Latin American institutions, achieving the identification of 702 publications. The information provided by this platform was organized through graphs and figures, categorizing the information by Year of Publication, Country of Origin, Area of Knowledge and Type of Publication. Once these characteristics have been described, the position of different authors on the proposed topic is referenced through a qualitative analysis. Among the main findings made through this research, it is found that Brazil, with 377 publications, was the Latin American country with the highest scientific production registered in the name of authors affiliated with institutions of that nation. The Area of Knowledge that made the greatest contribution to the construction of bibliographic material related to the study of Waste Management and Sustainable Development was Environmental Sciences with 457 published documents, and the most used Publication Type during the period indicated above were Journal Articles with 65% of the total scientific production.

Keywords: *Environmental Management, Solid Waste Management, Usable Solid Waste.*

1. Introduction

Good waste management practices are of interest today, since implementing sustainable development is a relevant issue in the 21st century. The effects of globalization bring with them exponential population growth, this promotes large masses of urban areas and new patterns of consumption, these large amounts in consumerism reflect a greater increase in volume which brings with it negative effects on waste management. The interest in good management of this waste is due to environmental, social and economic concerns. That is where being able to execute sustainable development comes in, since this component allows companies and large economies to offer solutions that help to comprehensively reduce the degradation of limited environmental resources, in order to safeguard public health and have more resilient economic entities.

The increase in the difficulties of poor waste management underscores the need to be able to manage new horizons in which holistic and sustainable practices in the management of this

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waste are sought. The environmental contamination of this waste by inadequate infrastructures and the lack of culture about the disposal of this waste have caused the deterioration of natural resources, which has had negative effects on the health of the population. With this, the way in which this waste has been managed must be redefined, which is why it is necessary to implement strategies focused on sustainability, circular economy and care for the ecosystem.

Sustainability in waste implies a transformation of the linear model which is characterized by three factors: take, do, eliminate. This is done with a circular approach that prioritizes the recovery, reuse and recycling of these resources. Not only does this change conserve valuable resources, but it also reduces the environmental footprint associated with waste disposal. Good management of this waste is linked to the objectives of sustainable development, which is based on addressing the challenges of climate change, facing changes in biodiversity and unequal problems.

The management of these resources requires a much more diverse landscape based on sustainable development, which needs a more comprehensive approach in environmental, social and economic dimensions. In the environmental environment, they involve minimizing the impact of waste on ecosystems, air and water quality, and mitigating greenhouse gas emissions from landfills. The societal focus encompasses public health concerns, equitable access to waste management services, and the empowerment of marginalized communities involved in waste management activities. Economic entities involve recognising waste as a valuable resource, encouraging innovation in recycling technologies and creating green jobs.

Good development initiatives and policies focused on waste management have become in the general interest of the policies of states, the financial sector and communities. In order to successfully achieve these policies, it is necessary to provide joint support to achieve an enabling environment with an innovative approach, infrastructures in line with environmental needs, and to promote education and awareness about the importance of reduction and recycling. Integrating the informal sector, often waste pickers and marginalized waste pickers, into formal waste management systems can improve inclusion and contribute to poverty reduction. For this reason, this article seeks to describe the main characteristics of the compendium of publications indexed in the Scopus database related to the variables Waste Management and Sustainable Development, as well. Such as the description of the position of certain authors affiliated with institutions, during the period between 2017 and 2022.

2. General Objective

To analyze, from a bibliometric and bibliographic perspective, the preparation and publication of research papers in high-impact journals indexed in the Scopus database on the variables Waste Management and Sustainable Development, during the period 2017-2022 by Latin American institutions.

3. Methodology

This article is carried out through a research with a mixed orientation that combines the quantitative and qualitative method.

