Environmental Management for the Sustainable Management of Usable Solid Waste in the Urban Area of the Municipality of Plato Magdalena

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Abstract

A documentary review was carried out on the production and publication of research works referring to the study of the variables Environmental Management and Solid Waste Management. 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 907 publications. The information provided by said 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 regarding the proposed topic is referenced through a qualitative analysis. Among the main findings made through this research, it is found that Brazil, with 550 publications, was the Latin American country with the highest scientific production registered in the name of authors affiliated with institutions of said nation. The Area of Knowledge that made the greatest contribution to the construction of bibliographic material referring to the study of Environmental Management and Solid Waste Management was Environmental Sciences with 669 published documents, and the Type of Publication most used during the period indicated above were Articles. Magazine with 79% of the total scientific production.

Keywords: Environmental Management, Solid Waste Management, Reusable Solid Waste.

1. Introduction

Solid waste management has become a cornerstone for nations globally, due to the substantial increase in population and urbanization of cities. Although we know that the epicenter of urban areas is the focus of attention on solid waste management, the value played by rural areas in the handling and management of this waste should not be underestimated, in which a sustainable and adequate management of these solid resources is sought. Based on this context, this

introduction plays an integral role in the environmental management of solid waste, in which it is sought that these resources can be exploited in the rural extension in the municipality of Plato, Magdalena.

The municipality of Plato, geographically located in the department of Magdalena in the country of Colombia, is characterized by its slender culture and fascinating rural countries. The characteristics that stand out in this rural area, such as the dispersed population and the different agricultural activities carried out in this area, require a personalized approach for good management and control of solid waste. Based on this premise, it is important to make these communities in the department of Magdalena aware that a good execution of waste and carrying out sustainable plans to be friendly with ecosystems, requires an active participation of those present, where waste reduction practices, knowledge of recycling and the promotion of responsible consumption can have a positive impact on mitigating environmental damage.

However, these areas where municipal resources are unlimited often face solid waste management challenges, which are reflected in limited infrastructure and little intervention by government plans to mitigate environmental damage. However, these challenges also present opportunities for innovative solutions. Identifying and exploring both challenges and opportunities are crucial to designing strategies that resonate with the local dynamics of this municipality.

It is worth mentioning that being able to integrate technology and the development of new infrastructures that help take advantage of these solid resources play an essential role in addressing the challenges presented by this area of the municipality of Plato, Magdalena. It seeks to plan efficient sustainable systems for waste collection, recycling facilities and to be able to exploit appropriate technologies which help manage and create new solid waste management ecosystems in a more sustainable and planet-friendly way.

Finally, it is important to be able to develop economically viable waste management initiatives is essential for their long-term sustainability. Recognizing and innovating new avenues for revenue generation through recycling, waste-to-energy projects, and other innovative approaches can transform waste management from a challenge to an economic opportunity for Plato residents. By knowing the context of the importance of good environmental management for the sustainable management of resources, it can be concluded that being able to manage solid waste well in this rural region can generate many opportunities and thus promote a sustainable waste management system. 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 Environmental Management and Solid Waste Management, as well. Such as the description of the position of certain authors affiliated with institutions, during the period between 2017 and 2022.

1.1 Problem statement

In recent years, Environmental Management has taken on great importance due to the growth of the world society and the constant consumption of different products and services regardless of the impact they have on nature, added to this, historically organizations focused on high

economic growth regardless of environmental sustainability. This is due to the transformation of lifestyles and consumption patterns that developed countries project to developing countries.

