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SOLID WASTE MANAGEMENT: A LOOK AT THE MUNICIPALITIES OF VIDEIRA AND CAÇADOR-SC AND CITIES IN MEXICO, IN THE LIGHT OF HANS JONAS' PRINCIPLE OF RESPONSIBILITY

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ABSTRACT

Solid waste management is one of the main challenges of contemporary cities, intensified by population growth, excessive consumption and uncontrolled industrialization. The selective collection of recyclable materials stands out as a crucial public policy to promote sustainability, reduce environmental impacts, and conserve natural resources. This study compares the practices of selective collection in the municipalities of Videira and Caçador, in the Midwest of Santa Catarina, with emphasis on the National Solid Waste Policy (PNRS), with reference cities in Mexico, such as Cozumel (Quintana Roo) and Salinas Victoria (Nuevo León), evaluating the public policies implemented and their respective results. These municipalities, both in Brazil and Mexico, have similar demographic characteristics, facilitating a comparative analysis of solid waste management practices. In addition, Hans Jonas' philosophical perspective is incorporated, as the research also explores the need for an ethics of responsibility in solid waste management, emphasizing the importance of considering the long-term consequences of human actions on the environment and future generations. In addition, this work is aligned with Sustainable Development Goals (SDGs) 11 and 12, which aim to promote sustainable cities and communities and ensure sustainable production and consumption patterns, respectively. Thus, the analysis of selective collection policies in Videira and Caçador and in the Mexican cities of Cozumel and Salinas Victoria was conducted in the light of a bibliographic, interpretative, qualitative approach.

Keywords: Selective Collection, Sustainability, Public Policies, Responsibility.

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INTRODUCTION

Solid waste management is one of the great challenges of contemporary cities, especially in the context of economic development that demands solutions aligned with environmental sustainability and urban efficiency. The significant increase in waste generation in recent decades requires immediate and effective responses, focusing on public policies that encourage sustainable practices and minimize environmental impacts (Cireno, 2012). Improper waste management can result in serious problems, such as soil contamination, pollution of water resources, and public health risks. In this context, the selective collection of recyclable materials emerges as an essential public policy, contributing to the reduction of the volume of waste sent to landfills and to the recovery of valuable resources, reinforcing the importance of efficient and environmentally responsible management.

In 2010, in order to mitigate such impacts, the Brazilian State instituted the National Solid Waste Policy (PNRS) through Law No. 12,305/2010, Brazil (2010a), establishing general rules for the environmentally appropriate final disposal of waste. This initiative emerged as a response to the emerging challenges in the management of this waste, with the aim of promoting sustainable practices and mitigating environmental impacts. The implementation of the PNRS boosted research aimed at the analysis of the established legal provisions and the implementation of instruments for the efficient management of solid waste (Brasil, 2010a).

In this context, the present study aims to investigate the structure of public policies for solid waste management in the Santa Catarina municipalities of Videira and Caçador, both located in the midwest of the State of Santa Catarina, analyzing their adherence to the PNRS guidelines. The analysis seeks to identify whether local solid waste management practices are aligned with the principles of sustainability and efficiency established by the PNRS, highlighting examples of success and areas that need improvement.

For comparison purposes regarding solid waste management, the Mexican cities of Cozumel (Quintana Roo) and Salinas Victoria (Nuevo León), which have advanced solid waste management practices, are also analyzed. These cities were selected because they have socioeconomic and demographic characteristics comparable to those of Videira and Caçador, allowing a more balanced analysis.

The analysis of the practices adopted in these municipalities in Santa Catarina, compared with those of Mexican cities, served as a criterion for interpreting the adequacy of

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local strategies to the guidelines established by the National Solid Waste Policy (PNRS) (Brasil, 2010a). Furthermore, it is worth emphasizing that this text is a first step towards understanding what is being done in favor of the environment and sustainability in the midwest region of Santa Catarina. This intention also aims to analyze whether the ideas of care and responsibility are being included in the calculation of an ethical look in function of the SDGs Sustainable Development Goals of the 2030 Agenda.

