

Public Management and Government Control in the Management of Solid Waste in the Andean Community of Nations: A Systematic Review

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Abstract The countries belonging to the Andean Community of Nations present various systems for the management of solid waste. The main objective was to evaluate the advances in public management and government control in the management of solid waste in the member countries of the Andean Community of Nations. The study was generated through a qualitative descriptive approach through a systematic review as an information collection tool. Searches were carried out in three academic databases: Scopus, PubMed, and Web of Science, and 33 research studies that met the established criteria were selected, to answer the research question: What are the advances in public management and government control of solid waste management in the member countries of the Andean Community of Nations? The first analysis identified three levels of progress in solid waste management: high, low, and medium. Furthermore, previous research in the Andean Community of Nations highlighted achievements such as waste reduction in Colombia, and the promotion of recycling in Ecuador. The importance of a sustainable approach to organic waste management and the presence of government control were highlighted. The reduction of solid waste in Colombia, the increase in recycling in Ecuador, the recovery of organic waste in Peru, and the optimization of waste management through the clustering approach in Bolivia were identified.

Keywords Solid Waste Management, Andean Community of Nations, Public Management, Government Control, Environmental Sustainability, Inclusion of Informal Collectors

1. Introduction

Efficient and sustainable public management of solid waste has become a central concern for global society in the 21st century [1,2]. The uncontrolled accumulation of waste, together with its environmental and health impacts, has led to a growing recognition of the need to address this challenge comprehensively and responsibly [3,4]. In this context, the present research focuses on conducting a literature review on public management and governmental control of solid waste management in the member countries of the Andean Community of Nations: Bolivia, Colombia, Ecuador, and Peru [5]. This approach is justified both by the intrinsic importance of solid waste management and by the relevance of the Andean region in the global panorama [6]. The following defines the key concepts, explains the importance of the research, justifies the choice of the Andean Community of Nations as the object of study, and highlights the importance of

governmental control in this context [7].

Bolivia, with a population of around 11.5 million inhabitants, faces significant challenges in solid waste management, especially in urban areas. The country has limited legislation and regulations in this regard, and informal recycling practices are common. Environmental problems, such as water and soil contamination due to improper waste disposal, are frequent and concerning.

For its part, Colombia, with an approximate population of 50 million people, has made progress in solid waste management but still faces difficulties in implementing effective policies and regulations uniformly throughout the territory. Although the country has a broad legal framework in this area, its application varies considerably between regions. The inadequate disposal of electronic waste and hazardous materials remains a pressing issue that requires attention.

As for Ecuador, with a population close to 17 million inhabitants, the government has launched various initiatives to improve solid waste management, such as recycling programs and the promotion of waste minimization. However, deficient infrastructure and limited resources hinder progress, especially in rural areas. Coastal regions are affected by problems of marine litter and plastic pollution, which require urgent attention.

Finally, Peru, with a population of approximately 33 million inhabitants, has taken measures to address solid waste management through legislation and policies. However, the implementation of these measures has been uneven, with significant gaps between urban and rural areas. The country faces challenges related to illegal dumping and managing hazardous waste from mining and industrial activities, which represent an environmental and health risk.

Public solid waste management is not limited simply to waste collection and disposal [8,9]. It goes much further, encompassing a set of planned and strategic actions that seek to mitigate the negative effects of waste on the environment [10]. This includes the implementation of policies and regulations that encourage the reduction of waste generation, recycling, and reuse of materials, as well as the safe and sustainable final disposal of waste [11,12]. Proper solid waste management is essential to preserve the quality of air, water, and soil, in addition to safeguarding public health and promoting the conservation of natural resources [13].

The Andean Community of Nations, composed of Bolivia, Colombia, Ecuador, and Peru, has been selected as the object of study because of its strategic position in Latin America and its commitment to regional cooperation. While these countries share geographic and cultural similarities, they also present significant differences in terms of economic development and governmental structure [14]. This makes the Andean region an interesting and diverse case for analyzing solid waste management. In addition, the Andean Community of Nations has established environmental agreements and commitments

that provide a framework for evaluating compliance and effectiveness of solid waste management in the region. Regional cooperation on environmental issues is essential to address problems that transcend national borders, such as transboundary pollution and the conservation of shared ecosystems [15].