Climate change has marked a milestone on the planet that has forced world leaders to take urgent actions regardless of borders, such as the United Nations conference on climate change with the Paris Agreement (UNFCCC) (United Nations Climate Change, 2015), and the Sustainable Development Goals (United Nations, 2015). 2015) as a universal frame of reference on the path to sustainable development that integrates the economic, social and environmental dimensions. Goal 13, climate action, establishes the adoption of urgent measures to combat climate change and its effects in Latin America and the Caribbean (United Nations, 2015), which requires all countries to develop in-depth policies that work for the environment, as evidenced in the National Development Plan (NATIONAL DEVELOPMENT PLAN 2022-2026: Roadmap for its Formulation) as a formal instrument through which It is governed by Law 152 of 1994 which establishes some functions and principles within which it is referred to as Environmental Sustainability: To enable socio-economic development in harmony with the natural environment, development plans must consider in their strategies, programs and projects, criteria that allow them to estimate environmental costs and benefits in order to define actions that guarantee an adequate environmental supply to current and future generations (Art 3. Law 152 of 1994). (Administrative Department of the Civil Service, 1994).

Currently there are no effective actions in the municipal mayor's office with education and citizen participation programs that stimulate the strengthening of the culture of the environment and recycling, limited promotion of public policies that encourage inhabitants to work from home for the good management of usable solid waste, deficient articulation with companies and public and private institutions that work in Environmental Management, This causes a constant deterioration of the ecosystem of the municipality and its surroundings. (Plato se Transforma Contigo Municipal Development Plan, 2020).

2. Research question.

How to develop the environmental management strategy for the sustainable management of usable solid waste in the urban area of the municipality of Plato Magdalena?

3. Justification

The geographical location of the municipality of Plato Magdalena is a strategic point for the development of this research proposal, taking into account that it is in the center of the department, which indicates that the strategic environmental management actions that are executed in the urban area will have an impact on the rural area and at the same time will have a great impact on the surrounding towns. It will be taken as a significant experience to carry out as a proposal for the implementation of good practices in the management of usable solid waste.

This project will facilitate the development of the Environmental Management strategy, achieving an articulated strategy with the general population, public and private entities in the

urban area of the municipality of Plato Magdalena. on the variables Environmental Management and Solid Waste Management, during the period 2017-2022 by Latin American institutions.

4. 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 Environmental Management and Solid Waste Management 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.

4.1. Methodological design

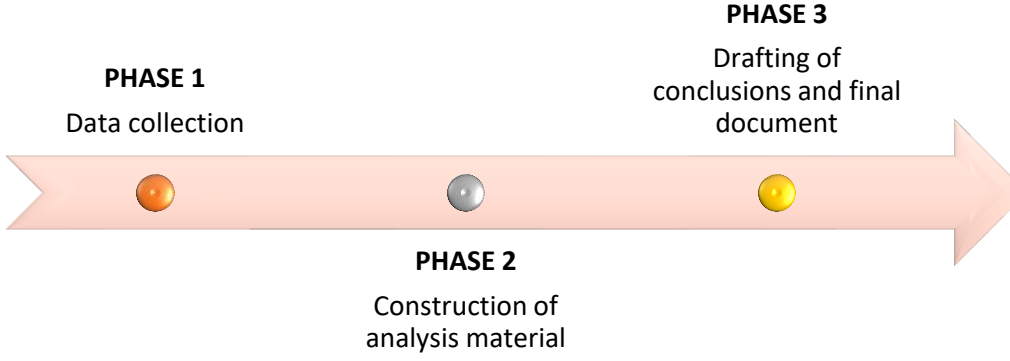

Figure 1. Methodological design

Source: Own elaboration

4.1.1 Phase 1: Data Collection

Data collection was carried out from the Search tool on the Scopus website, where 907 publications were obtained from the following filters:

 TITLE-ABS-KEY (environmental AND management, AND solid AND waste AND management) AND PUBYEAR > 2016 AND PUBYEAR < 2023 AND (LIMIT-TO (AFFILCOUNTRY , "Brazil") OR LIMIT-TO (AFFILCOUNTRY , "Mexico") OR LIMIT-TO (AFFILCOUNTRY , "Chile") OR LIMIT-TO (AFFILCOUNTRY , "Peru") OR LIMIT-TO (AFFILCOUNTRY , "Argentina") OR LIMIT-TO (AFFILCOUNTRY , "Ecuador") OR LIMIT-TO (AFFILCOUNTRY , "Bolivia") OR LIMIT-TO (AFFILCOUNTRY , "Venezuela") OR LIMIT-TO (AFFILCOUNTRY , "Costa Rica") OR LIMIT-TO (AFFILCOUNTRY , "Cuba")