On the one hand, a quantitative analysis of the information selected in Scopus is carried out under a bibliometric approach of the scientific production corresponding to the study of Waste Management and Sustainable Development from a qualitative perspective, examples of some

research works published in the area of study indicated above, based on a bibliographic approach that allows describing the position of different authors on the subject suggested. It is important to note that the entire search was carried out through Scopus, managing to establish the parameters referenced in *Figure 1*.

3.1. Methodological Design

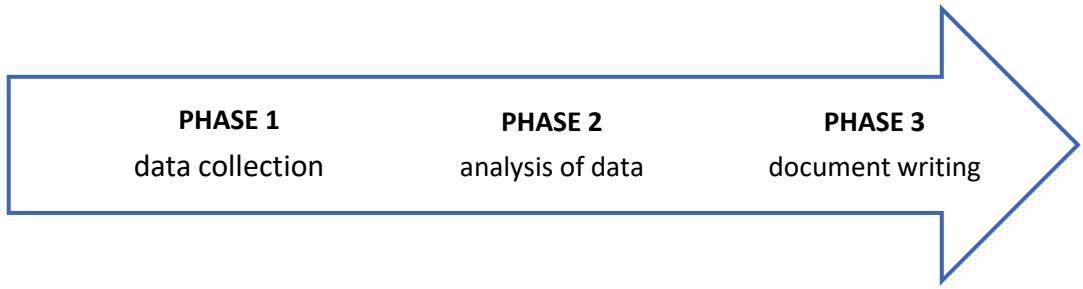

Figure 1. Methodological Design.
Source: Authors.

3.1.1 Phase 1: Data Collection

Data collection was carried out from the Search tool on the Scopus website, where 702 publications were obtained from the following filters:

TITLE-ABS-KEY (waste and management, AND sustainable and development) AND PUBYEAR > 2016 AND PUBYEAR < 2023 AND (LIMIT-TO (AFFILCOUNTRY , "Brazil") OR LIMIT-TO (AFFILCOUNTRY , "Mexico") OR LIMIT-TO (AFFILCOUNTRY , "Colombia") OR LIMIT-TO (AFFILCOUNTRY , "Chile") OR LIMIT-TO (AFFILCOUNTRY , "Argentina") OR LIMIT-TO (AFFILCOUNTRY , "Ecuador") OR LIMIT-TO (AFFILCOUNTRY , "Bolivia") OR LIMIT-TO (AFFILCOUNTRY , "Peru") OR LIMIT-TO (AFFILCOUNTRY , "Uruguay") OR LIMIT-TO (AFFILCOUNTRY , "Costa Rica") OR LIMIT-TO (AFFILCOUNTRY , "Venezuela") OR LIMIT-TO (AFFILCOUNTRY , "Cuba") OR LIMIT-TO (AFFILCOUNTRY , "Panama") OR LIMIT-TO (AFFILCOUNTRY , "Puerto Rico") OR LIMIT-TO (AFFILCOUNTRY , "Honduras")

- Published documents whose study variables are related to the study of Waste Management and Sustainable Development.
- Limited to the years 2017-2022.
- Limited to Latin American countries.
- Without distinction of area of knowledge.
- No distinction of type of publication.

3.1.2 Phase 2: Construction of Analytical Material

The information collected in Scopus during the previous phase is organized and then classified by graphs, figures and tables as follows:

- Co-occurrence of words.
- Year of publication.
- Country of origin of the publication.
- Area of knowledge.
- Type of publication.

3.1.3 Phase 3: Drafting of Conclusions and Outcome Document

In this phase, the results of the previous results are analysed, resulting in the determination of conclusions and, consequently, the obtaining of the final document.

4. Results

4.1 Co-Occurrence of Words

Figure 2 Shows the Co-Occurrence of Keywords Found in the Publications Identified in the Scopus Database.