Governmental control plays a fundamental role in solid waste management. This is because it ensures compliance with environmental regulations and supervision of waste management activities [16]. The effectiveness of governmental control translates into consistent enforcement of policies and regulations, ensuring that businesses and citizens comply with legal provisions related to waste generation, collection, treatment, and disposal [17]. Sound governmental control also promotes transparency and accountability in decision-making related to solid waste management [18]. This is essential to prevent corruption and ensure that resources are used efficiently for the benefit of society.

The relevance of this research lies in several crucial aspects. First, inadequate solid waste management can have serious environmental consequences, such as water and soil contamination, ecosystem degradation, and the generation of greenhouse gas emissions [19]. In addition, uncontrolled garbage accumulation can lead to public health problems, such as vector-borne diseases and the proliferation of pests [20]. Second, solid waste management represents a significant economic challenge. The costs associated with waste collection and disposal are substantial for governments and taxpayers [21]. Inefficient management can increase these costs and divert resources that could be used for other essential programs and services [22].

In this sense, this research has the potential to provide valuable information that can inform decision-making and policy formulation at both regional and national levels. By identifying the challenges and opportunities in solid waste management in the Andean Community of Nations, more effective strategies can be developed to address this problem and move towards more sustainable management.

In this way, the general objective of the research is to evaluate the level of progress in public management and government control in the management of solid waste in the member countries of the Andean Community of Nations, for which the problem of the study is formulated. Through the following questions: What is the level of progress in public management and government control in the management of solid waste in the member countries of the Andean Community of Nations? What effective strategies have been applied to reduce solid waste? What policies and regulations have governments promoted to support effective practices to achieve viable and sustainable waste management? Recognizing the complexity and importance of this topic, it is expected that the research results will provide a solid basis for informed decision-making as well as the promotion of sustainable and responsible practices in the Andean region.

2. Materials and Methods

This study adopts a qualitative methodological approach, focusing on the systematic review of the literature to evaluate the public management of solid waste in the member countries of the Andean Community of Nations. This choice is based on the need to understand the complex dynamics and perspectives of the actors involved in this crucial area of environmental management.

An exhaustive literature search was conducted in reputable academic databases such as PubMed, Scopus, and Web of Science. The reporting methodology recommended by PRISMA was adopted for the execution of the literature search during the systematic review (Figure 1). In addition, search equations were designed to search for information related to solid waste management and public waste policies concerning the Andean Community of Nations. These equations were applied in three different databases: PubMed, Scopus, and Web of Science. The search included key terms such as "Solid

Waste Management", "Waste Control", "Public Waste Policies", "Andean Community Nations" and "Comunidad Andina de Naciones" to collect relevant studies on the topic of interest.

The selection of studies was carried out following a two-step strategy: study titles and abstracts were evaluated for relevance, and then the full texts of potentially relevant studies were reviewed. Key data, including solid waste management practices, government policies, identified challenges, and other relevant data, were extracted from the selected studies. The extracted data were subjected to an in-depth qualitative analysis to identify patterns, trends, and emerging issues related to solid waste management and governmental control in the countries of the Andean Community of Nations. This process of analysis was conducted in a systematic manner and narrative synthesis techniques were employed to present the results in a coherent and meaningful way. During all stages of the research, the ethical principles of research were respected, ensuring proper citation of sources and data integrity.