OR LIMIT-TO (AFFILCOUNTRY , "Uruguay") OR LIMIT-TO (AFFILCOUNTRY , "Paraguay") OR LIMIT-TO (AFFILCOUNTRY , "Panama") OR LIMIT-TO (AFFILCOUNTRY , "Puerto Rico") OR LIMIT-TO (AFFILCOUNTRY , "Guatemala")

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

4.1.2 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.

4.1.3 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.

5. Results

5.1 Co-occurrence of words

Figure 2 shows the co-occurrence of keywords found in the publications identified in the Scopus database.

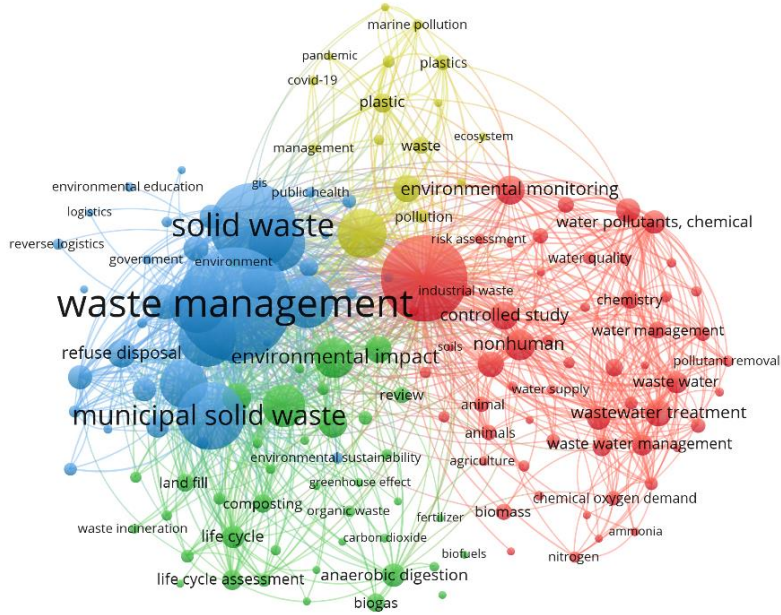

Figure 2. Co-occurrence of words

Source: Authors' own elaboration (2023); based on data exported from Scopus.

Waste Management 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. Environmental Education is among the most frequently used variables, associated with variables such as Innovation, Agriculture, Municipal Solid Waste, Environmental Monitoring, Wastewater Treatment, Sustainable Management, Biomass, Waste Management. Environmental management that uses sustainable solid waste management is key to promoting responsible practices that help protect the environment and sustain local communities. Implementing effective strategies in this area is essential to reduce the negative impact of solid waste on the environment and promote responsible use of resources. An essential part of managing this environment is community education. By promoting awareness of the importance of proper waste sorting and promoting waste reduction, reuse and recycling, local communities can play an active role in protecting the environment. Increased awareness of the harmful effects of improper solid waste disposal can lead to a change in attitude towards more sustainable practices. It is also very important to create an adequate infrastructure for the separate collection and efficient treatment of available solid waste. Establishing local recycling centres, promoting local composting practices and investing in appropriate technology are important measures to ensure sustainable waste management.