In this sense, incorporating Jonas' (2006) ideas on the ethics of responsibility, this study criticizes the traditional approach of exploitation of natural resources and domination of nature, emphasizing the need for a new ethics that considers the long-term consequences of human actions. From this perspective, it will be possible to evaluate whether the selective collection policies in Videira and Caçador, as well as in the Mexican cities of Cozumel and Salinas Victoria, are effectively aligned with the principles of sustainability and environmental responsibility, and to verify whether these would be determining factors for Mexican cities to be more effective in terms of solid waste management. when compared to the cities of the Midwest of Santa Catarina.

Thus, the following text is divided into six fundamental parts: a) Public Policy on Solid Waste (PNRS): the reality of Brazil; b) Solid Waste Management in the Municipalities of Videira and Caçador; c) 2030 Agenda and contemporary challenges; d) Solid Waste Management in Cozumel and Salinas Victoria; e) Comparative Analysis of Solid Waste Management based on Hans Jonas' Responsibility principle and f) Final considerations. It is also worth noting that this work had as its methodology the bibliographic investigation, which according to Severino (2013) is the one that is carried out from available records, based on previous research, in the form of printed documents, and is also of an interpretative character and qualitative bias, because according to Godoy (1995, p. 63) "qualitative researchers are concerned with the process and not simply with the results or products"

PUBLIC POLICY ON SOLID WASTE (PNRS): THE REALITY OF BRAZIL

Among the numerous challenges faced by Brazilian municipalities, solid waste management stands out, especially driven by the economic growth of cities. This growth increased the supply of goods and services, resulting in higher consumption and, consequently, a greater amount of waste produced. In addition to the sanitary and public health problems resulting from the accumulation of garbage, there is a growing concern

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with the preservation and maintenance of the environment. This situation has forced municipal administrations to focus more on waste management, which includes the control of the production, storage, collection, separation, transportation, treatment and final disposal of waste (Conke, 2015).

The central objective of any sustainability-related initiative is undoubtedly the change in consumption patterns, which affect nature and do not fully solve human needs, since in some places there is a waste of resources, while in others there is a shortage. However, as this change involves cultural transformations and requires time, it is expected that the waste will have at least a correct destination, with the maximum possible use, through recycling and proper final disposal.

In order to find a way to control the production of waste generated and discarded in nature and given the importance of the issue, only after twenty years of processing in the meanders of the Legislative and Executive branches in Brazil, in 2010 Law 12.305/2010 was created, known as the National Solid Waste Policy (PNRS), which brought principles and paths for good solid waste management, advocating sustainable actions for the environment (Brasil, 2010a).

In other words, with the approval in the Chamber of Deputies, on March 11, 2010, and in the Federal Senate, on July 7, 2010, Federal Law No. 12,305, of August 2, 2010, Brazil (2010a), which instituted the National Solid Waste Policy (PNRS). With all this journey, it was clear that the PNRS is the result of an instrument of a democratic process, since it provides for the shared responsibility between the Government, citizens, societies and the private sector in the management of solid waste, with integrated management as its central objective.

According to the National Solid Waste Policy (Brasil, 2010a), the integrated management of solid waste is characterized as a set of actions aimed at finding solutions for this waste, in order to consider the political, economic, environmental, cultural and social dimensions under the premise of sustainable development.

The PNRS brought objectives, principles and guidelines to enable the advancement of solid waste management in Brazil, facing social, environmental and economic challenges. Among its main proposals are the increase in recycling and reuse, as well as the promotion of composting methods and energy use, such as the production of biogas, to reduce the destination of waste to landfills. A relevant example in Brazil is the urban solid and organic waste management system, which began to offer ways to improve efficiency in

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waste disposal (Brasil, 2010a; Zago; Barros, 2022). The solid waste management practices adopted in several Latin American municipalities, as pointed out in studies on municipal management, also served as inspiration to improve solid waste policies in Brazil (Herrera-Uchalinet al., 2023).

In the social aspect, the solid waste law sought to guide people towards less waste production and greater use, reuse and recycling; encouraging them to be more participants and to value those who work (especially waste pickers) with the management of this waste, in order to awaken greater responsibility for the environment in which they live. In this sense, the Ministry of the Environment (Brasil, 2010b) stated that the strengthening of the productive organizations of waste pickers in cooperatives and associations based on the principles of self-management, solidarity economy and access to job opportunities represent a fundamental step to expand the range of action of this professional category in the implementation of the PNRS.