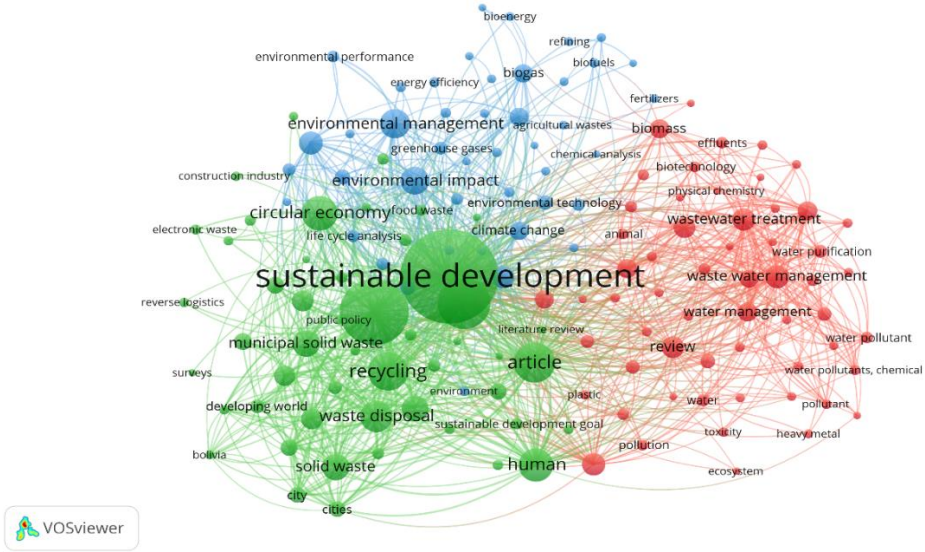

Figure 2. Co-Occurrence of Words.
Source: Authors' Own Elaboration (2023); Based on Data Exported from Scopus.

Sustainable development was the most frequently used keyword within the studies identified through the execution of Phase 1 of the Methodological Design proposed for the development of this article. Waste Management is among the most frequently used variables, associated with variables such as Recycling, Sustainable Impact, Circular Economy, Energy Efficiency, Innovative Technology, Bioenergy, Ecosystems. This introduction lays the groundwork for a deeper exploration of waste management for sustainable development, delving into its various dimensions, challenges and innovative solutions. As we navigate the complexities of waste in the modern world, the imperative to develop and implement sustainable waste management practices becomes increasingly clear, offering a path to a more resilient, equitable, and environmentally responsible future. such as the United Nations Sustainable Development Goals, underscore the importance of sustainable waste management in achieving broader development goals. Specifically address responsible consumption and production, calling for efficient resource management, reduction of waste generation, and promotion of sustainable practices across industries. Recognizing the interconnectedness, it is clear that progress in waste management contributes not only to environmental goals but also to poverty alleviation, improved health, and sustainable urbanization

4.2 Distribution of Scientific Production by Year of Publication

Figure 3 shows how scientific production is distributed according to the year of publication.