5.2 Distribution of scientific production by year of publication.

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

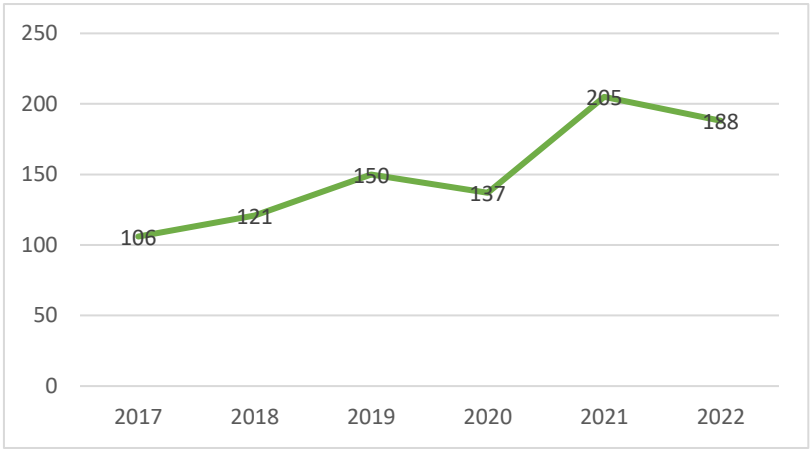

Figure 3. Distribution of scientific production by year of publication.

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 2021, reaching a total of 205 documents published in journals indexed on this platform. This can be explained by articles such as the one entitled "Evaluation of surface water quality in Chilean Altiplano-Puna basins and implications for water treatment and monitoring." The objective of this study was to review and evaluate the available official data on water quality in the Chilean Altiplano-Puna basins over a 10-year period (2008-2018), including water treatment systems. Within the 43,600 km2 of the Chilean Altiplano-Puna territory, only 16 official water quality monitoring stations had up-to-date data and the sampling frequency was less than 3 per year. Most of the water samples collected at the tested stations exceeded Chilean standards for drinking water and irrigation in terms of arsenic, boron, and electrical conductivity. In addition, the characteristics of the Altiplano-Puna affect water quality inside and outside the area, limiting water use in all Altiplano-Puna basins. Drinking water treatment plants exist in urban and rural settlements; However, the supply of drinking water in rural localities is limited due to the lack of adequate treatment and continuity of service. Sewage treatment plants operate in some urban areas, but they rarely exist in rural areas. Limited data prevent a proper assessment of water quality and thus the assessment of the need for treatment systems. As such, it is imperative to implement public policies that prioritize water in adequate quantity and quality for local communities and ecosystems.(Lizama-Allende, 2022)

5.3 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.

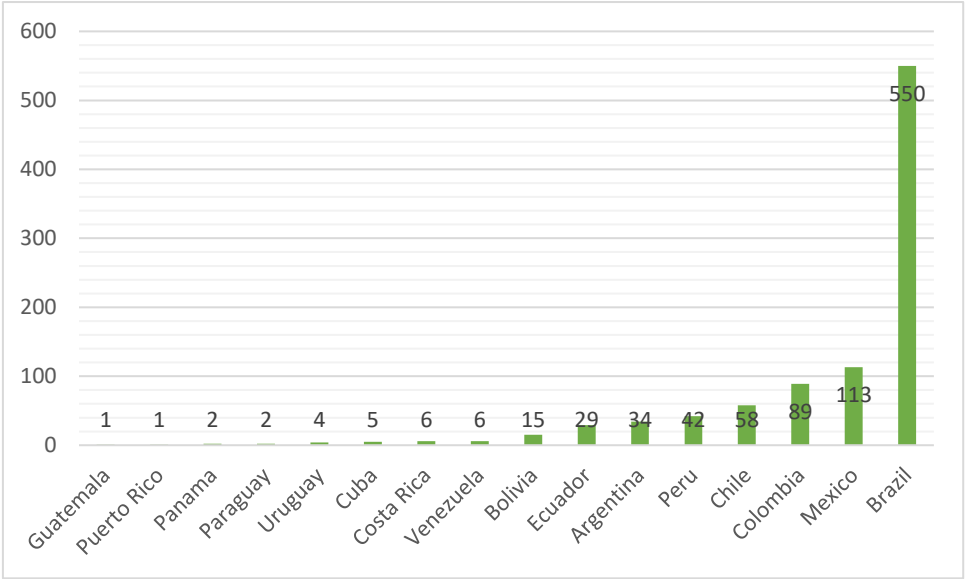

Figure 4. Distribution of scientific production by country of origin.