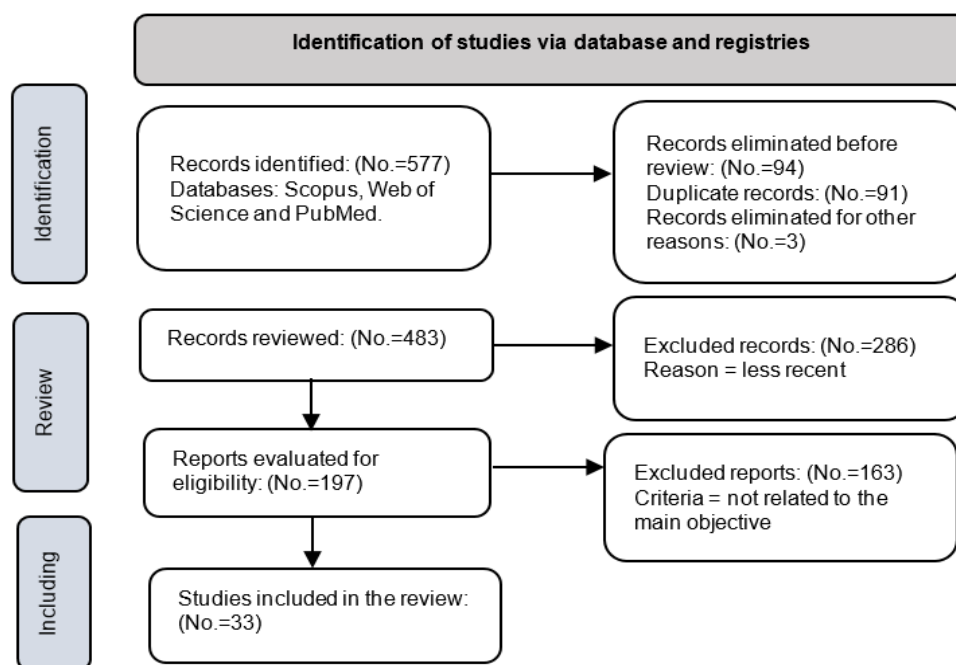


Figure 1. PRISMA Flowchart

3. Results

The results are presented in Table 1 below, showing the number of investigations found in each search engine, as well as the precise filters applied during the search process:

Table 1. Articles selected for review

Search engine	Total	Filter application	Most Recent	Relation to the subject	Presence of categories	Level of progress	Final Articles
Scopus	258		149	72	32	20	33
Web of Science	132		57	23	15	7	
PubMed	187		65	42	21	6	

The filters used encompass a series of rigorous criteria that focus on relevance to solid waste management. These criteria consider the date of the most recent publication, the presence of categories related to waste management, the level of research progress, and the identification of final articles. This thorough analysis provided a comprehensive understanding of the current state of research in solid waste management in the Andean region while highlighting specific areas of focus and interest in the academic community. Based on these criteria, we proceeded to select the articles that best fit the research objective, resulting in the inclusion of a total of 33 research papers from the 577 initially identified.

It is relevant to point out that the search engine that yielded the largest number of articles was Scopus, with a total of 258 findings, of which 20 were selected for inclusion in this research. On the other hand, the Web of Science search engine identified 132 investigations, but

after applying the selection criteria, these were reduced to only 7 investigations included in the study. Finally, in PubMed, only 6 investigations were included out of the 187 found in total, due to the lack of categories linked to the research in many of them.

The findings have been grouped into four sectors. Three groups are configured according to the level they show concerning the progress of public management in waste Management, while the last group is related to government control. This way, the established axes are: 1) High-level research in Solid Waste Management in the Andean Community of Nations. 2) Medium-level research on solid waste management in the Andean Community of Nations. 3) Low-level research on Solid Waste Management in the Andean Community of Nations. 4) Investigations that show governmental control concerning Solid Waste. The research selected for the review and selection of articles is shown in Table 2.

Table 2. Articles selected for review

Title	Author	Finding
A combined approach to improving municipal solid waste management in upper-middle-income countries: the case of Sabana Centro, Colombia	Franceschi et al. [15]	High level of progress
Urban solid waste management model in the province of El Oro, Ecuador	Carvajal et al. [23]	High level of progress
Solid Waste Characterization and Management in a Highly Vulnerable Tropical City	Cantillo and Quesada [24]	High level of progress
Comparison of environmental impacts related to municipal solid waste and construction and demolition waste management and recycling in a Latin American developing city	Ferronato et al. [25]	High level of progress
Evaluation of the Environmental Impacts Generated by the Management of Urban Solid Waste in the Open Waste Dump in Loreto, Eastern Ecuador	Poma et al. [26]	High level of progress
Formalization of recyclable waste transfer stations within the Grand Guayaquil	Hidalgo-Crespo et al. [27]	High level of progress
Analyzing solid waste landfills using satellite imagery and designing new landfill reception areas	R óvolo-Acevedo et al. [28]	High level of progress
Challenges of household medical waste collection systems: an analysis of regulatory instruments and stakeholders in three Latin American countries	Felipe et al. [29]	Level of progress Low
Suitable site selection for transfer stations in a solid waste management system using analytical hierarchy process as a multi-criteria decision analysis: a case study in Azuay-Ecuador	Mora et al. [30]	Level of progress Medium
Construction and demolition waste recycling in developing cities: management and cost analysis.	Ferronato et al. [31]	High level of progress
Solid Waste Management in Peru's Cities: A Clustering Approach for an Andean District	Quispe et al. [32]	High level of progress
Barriers and opportunities for waste pickers within solid waste management policy in Colombia	G ómez-Maldonado et al. [33]	Level of progress Low
Valuation of Plastic Waste as a Community Circular Economy Strategy in the Municipality of Choco-Colombia	Ortega-Ram íez et al. [34]	Level of progress Low
Solid waste management and urban environmental quality of public space in Chiclayo, Peru	Arteaga et al. [35]	Level of progress Medium
Management of the Organic Fraction of Municipal Solid Waste in the Context of a Sustainable and Circular Model: Analysis of Trends in Latin America and the Caribbean	Ulloa-Murillo et al. [36]	Level of progress Medium