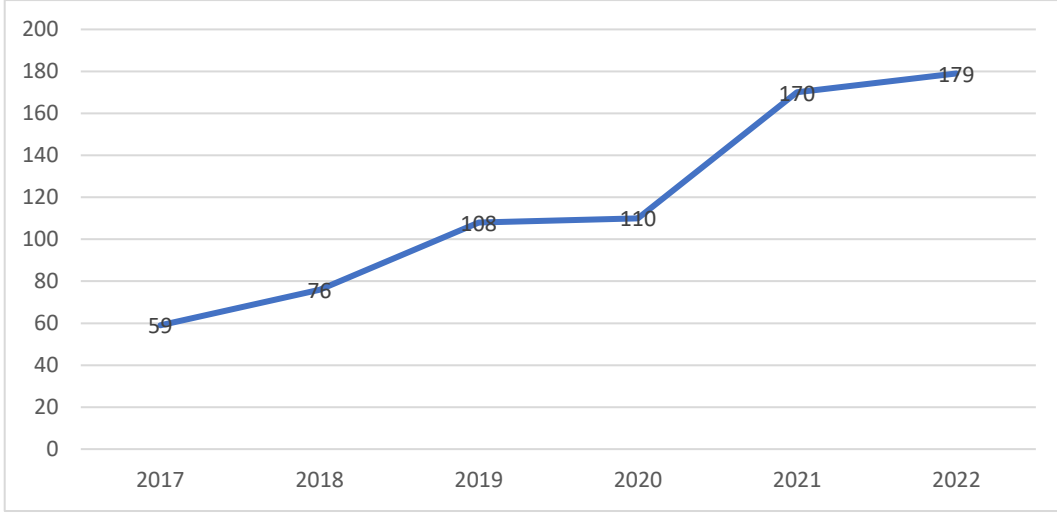

Figure 3. Distribution of Scientific Production by Year of Publication.
Source: Authors' Own Elaboration (2023); Based on Data Exported from Scopus.

Among the main characteristics evidenced through the distribution of scientific production by year of publication, the number of publications registered in Scopus was in 2022, reaching a total of 179 documents published in journals indexed on this platform. This can be explained thanks to articles such as the one entitled "Characteristics of environmental labels and their theoretical implications for sustainability market practices towards a circular economy" This article aims to understand the association between the use of labels to communicate a sustainable image through green marketing and their impact on consumer perception. A qualitative, theoretical and empirical research was carried out. No studies were identified that analyse the relationship between the communication of green marketing, oriented to the circular economy, with the perspective of environmental labelling, this being the main contribution to the improvement of studies in the field of research. Then, a sample of 60 product packages across 15 segments and 50 different brands was used. We found that the way in which the manufacturer seeks to communicate about the potential for reuse or recycling of the material used in the packaging can raise doubts in the consumer. The results show that no standard symbology is used in environmental labelling. Purchasing decisions would be influenced by information about environmental or ethical aspects of products. Studying how the industry labels its products and offers them to the consumer is certainly a way to understand the degree of maturity and how much progress can be made in terms of sustainable consumption and production. There is still a low relationship between the theories explored and their effective use in environmental labeling, so it is suggested to deepen this gap in future work. While there is research on environmental labeling, few seek to identify in the field how concepts and standards have been effectively applied.(Gomes, 2022)

4.3 Distribution of Scientific Output by Country of Origin

Figure 4 shows how scientific production is distributed according to the country of origin of the institutions to which the authors are affiliated.