Source: Authors' own elaboration (2023); based on data provided by Scopus.

Within the distribution of scientific production by country of origin, the 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 550 publications in total. In second place, Mexico with 113 scientific papers, and Colombia occupying the third place presenting to the scientific community, with a total of 89 documents among which is the article entitled "Comparative Evaluation of Landfill Waste Incineration and Methane Capture in the Central Region of Mexico." This article aims to conduct a techno-economic feasibility assessment of energy production through waste incineration and methane capture in the central region of Mexico. Three scenarios with different efficiency indices were considered: 50, 80 and 100%. For the methane project, yields and electrical capacity were determined using the potential generation rate and degradable organic carbon content through the LandGEM model. In the case of incineration, the heat potential of the waste and the average moisture content were used to estimate the achievable electrical performance. The estimated annual energy was 35,018 GWh for methane, compared to 537.71 GWh for incineration. Both projects reported economic and financial viability when evaluated at a discount rate of 12%. Incineration reported a net present value of $49,942,534 and an internal rate of return of 26% in contrast to $4,054,109 and 17% for the methane project. Although the payback period from incineration was shorter than that of methane, its levelized energy cost was significantly higher. These results are intended to help in the decision-making process when planning and developing waste management strategies under circular economy principles in Mexico and similar regions worldwide.(Pablo Emilio, 2022)

5.4 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.

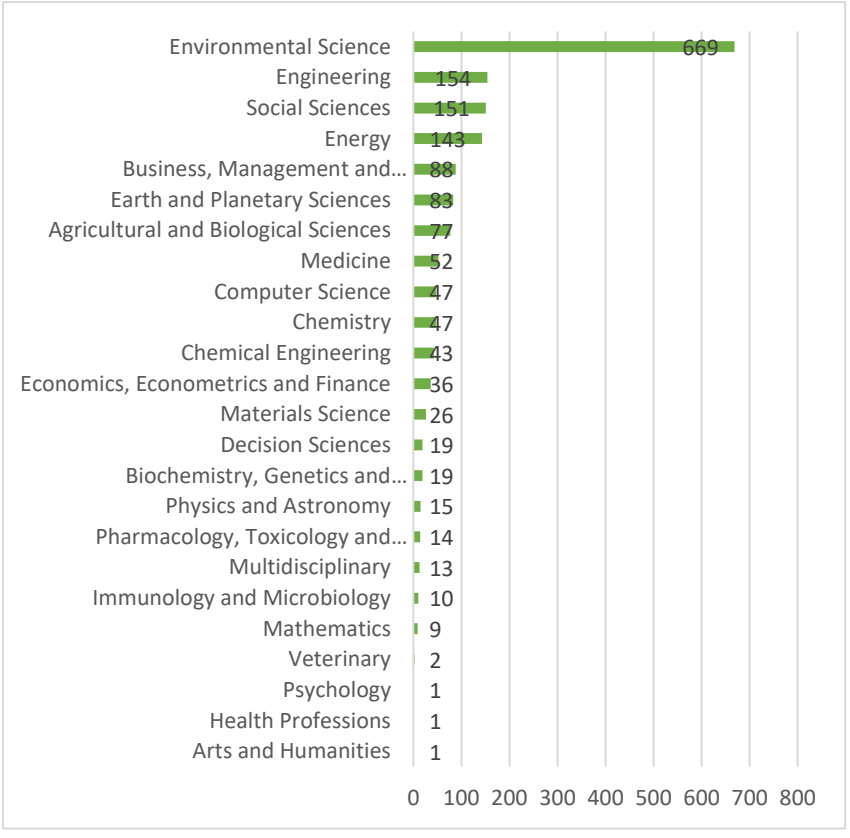

Figure 5. Distribution of scientific production by area of knowledge.