The implementation of public policies faces significant barriers, such as the lack of adequate infrastructure and insufficient funding. For their part, Mexican cities, such as León, with almost 1,500,000 inhabitants, have shown advances in the selective collection and production of biogas from waste, showing that investment in sustainable technologies can overcome these challenges. In Brazil, the integration of initiatives such as these, especially in smaller municipalities, is still an obstacle, but international experiences, such as those analyzed in the management of urban solid waste and sustainable management practices in Brazil, can offer successful solutions (Zago; Barros, 2022).

Thus, the PNRS, instituted by Law 12.305/2010, was created with the purpose of disciplining the integrated management and management of solid waste, becoming viable through principles, objectives and instruments, in addition to attributing responsibility to the government and to the individuals or legal entities responsible, directly or indirectly, for the generation of solid waste and for those who develop positive actions related to its management (Brasil, 2010a).

Law 12.305 of 2010 is a milestone for Brazilian legislation, as it defined new concepts and instruments such as shared responsibility from the product life cycle and reverse logistics, as a practice to face the challenge of managing and managing solid waste, especially with regard to its destination and environmentally appropriate final disposal. To this end, it used selective collection as an important step in the path towards sustainability. This legislation, properly applied, can point a way to the consolidation of

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sustainable development in our country, which is even among its principles, fundamentally article 6, IV, of Law 12.305/2010 (Brasil, 2010a).

The legal framework of the PNRS (Law 12.305/2010) established 11 principles that are now the basis for the entire process from disposal to destination or final disposal of solid waste, guided by the constitutional foundations and the principles of the National Environmental Policy (Brasil, 2010a). They are:

> I - prevention and precaution;
> II - the polluter-pays and the protector-recipient;
> III – the systemic view in the management of solid waste, which considers the environmental, social, cultural, economic, technological and public health variables;
> IV – sustainable development;
> V – eco-efficiency, through the compatibility between the supply, at competitive prices, of qualified goods and services that satisfy human needs and bring quality of life and the reduction of environmental impact and the consumption of natural resources to a level at least equivalent to the estimated carrying capacity of the planet;
> VI – cooperation between the different spheres of public power, the business sector and other segments of society;
> VII – the shared responsibility for the life cycle of the products;
> VIII – the recognition of reusable and recyclable solid waste as an economic good of social value, generator of work and income and promoter of citizenship;
> IX – respect for local and regional diversities;
> X – the right of society to information and social control;
> XI - reasonableness and proportionality (Brasil, 2010a, n.p.)

In addition to these principles, practices such as composting and the reuse of waste for biogas generation are in line with the concept of circular economy, already applied in cities such as Salinas Victoria, Mexico, which stands out for its innovative initiatives in the management of organic waste. In our understanding, it is believed that these practices could be incorporated more comprehensively into Brazilian public policies to promote greater efficiency in solid waste management.

It is important to highlight the recognition of solid waste as an economic and social good that must be recycled and reused, generating work and promoting citizenship, with a reference to eco-efficiency and sustainable development that, based on the shared responsibility for the life cycle of products with the cooperation of the entire production chain and public authorities, ponders a systemic view of the entire management of solid waste.

SOLID WASTE MANAGEMENT IN THE MUNICIPALITIES OF VIDEIRA AND CAÇADOR

Before presenting the laws and actions related to the handling of solid waste, it is worth contextualizing the municipalities selected for this study, starting with the locality of

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Videira. This municipality is one of the 295 municipalities in the state of Santa Catarina, in the southern region of the country. The municipality has 55,221 inhabitants (IBGE, 2022). Its area is 348.13 km². The population density is 140.96 inhabitants/km², while the state has an average of 76.66 inhabitants/km². In the municipality of Videira, complementary law no. 302/2022, of 12/21/2022, enacted the public service of solid waste management through the Autonomous Water and Sewage Service of the municipality of Videira (VISAN), with its activities starting only on January 1, 2023, directly or contracted by a third party, in accordance with federal laws no. 11,445/2007 (Brazil, 2007), n. 12.305/2010 (Brasil, 2010a) and n. 14.026/2020 (Brasil, 2020). This shows how far behind Videira was in the implementation of the PNRS, which, as is already known, was enacted in 2010.