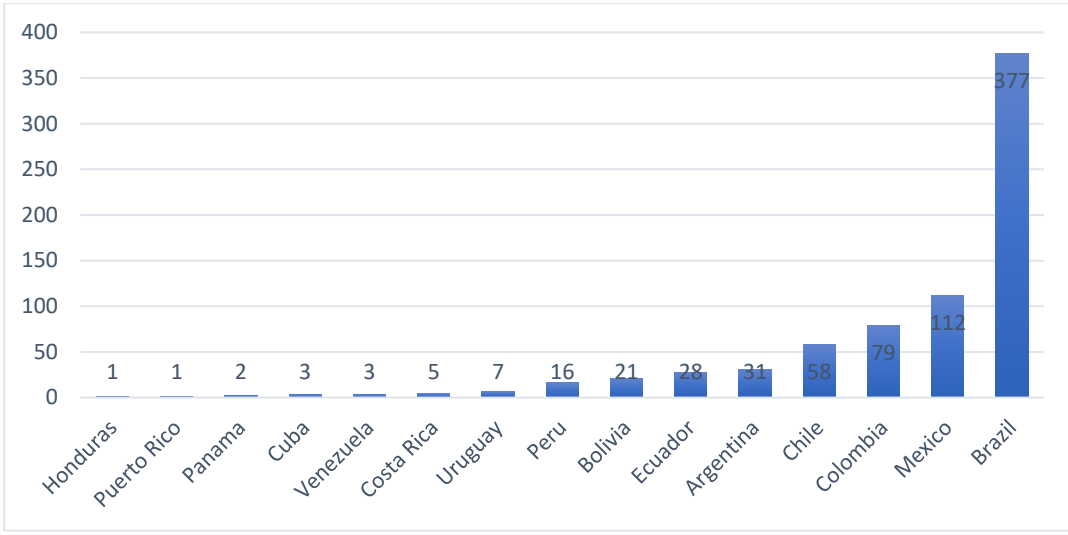

Figure 4. Distribution of Scientific Production by Country of Origin.
Source: Authors' Own Elaboration (2023); Based on Data Provided by Scopus.

Within the distribution of scientific production by country of origin, registrations from institutions were taken into account, establishing Brazil as the country of this community, with the highest number of publications indexed in Scopus during the period 2017-2022, with a total of 377 publications in total. In second place, Mexico with 112 scientific papers, and Colombia occupying the third place presenting to the scientific community, with a total of 79 documents among which is the article entitled "Circular economy in the Nexus approach to biosolids management: a perspective to improve the safe recycling of nutrients: concern for pathogens, metals and emerging organic pollutants" The present study aimed to contribute to the knowledge of the Composition and characteristics of biosolids during four years of monitoring (2016-2019). We investigated the agronomic potential of biosolids in a batch sequencing reactor. The biosolids content in the studied crops is a potential source of macronutrients, especially N, P and S. The pathogens were classified in class B according to Conama 498 (Brazil), Standard 503 (USA) and Directive 86/278 (EU) on Escherichia coli and enteric viruses. The metals, also compared to the three previous standards, met the concentration thresholds of the respective legislations. Emerging organic pollutants remained below the detection limit, except for naphthalene, which was found only once in biosolids above the detection limit. Finally, the PCA demonstrated that the chemical elements of biosolids do not vary significantly in relation to changes in tropical climatic conditions (resilience to climate change). Our study confirms the agronomic potential of safe biosolids to promote a circular economy in wastewater treatment plants. In line with cleaner agricultural production in tropical soils, complying with micropollutant legislation and reducing the amount of biosolids sent to landfill or improperly disposed of into the environment.(de Amorim Júnior, 2022)

4.4 Distribution of Scientific Production by Area of Knowledge

Figure 5 shows the distribution of the elaboration of scientific publications based on the area of knowledge through which the different research methodologies are implemented.