Table 2 continued

Solid waste assessment in a coastal fishing community in Peru	Ortiz-Alvarez et al. [37]	Level of progress Medium
Perspectives in solid recovered fuel production in Bolivia: Analysis of characteristics and potential benefits	Ferronato et al. [38]	Level of progress Medium
Proposal for the Management of Solid Urban Waste Generated in Naranjillo, Capital of the District of Luyando, Peru	Daza et al. [39]	Level of progress Medium
Waste Management Drivers Towards a circular economy in the Global South - The Colombian case	Calderón and Rutkowski [40]	Level of progress Low
An evaluation of final disposal alternatives for municipal solid waste through life cycle assessment: A case of study in Colombia	Caicedo-Concha et al. [41]	Level of progress Low
Solid Waste Management of the Provincial Municipalities of the Cajamarca Region, Peru	Peralta et al. [42]	Level of progress Low
Assessment of municipal solid waste collection in Bolivia: Perspectives for avoiding uncontrolled disposal and boosting waste recycling options	Ferronato, et al. [43]	Level of progress Low
Preliminary Assessment of Plastic Litter and Microplastic Contamination in Freshwater Depositional Areas: The Case Study of Puerto Misahualli, Ecuadorian Amazonia	Lucas-Solis et al. [44]	Level of progress Low
Green supply chain: Strategic analysis of solid waste management in Pelileo-Ecuador	Moreno et al. [45]	Level of progress Low
Management Strategies and Stakeholders Analysis to Strengthen the Management and Use of Biosolids in a Colombian Municipality	Venegas et al. [46]	Level of progress Low
Garbage in paradise: marine debris on the beaches of the island of San Andres, Seaflower Biosphere Reserve, Colombian Caribbean	Gavio et al. [47]	Level of progress Low
Circular Economy, International Cooperation, and Solid Waste Management: A Development Project in La Paz (Bolivia)	Ferronato et al. [48]	Level of progress Low
Environmental management of urban solid waste in the district of Castilla, Piura	Najar et al. [49]	Level of progress Low
M-GRCT: A Dynamic Circular Economy Model for the Optimal Design of Waste Management Systems in Low-Income Municipalities	Terranova et al. [50]	Level of progress Low
Integrated management for the prevention and control of dengue fever and other arbovirus is in the Municipality of Ambato	Martinez et al. [51]	Presence of Government Control
Design of the Occupational Health and Safety Management System Based on the Iso 45001:2018 Standard, Adjusted to the Needs of an Association of Waste Pickers in the City of Bogotá	Cozzani et al. [52]	Presence of Government Control
The carbon footprint of water treatment as well as sewer and sanitation utilities of Pamplona in Colombia	Ortíz et al. [53]	Presence of Government Control
Sanitary landfill site selection using multi-criteria decision analysis and analytical hierarchy process: A case study in Azuay province, Ecuador	Cobos et al. [54]	Presence of Government Control

According to the findings, it is evident that solid waste management and governmental control in the Andean Community of Nations has been the subject of a series of investigations in which significant results have been found in recent years. These studies provide a clearer vision of the challenges and opportunities in this crucial area for environmental sustainability and the quality of life of the communities.

The results obtained in this systematic review allow for an evaluation of the level of progress in public management and government control in solid waste management in the member countries of the Andean Community of Nations.