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 669 documents that have based their methodologies on the Environmental Management and Solid Waste Management. In second place, Engineering with 154 articles and Social Sciences in third place with 151. 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 "Climate change mitigation potential of the transition from open landfills in Peru: Evaluation of mitigation strategies in critical landfills" the main objective of this study is to evaluate the contribution of past and present biodegradable waste produced and disposed of in the most open containers. Peru's overall annual greenhouse

gas (GHG) emissions using the IPCC model. Subsequently, the climate change mitigation potential of potential landfill closure strategies based on a selection of technologies, including economic feasibility, was estimated. The results show that cumulative GHG emissions in 2018 for the 24 critical landfills assessed totaled 704 kt CO2 eq. and a cumulative value of 4.4 Mt CO2 eq. in the period 2019-2028, accounting for more than 40% of projected solid waste emissions by 2030. The mitigation potentials of these emissions ranged from 91 to 970 kt CO2 eq. in the ten-year period depending on the mitigation strategies adopted. The costs of these strategies are also discussed and are expected to be useful in complementing Peru's waste management commitments under the Paris Agreement.(Cristóbal, 2022)

5.5 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.

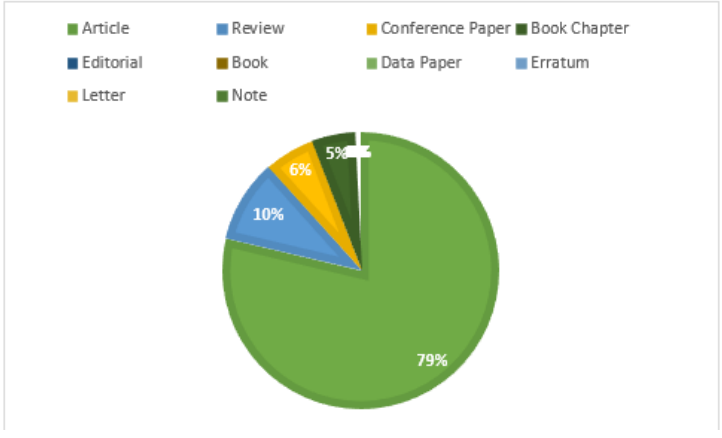

Figure 6. Type of publication.

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 79% of the total production identified for analysis, followed by Editorial with 10%. Letters are part of this classification, representing 6% 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.(Silva, 2022)

6. Conclusions

Through the bibliometric analysis carried out in this research work, it was established that Brazil was the country with the highest number of published records for the variables Environmental Management and Solid Waste Management with a total of 550 publications in the Scopus database. In the same way, it was possible to establish that the application of theories framed in the area of Environmental Sciences, were used more frequently in the integration of environmental management models for the sustainable management of solid resources, which reflects that these solid waste practices in rural areas have a diversified approach which brings as active participation among the communities, education and awareness of proper waste management. Therefore, being able to establish environmental awareness routes is essential for a good management of recycling and to promote a change in a significant way for the well-being of ecosystems, on the other hand, it is essential to develop profitable and efficient systems which seeks as an objective the collection and disposal of waste adapted to the unique needs of rural areas as mentioned above in the case of the municipality of Plato. Cupcake. Being able to carry out these environmental management systems would imply being able to implement new community initiatives, based on the cooperation of national authorities, environmental management policies, implementation of new innovative technologies which could encourage a more resilient process with waste management. However, many of the benefits of being able to properly manage solid resources in rural areas can also be attributed to new economic policies that emphasize recycling and the development of more sustainable practices. By turning waste into a valuable resource, rural communities can improve their resilience, improve their livelihoods, and reduce their ecological footprint. To conclude, it can be concluded that the environmental management of solid resources usable in rural areas not only represents a lifeline for economies to minimize negative impacts on the environment, but also establishes paradigms towards the construction of more resilient and prosperous communities. A holistic, community-driven approach, coupled with the integration of sustainable technologies, will play a critical role in shaping a future in which rural areas contribute positively to environmental conservation and overall well-being.

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