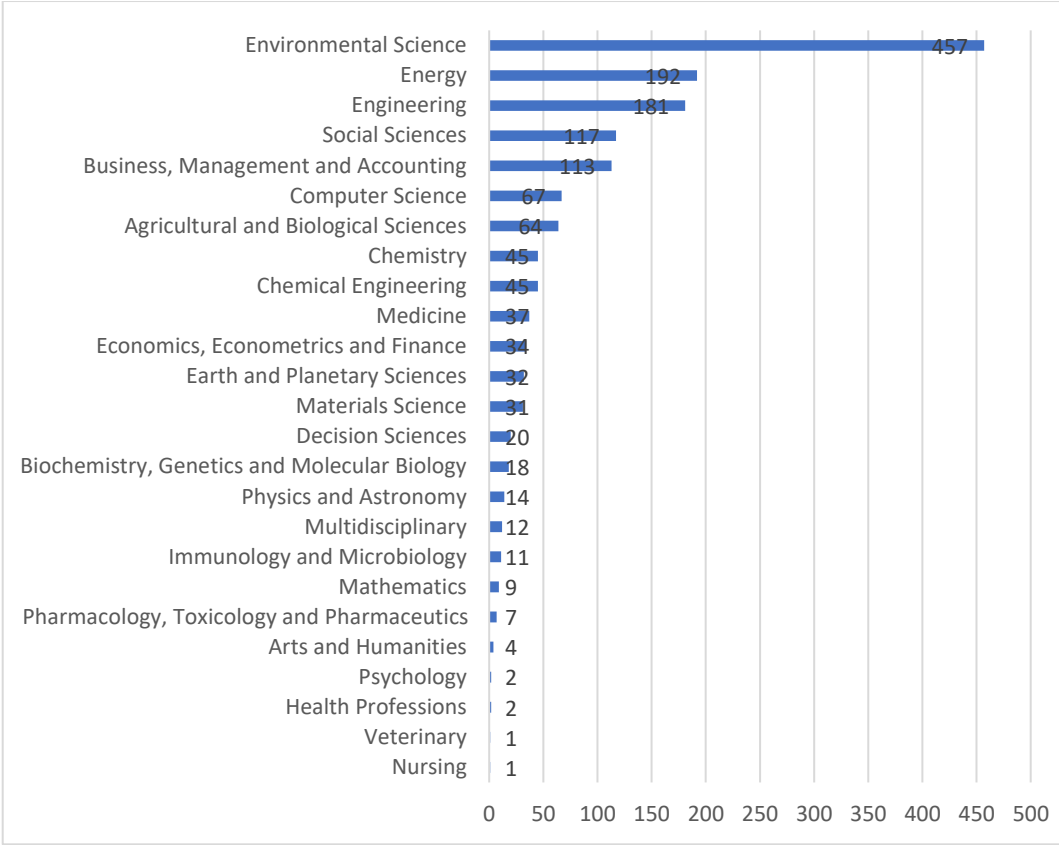

Figure 5. Distribution of Scientific Production by Area of Knowledge.
Source: Authors' Own Elaboration (2023); Based on Data Provided by Scopus.

Environmental Sciences was the area of knowledge with the highest number of publications registered in Scopus, with a total of 457 documents that have based their methodologies on the Waste Management and Sustainable Development. In second place, Energy with 192 articles and Engineering in third place with 181. The above can be explained thanks to the contribution and study of different branches, the article with the greatest impact was registered by Environmental Sciences entitled "Sargassum-pig manure codigestion: an alternative for the production of bioenergy and the treatment of a polluting coastal waste" The objective of this study was to evaluate the synergistic effect of the co-digestion of sargassum biomass (S) with pig manure (PM) in terms of achieving the maximum potential of biomethane (PMB). Five different ratios (100S-0PM, 65S-35PM, 50S-50PM, 30S-70PM and 0S-100PM) were evaluated. The results showed a significant synergistic effect of codigestion by improving BMPs from 79.5 to 160.4% with respect to monodigestion treatments. The highest BMP of 441.47 mLCH4·g−1VSFed was obtained in the 50S-50PM treatment, which recorded a C:N ratio of 16.8. This study demonstrated that co-digestion of sargassum biomass with pig manure has the potential for sustainable management of both wastes and also facilitated an increase in methane production.(Rivera-Hernández, 2022)

4.5 Type of Publication

In the following graph, you will see the distribution of the bibliographic finding according to the type of publication made by each of the authors found in Scopus.