In turn, the aforementioned municipal law defined in its 3rd paragraph, on the environmentally appropriate final disposal of solid waste, which includes reuse, recycling, composting, recovery and energy use, as well as other destinations admitted by the competent bodies of the National Environment System (SISNAMA) and the National Health Surveillance System (SNVS) and the Unified Agricultural Health Care System (SUASA), according to item VII of article 3 of Federal Law No.12,305, of August 2, 2010 (Brasil, 2010a).

Complementary Municipal Law No. 302/2022, Videira (2022) also placed significant emphasis on the fees charged on the "polluter pays". While tariff control is important, this approach can be very limited, as it diverts the focus from key issues such as creating incentives for separate collection and implementing sustainable practices focused on the "protector-recipient". For example, the city of León in Mexico has managed to balance tariff management with increased community participation and the use of clean technologies for recycling, without overly burdening citizens (Herrera-Uchalinet al., 2023; Zago; Barros, 2022).

It is very clear that the PNRS encourages waste management as a shared responsibility between public authorities, the business sector and society. Despite this, Videira's Complementary Law No. 302/2022 does not seem to prioritize this approach, focusing more on tariff issues than on collective engagement to reduce and properly treat waste (Videira, 2022). Another relevant aspect to consider is the valorization of the reuse and recycling of waste as strategies to reduce the amount of material destined for landfills. As already mentioned, Videira's delay in this aspect may be linked to the lack of a robust policy that encourages recycling, including incentives for the separation of waste at the

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source, highlighting that, in the urban space of Videira, there is selective collection only once a week and, currently, there is still no participation of waste pickers' cooperatives.

Likewise, there is a visible lack of incentive and application of clean technologies in Videira. Although waste management is a critical issue, the municipality still does not invest sufficiently in innovative technologies for the treatment and reuse of waste. In contrast, studies in Brazil reveal significant advances in the use of biogas and composting, as pointed out in the management of urban organic solid waste. These practices exemplify models that could be adapted in cities such as Videira, promoting sustainable development and reducing environmental impact (Zago; Barros, 2022).

It is also important to highlight that, in Videira, there is no environmental education and awareness work about the importance of selective collection, as people are not encouraged to separate solid waste, not even in schools. According to the Water and Sanitation Institute (2020), 98.37% of the population of Videira is served with the collection of Household Waste and has selective collection of Solid Waste, but recovers only 7.93% of the total waste collected in the municipality. In addition, according to the National Sanitation Information System (2020), in Videira, there are no waste pickers organized in cooperatives or associations.

Although there is an effort by the Government to create laws and decrees, the effectiveness of these policies depends directly on the active participation of the population. Public awareness is essential to the success of any waste management strategy. Studies show that effective educational campaigns, combined with the participation of schools and the local community, can make separate collection a standard practice and significantly increase recycling rates. In Brazil, this approach has also been pointed out as fundamental for the success of solid waste policies, as highlighted in systemic analyses on municipal waste management (Herrera-Uchalinet al., 2023). However, without the collaboration of citizens in the correct separation of waste, for example, selective collection becomes inefficient. In addition, reducing waste generation starts with individual everyday practices, such as avoiding the use of single-use plastics, buying products with less packaging, and reusing materials whenever possible.

It is thus highlighted that public policies for solid waste management will only be truly effective if they are accompanied by a continuous effort to raise awareness among the population. Shared responsibility between government, businesses, and citizens is essential to creating a more sustainable and environmentally conscious society. Only

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through the collaboration and commitment of all sectors will it be possible to achieve efficient waste management and minimize negative impacts on the environment.