Regarding the level of progress in public solid waste management, important advances were found in effective strategies to reduce waste generation. Source reduction and selective collection proved to be effective strategies, achieving a 30% decrease in waste generation in Sabana Centro, Colombia, and a 20% increase in the recycling rate in El Oro, Ecuador. In addition, the valorization of organic waste, which represents 60% of solid waste in many cities in the region, has driven the implementation of composting programs as a key strategy.

On the other hand, it was evidenced that the management of construction and demolition waste has a lower environmental impact compared to municipal waste

management in developing cities of the Andean Community. Likewise, international cooperation has played an important role in promoting reuse and recycling, encouraging more sustainable practices. However, serious environmental impacts caused by inadequate landfill management were detected, including soil and groundwater contamination, which highlights the urgent need to address waste management in ecologically sensitive environments.

Regarding government control, it was found that several countries have promoted policies and regulations to support effective practices and achieve viable and sustainable waste management. Ecuador established in 2010 the National Plan for Integral Solid Waste Management (PLANRES), intending to promote integrated and sustainable solid waste management at the municipal and national levels. Bolivia enacted in 2015 the Integrated Waste Management Law No. 755, which promotes a "cyclical management" approach to reducing waste generation, maximizing reuse and recovery, and minimizing final disposal.

Peru, within the framework of the National Environmental Policy, has implemented programs and investments at the national level to address deficiencies in solid waste management, such as Legislative Decree No. 1278 and the National Plan for Integrated Solid Waste Management 2016–2024 (PLANRES). Meanwhile, in Colombia, efforts are being made to transform the traditional approach to waste management, focusing on collection, transportation, and final disposal, towards one centered on the circular economy, sustainable development, risk management, and climate change, through programs such as the National Guide for Proper Waste Separation.

In summary, although challenges persist, research in this area has provided valuable lessons and opportunities to improve waste management in the Andean Community of Nations. The aforementioned studies have demonstrated the importance of the circular economy, the inclusion of informal recyclers, waste recovery, and the adoption of more sustainable approaches, which represent significant contributions to moving towards more efficient and sustainable solid waste management in the region.

4. Discussion

At the most advanced level of waste management, there are success stories that demonstrate effective strategies to reduce solid waste generation. For example, in Sabana Centro, Colombia, source separation and selective collection have been successfully implemented, resulting in an impressive 30% reduction in solid waste generation [15]. This approach highlights the effectiveness of addressing waste reduction at source. In El Oro, Ecuador, a waste management model has succeeded in increasing the recycling rate to 20%, which not only reduces the amount of waste sent to landfills but also fosters the circular

economy in the region [23]. The promotion of recycling and reuse practices thus becomes a key strategy for sustainable waste management [25]. In addition, the importance of recovering organic waste, which represents up to 60% of solid waste in cities in Colombia and Ecuador, has been emphasized. This has led to the implementation of composting programs in several areas [24]. Proper management of construction and demolition waste has also proven to be an option with a lower environmental impact compared to municipal waste management in developing cities of the Andean Community of Nations, for example, in Luyando, Peru [41,39]. International cooperation has also played a role in advancing waste management in the region. In La Paz, Bolivia, a circular economy project that promotes reuse and recycling has been promoted, encouraging international cooperation to improve waste management [28,38]. This initiative highlights the importance of addressing waste management at a global level [43].

On the other hand, the formalization of transfer stations for recyclable waste has improved efficiency in the recycling value chain in Guayaquil, Ecuador [27]. This strategy not only reduces waste sent to landfills but also promotes active community participation in waste management. Similarly, in Azuay, Ecuador, waste management efficiency has been improved through the process of site selection for transfer stations [30]. This involves strategic planning that optimizes logistics and waste management in the region [36].

As for the medium level of progress, there is a focus on sustainable waste management, although significant challenges remain. For example, in Peru, the significant impact of marine waste management on fishing communities has been highlighted, underscoring the need for sustainable practices in coastal areas [37]. This includes the proper management of waste generated in maritime activities. Similarly, the economic viability of recycling construction and demolition waste in developing cities of the Andean Community of Nations has been identified, which contributes to environmental sustainability [31]. This not only reduces disposal costs but also promotes the reuse of construction materials, a key aspect of the circular economy. In terms of efficient management, Peruvian cities have successfully implemented the clustering approach, which has optimized waste collection and disposal, resulting in more efficient and sustainable management [32]. This strategy focuses on grouping geographic areas for more efficient collection.