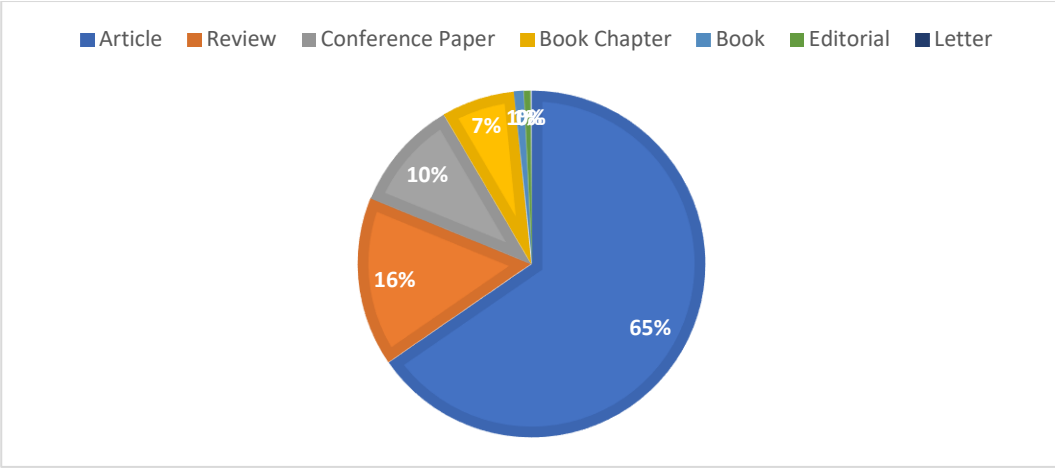

Figure 6. Type of Publication.
Source: Authors' Own Elaboration (2023); Based on Data Provided by Scopus.

The type of publication most frequently used by the researchers referenced in the body of this document was the one entitled Journal Articles with 65% of the total production identified for analysis, followed by Journal with 16%. Session Paper are part of this classification, representing 10% of the research papers published during the period 2017-2022, in journals indexed in Scopus. In this last category, the one entitled "Proposal of the waste management model" stands out. This article presents a waste management model for civil construction based on the recycling and reuse of aggregates. A mixed-approach research was conducted, using primary and secondary data to develop a strategic model based on waste recycling and reuse. Recycling alternatives already used in the studied region were used to define the aggregates that would make up the model, judging them through the hybrid method composed of Fuzzy TOPSIS and Shannon Entropy. The model was implemented in a case study in southern Brazil to demonstrate empirical evidence. The results showed an approximation of public entities with universities, research centers and private companies contributing to the environmental, economic and social development of the region. By implementing the model, many benefits can be added, such as reduced pollution, a cleaner environment, and revenue generation through the commercialization of the aggregate. This study provides practical and theoretical contributions, helping to formulate strategic guidelines in the public sphere for the correct destination and reuse of waste and contributing to the sustainability of cities.(Silva, 2022)

5. Conclusions

Through the bibliometric analysis carried out in this research work, it was possible to establish that Brazil was the country with the highest number of records published in the variables Waste Management and Sustainable Development. With a total of 377 publications in the Scopus database. In the same way, it was established that the application of theories framed in the area of Environmental Sciences, They were used more frequently in the implementation of waste management practices for sustainable development. To execute waste management practices in an appropriate manner, the care of ecosystems is evidenced in a beneficial way, allowing us to reduce the environmental adversities caused by the mismanagement of waste, reduce pollution and at the same time conserve the limited resources that we have. Poor waste management, especially in landfills, contributes to soil degradation, water pollution, and

greenhouse gas emissions, exacerbating the global environmental crisis. Adopting sustainable waste management practices is not only an environmental imperative but a moral responsibility to safeguard the planet for future generations. Being able to incorporate programs focused on recycling into good resource management requires the support of various economic entities, state policies, financial models and communities. This would constitute the creation of incentives for the development and use of these resources for the production of recycled materials, which stimulates economic growth and at the same time reduces the environmental burden through good recycling practices. However, it is important to take advantage of technological resources today as the conversion of waste into energy could be a valuable resource when it comes to converting these resources. By harnessing the energy potential of waste through methods such as incineration or anaerobic digestion, communities can generate electricity, heat or biofuels while reducing the volume of waste that ends up in landfills. The benefits that would be obtained by executing these technologies are important to carry out responsibly, since environmental, social and health care must be taken into account.

To conclude, public awareness and education are cornerstones in order to implement good recycling policies and good waste management, since the general population must be involved so that they can be aware of poor waste management and the environmental consequences that this would bring to communities and the environment. Foster a sense of responsibility towards sustainable practices that can bring about positive change. By using the principles of reduce, reuse and recycle, investing in innovative waste management technologies and fostering a culture of environmental responsibility, we can pave the way to a more sustainable and resilient future.

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