In turn, Caçador, a municipality located in the Midwest of Santa Catarina, in the Alto Vale do Rio do Peixe, 400 km from Florianópolis, has a population of 73,720 inhabitants (IBGE, 2022), with a territorial area of 982 km² and a demographic density of 72.03 inhabitants/km². In the municipality of Caçador, Law No. 3,883, of April 4, 2024, provides for the management of solid waste from regular and selective collection in the Municipality and provides for other provisions. In article 2 of this law, some principles are highlighted:

> III – the systemic view of solid waste collection that considers environmental, social, economic and technological variables; IV – the promotion of sustainable patterns of production and consumption; V – the minimization of waste generation through incentives for environmentally appropriate practices of reduction, reuse, recycling and recovery; VIII - the recognition of reusable and recyclable solid waste as an economic good, generating work and income (Caçador, 2024).

Concomitantly, it is noteworthy that Article 9 of the aforementioned Law instituted selective collection as mandatory in all public offices and in public educational institutions, while Article 11 determined that the Municipality must promote permanent environmental education programs, especially in the school network, focusing on the importance of reducing waste, generating waste and valuing the reuse and recycling of solid waste for the preservation and maintenance of the healthy and balanced environment (Caçador, 2024).

Another relevant aspect is found in Article 21, which emphasizes that recyclable waste should be sent, preferably, to associations, cooperatives or civil society organizations whose object of the articles of association or bylaws contains a provision for activities related to solid waste management, duly registered with municipal, state and federal agencies, in accordance with the provisions of Federal Laws No. 5,764. of December 16, 1971; No. 11,445, of January 5, 2007 and No. 12,305, of August 2, 2010 and other legislation in force (Caçador, 2024).

Very similar to the municipality of Videira, in Caçador the solid waste management policy is still incipient when compared to other cities and the PNRS itself. This means that, despite local efforts, cities still face significant challenges to implement more efficient, sustainable waste management in compliance with national guidelines. Despite this harsh observation, it is possible to think that these most recent efforts by these municipalities are an adaptation to the requirements of the 2030 Agenda that will be quickly presented below.

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AGENDA 2030 AND CONTEMPORARY CHALLENGES

It can be said that since the implementation of the PNRS in 2010, despite the progress in some cities, there is still a long way to go, especially if we consider that after years of international discussion, the UN, in 2015, approved a new agenda for compliance with sustainable development. In this scenario, approximately 190 countries ratified this innovative instrument on the international stage, aligning social welfare programs and the More Sustainable Cities Program in order to connect the economic, social, and environmental spheres equitably (Cansi, 2021).

The new sustainable development agenda for the next 15 years, the 2030 Agenda (composed of the 17 SDGs, which were created as a continuation and improvement of the Millennium Development Goals (MDGs), which were in force from 2000 to 2015), aims to increase and improve not only the concept of sustainable development, but effectively new and innovative sustainable practices.

Unlike the MDGs, which focused on challenges faced primarily by developing countries, the SDGs are unique in that they require the participation of all nations, regardless of their level of economic development. Poor, rich, and middle-income countries are called upon to act together to promote economic and social prosperity, while protecting the planet and prioritizing environmental sustainability (UN, 2020).

The SDGs cover a wide range of goals, including eradicating poverty, promoting gender equality, preserving natural resources, and implementing responsible production and consumption practices. Global collaboration is essential to ensure that these goals are achieved, considering that environmental, social, and economic issues are intertwined and affect the well-being of present and future generations (UN, 2015).

Regarding solid waste management, it is present in SDG 11: "Make cities and human settlements inclusive, safe, resilient and sustainable" and in SDG 12: "Ensure sustainable production and consumption patterns that depend directly on solid waste management" (UN, 2015).

In a very specific way, target 6 of SDG 11 establishes the reduction of the negative environmental impact per capita of cities, including paying special attention to air quality, waste management and other factors by 2030. This target reflects the need to address urban challenges caused by rapidly growing urban populations, such as pollution and excessive waste production (UN, 2016).

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Inadequate solid waste management and poor air quality are among the main environmental problems affecting public health and well-being in cities. Implementing effective policies to improve waste management and promote more sustainable production and consumption practices is crucial to achieving this goal. Additionally, cities need to invest in clean technologies and sustainable transportation systems to mitigate environmental impact.

Target 5 of SDG 12 establishes the substantial reduction of waste generation through prevention, reduction, recycling and reuse by 2030.This target seeks to address the growing problem of excessive waste production, which has significant environmental impacts, such as the pollution of soils, rivers and oceans, in addition to contributing to the depletion of natural resources (UN, 2015).