In Colombia, the importance of including informal waste collectors in waste management policies has been highlighted. This can not only improve the living conditions of these workers but also contribute to more inclusive and efficient waste management in the country [33]. Furthermore, in Chocó, Colombia, plastic waste recovery has boosted the circular economy and generated employment and economic benefits for the community [34], [40]. This approach not only reduces pollution but

also contributes to local economic development. Proper solid waste management has also improved the environmental quality of public spaces in Chiclayo, Peru. The implementation of efficient collection and disposal practices has reduced pollution and improved public health in the region [35]. This example highlights the importance of effective waste management for community well-being.

On the other hand, at the lowest level of progress, there are areas where greater attention and substantial improvements are required. For example, in some provincial municipalities in Cajamarca, Peru, a strengthening of waste management has been observed, although no specific details on concrete improvements are provided [42]. This suggests the need for a more detailed assessment of progress and challenges in these areas. Despite the opportunities for the inclusion of informal waste collectors in Colombia, substantial challenges remain in their implementation [33]. This approach to social inclusion in waste management is a fundamental aspect that has been widely discussed in the literature.

Serious environmental impacts caused by inadequate waste management have been identified at several sites, such as soil and groundwater contamination at the Loreto landfill in Eastern Ecuador [26]. These environmental impacts highlight the urgent need to address waste management issues in ecologically sensitive environments. From a public health perspective, it has been identified that the lack of effective regulation of medical waste collection in the countries studied in the Andean Community of Nations has generated public health risks [29]. This issue is of great importance and requires careful attention by health authorities [48].

In a marine context, the presence of marine debris has been identified on the beaches of San Andres, in the Seaflower Biosphere Reserve in the Colombian Caribbean [47]. This highlights the imperative need for coastal management and beach cleanup in the region to preserve marine ecosystems. In another approach, a dynamic circular economy model has been developed to optimize waste management systems in low-income municipalities [50]. Although their research does not delve into specific results, their approach aims to improve the efficiency of waste management in these communities. In an evaluation of solid waste disposal alternatives in Colombia, the importance of sustainability in waste management is highlighted [41]. This suggests the need to carefully consider disposal options to minimize environmental impact [49,46]. In addition, the presence of microplastics has been identified in freshwater deposition areas in the Ecuadorian Amazon, underscoring the importance of plastics management in natural environments, although their study does not delve into specific solutions [44].

Thus, solid waste management in the Andean Community of Nations is a complex and varied issue, with notable progress in some places and pending challenges in others. The inclusion of informal collectors, environmental sustainability, and efficient management are key issues that

must be addressed to move towards more effective and responsible waste management in the region. Each level of progress presents unique opportunities and challenges, highlighting the importance of sharing best practices and promoting regional cooperation in this field.

In Peru, governmental control plays a crucial role in solid waste management, through the supervision and verification of actions and results in the use of state resources and assets allocated to such activities, as various programs and investments have been implemented at the national level to address deficiencies in this area. These efforts include the improvement of public cleaning services, the construction of infrastructure for waste management, the promotion of recycling in municipal areas, and the promotion of environmental education for responsible consumption. Despite these advances, significant challenges remain, such as the fact that only 55% of the waste generated in the country goes to landfills, while the rest is still in landfills. This underscores the need to continue working on waste recovery and recycling to reduce the amount going to landfills [42].

On the other hand, in Colombia, solid waste management has changed over time. Initially, it was centered on public cleaning services that focused on the collection, transportation, and final disposal of waste, with a primarily sanitary approach. However, efforts are now being made through various government programs and agencies to integrate these services into a broader framework that encompasses concepts such as the circular economy, sustainable development, risk management, and climate change adaptation [45]. For example, the Ministry of Housing, City, and Territory is working on the integration of the Drinking Water and Basic Sanitation sector with the National Policy for the Integrated Management of Solid Waste - CONPES 3874 of 2016 [52]. Additionally, the National Guide for the Adequate Separation of Solid Waste has been issued, whose purpose is to boost recycling, reduce the negative environmental impact of waste, promote extended producer responsibility, and improve the general solid waste management policy [53].