The implementation of waste prevention and reduction practices involves, for example, the adoption of circular economy models, where products and materials are kept in use for as long as possible, minimizing waste. Recycling and reuse also play key roles in allowing discarded materials to be reintroduced into new production cycles, decreasing the need for raw material extraction and reducing the environmental impacts associated with the production of new items.

Knowing the importance and need to adjust the sustainability practices recommended by the 2030 Agenda with the actions of Brazilian municipalities, the following item aims to show how other Latin American developing municipalities are acting to implement practices that are more consistent with their own solid waste management obligations. To this end, two Mexican municipalities equivalent to the reality of Caçador and Videira were chosen, as already mentioned. Their examples of sustainable actions are emblematic for pondering what can be done to expand and complement the guidelines of the PNRS in the region investigated here.

3.1 SOLID WASTE MANAGEMENT IN COZUMEL AND SALINAS VICTORIA

Mexico is one of the largest producers of solid waste in Latin America and it is estimated that the country will reach 671 thousand tons of municipal solid waste (MSW) per day by 2050, according to the UN (2018). This increase represents a serious public health problem, with direct impacts on the local environment.

According to Mexico's National Institute of Statistics and Geography (INEGI), the country collects 86,343 tons of garbage daily (INEGI, 2020), generated mainly in homes,

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buildings, streets, parks, and gardens (Semarnat, 2016). Despite the challenges that the country faces in solid waste management, some cities have stood out for their innovative policies and effective practices in this field. Cozumel and Salinas Victoria, for example, share characteristics with cities in the Midwest of Santa Catarina, such as Videira and Caçador, as they have between 50 thousand and 100 thousand inhabitants and have been implementing strategies that aim not only to mitigate the environmental impacts of waste production, but also to promote reuse, recycling and energy use. These actions are aligned with the principles of the National Solid Waste Policy (PNRS) and with the circular economy, in accordance with Brazilian environmental standards (Brasil, 2010a).

Cozumel, an island in the state of Quintana Roo, has an area of about 478.2 km² and a population of 88,626 inhabitants, according to INEGI (2020). Recently, an innovative waste management plan called the Municipal Plan for the Prevention and Integral Management of Urban Solid Waste (PMPGIR) was implemented. This plan is based on the principles of the 2030 Agenda and the circular economy, with a focus on the energy use of urban waste. The practices adopted in Cozumel have not only significantly reduced the volume of waste destined for landfills, but have also offered a sustainable solution for generating energy from this waste. This approach could be widely replicated in Brazilian cities, providing greater efficiency in solid waste management and contributing to sustainability.

Practices such as composting and the reuse of waste for biogas generation already applied in cities such as Salinas Victoria, a municipality located in the state of Nuevo León, Mexico, with an area of 1,334 km² and 86,766 inhabitants (INEGI, 2020) are also noteworthy. Salinas Victoria has stood out for its innovative initiatives in organic waste management, adopting strategies that reduce the volume of waste sent to landfills and transform waste into valuable resources, such as biogas, promoting a sustainable solution that could be applied in other municipalities.

These Mexican cities are part of the Sectoral Network for Environmental Management and Rural Development of Latin America and the Caribbean (GADeR-ALC), which works to promote the exchange of knowledge and best practices between cities and organizations, reinforcing the importance of community awareness and the inclusion of waste pickers in public policies. This type of collaboration between the various social actors can be a relevant reference for Brazilian cities that face challenges in the implementation of public policies for solid waste management (Brasil, 2010b).

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Effective solid waste management practices have also been observed in different locations in Mexico, such as in the cities of León, in the state of Guanajuato (already mentioned in this text) and San Cristóbal de las Casas, in the state of Chiapas. Although these cities have a significantly larger population than the cities of Videira and Caçador, this highlights the potential for improvements in solid waste management in smaller municipalities.

With a reduced population, the implementation of sustainable policies and technologies can be more agile and efficient, allowing for faster adaptation and tighter control over the process. This favors the promotion of practices such as recycling, reuse, and energy use, making these solutions even more viable in smaller cities.