As for Bolivia, solid waste management is regulated by Law N°755 of 2015, Law on Integrated Solid Waste Management, which promotes a "Cyclical Management" approach. This involves the treatment of waste for recovery and reuse through comprehensive planning that encompasses regulations, organization, financial sustainability, operational management, environmental education, and community development. The purpose of this law is to reduce the generation of waste, maximize its use, and minimize its final disposal. It also establishes the responsibilities of local governments in waste management and encourages citizen participation in this process. In this sense, government control in Bolivia has a significant impact on solid waste management by establishing guidelines and promoting more sustainable and responsible practices in this area [48].

In Ecuador, governmental oversight of solid waste management falls mainly to the Ministry of Environment, through the creation in 2010 of the National Program for Integrated Solid Waste Management (PNGIDS) [51]. The primary purpose of PNGIDS is to promote solid waste management in Ecuador's municipalities, adopting an integrated and sustainable approach. Its goal is to influence solid waste management at the national level through the formulation of an Integrated Solid Waste Management Policy. In addition, the Ministry of the Environment has established regulations and standards governing solid waste management, covering aspects such as classification, collection, transportation, treatment, and final disposal of these materials [54].

5. Conclusions

Solid waste management in the Andean Community of Nations presents a diverse landscape, characterized by varying levels of progress and pending challenges. An essential factor influencing these levels of progress is governmental control, which plays a crucial role in overseeing policy formulation and regulations and promoting responsible and sustainable waste management practices.

At the most advanced levels of waste management, successful cases have been identified that have applied effective strategies to reduce solid waste generation. For example, in Sabana Centro, Colombia, source separation and selective collection have been successfully implemented, resulting in a 30% reduction in solid waste generation. Promoting the circular economy and recycling are central practices in such successful strategies. In these areas, public management and governmental control have played an active role in establishing regulations that promote sustainability and the inclusion of informal waste collectors. International cooperation has also contributed to the success of these programs, highlighting the importance of a global approach to waste management.

At the intermediate level of progress, there is a focus on sustainable waste management, although significant challenges persist. At this stage, the influence of public management and governmental control is evident in the implementation of policies on marine waste management in fishing communities in Peru and the promotion of economic regulations for the recycling of construction and demolition waste. The importance of regional cooperation to address common challenges is highlighted.

At the lower levels of progress, some areas require greater attention and substantial improvements. Strengthening waste management in provincial municipalities in Cajamarca, Peru, is an example of an area where public management and governmental control can play a key role in providing guidelines and technical

support to improve waste management. The inclusion of informal waste collectors is another challenge that requires government attention to ensure more inclusive and efficient management.

Achieving consistent, viable, and sustainable waste management requires a comprehensive and long-term approach by governments and competent authorities. This involves the formulation of solid and coherent policies and regulations, accompanied by effective control and monitoring mechanisms. Furthermore, it is essential to promote the active participation of all stakeholders involved, including citizens, the private sector, and civil society organizations. Environmental education and awareness-raising are key to promoting behavioral changes and responsible practices in waste management. Likewise, investing in adequate infrastructure and technologies, as well as continuous training of personnel in charge of waste management, are crucial aspects of ensuring the long-term sustainability of waste management systems.

As mentioned earlier, at the most advanced levels of waste management, effective strategies such as source separation and selective collection have been applied, resulting in a significant reduction in solid waste generation, as in the case of Sabana Centro in Colombia, with a 30% reduction. Additionally, promoting the circular economy and recycling are key practices in these successful strategies.

At the most advanced levels, governments have promoted policies and regulations that foster sustainability and the inclusion of informal waste collectors. Similarly, at the intermediate level, policies on marine waste management in fishing communities in Peru have been implemented, and economic regulations for the recycling of construction and demolition waste have been promoted. At the lower levels, public management and governmental control are needed to play a key role in providing guidelines and technical support to improve waste management.

In summary, public management and governmental control exert a significant influence on the levels of progress in solid waste management in the Andean Community of Nations. At the most advanced levels, the government has promoted policies and regulations that support effective practices, such as source separation and selective collection, as well as the promotion of the circular economy and recycling. At the intermediate levels, the government has addressed specific challenges, such as marine waste management and the recycling of construction and demolition waste. At the lower levels, public management and governmental control can play a key role in strengthening waste management and the inclusion of informal waste collectors. Ultimately, regional cooperation and international collaboration are key elements in the pursuit of more effective and responsible waste management throughout the region.

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