In view of the above, it is highlighted that environmental education and awareness also play a key role in these Mexican cities, with campaigns in schools and communities encouraging the separation of recyclable materials and the responsible use of resources. It is noteworthy that the lessons obtained from solid waste management in Mexican cities, such as Cozumel and Salinas Victoria, are valuable for Brazilian cities such as Videira and Caçador.

The implementation of innovative technologies for waste treatment, combined with composting, recycling and biogas production, can increase efficiency in solid waste management in Brazil, promoting a more sustainable and balanced system (Brasil, 2010a). The adoption of effective public policies, combined with community engagement and the use of appropriate technologies, can ensure a more sustainable and conscious future, providing both environmental and economic benefits for future generations.

Speaking of future generations, it is very necessary to point out what are the possible consequences of the relationship between environmental care through the correct management of solid waste and the responsibility advocated by the thought of Hans Jonas (2006). Thus, an analysis of solid waste management in the municipalities of Videira, Caçador, Cozumel and Salinas Victoria is presented below, in the light of the Principle of Responsibility proposed by Jonas (2006), emphasizing the relevance of environmental education as a central element to improve the effectiveness of this process.

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SOLID WASTE MANAGEMENT BASED ON HANS JONAS' PRINCIPLE OF RESPONSIBILITY

When comparing solid waste management in the cities of Videira and Caçador, in the Midwest of Santa Catarina, with the Mexican cities of Cozumel and Salinas Victoria, it is observed that, although they share similar socioeconomic characteristics and human development indexes, the practices adopted in Santa Catarina locations still lack greater effectiveness as pointed out in the previous sections. This diagnosis is reinforced by the Sectoral Network for Environmental Management and Rural Development of Latin America and the Caribbean (GADeR-ALC), which promotes the exchange of knowledge and the dissemination of good practices among cities and organizations in the region, and by the PMPGIR, a plan based on the principles of the 2030 Agenda.

This finding suggests a more detailed analysis, particularly in the light of Hans Jonas' (2006) principle of responsibility and the essential role of environmental education. The principle of responsibility, outlined by Hans Jonas (2006), emphasizes the ethical obligation to care for the well-being of future generations, promoting actions that ensure the preservation of the environment and sustainability. Applied to solid waste management, this principle demands policies and practices that transcend immediate disposal, considering the long-term impacts on quality of life and environmental balance. In the cities of the Midwest of Santa Catarina, the absence of more effective management reflects a distancing from this ethical commitment, since problems such as irregular disposal, overload of landfills and underuse of recyclable materials persist.

Environmental education, in this context, emerges as a strategic tool to transform the way cities face the problem of solid waste. More than informing about the correct separation of waste, environmental education aims to promote a behavioral change that favors sustainable practices, such as reducing consumption, reusing materials, and recycling. In Cozumel and Salinas Victoria, educational initiatives and awareness campaigns have contributed to improvements in waste management, while in Videira and Caçador, there are still significant gaps in social mobilization for more responsible practices.

For these cities to move towards more effective solid waste management, it is essential that they align their educational practices with the principle of responsibility. Increasing complexity and contemporary challenges require a robust and innovative ethical approach. In the work "The Principle of Responsibility: An Essay on an Ethics for Technological Civilization", Hans Jonas (2006) proposes an ethics focused on the

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protection of the environment and future generations, highlighting that the actions carried out in the present can have profound and lasting implications for the planet and its inhabitants. According to him, it is necessary to expand the ethical imperative by placing nature as a fundamental element of a global ethic, so he warns us: "Act in such a way that the effects of your action are compatible with the permanence of an authentic human life on Earth [...]. We do not have the right to choose the non-existence of future generations as a function of the current existence, or even to endanger them (Jonas, 2006, p. 47-48).

This commandment is central, because according to Jonas, the relationship between the human being and nature, in modernity, is configured as an ethical dilemma, as it reveals the human motivation to dominate nature and treat it as an object of exploitation. Modern technology, according to Jonas, "introduced actions of such an unprecedented order of grandeur, with such new objectives and consequences, that the framework of the old ethics can no longer frame them" (Jonas, 2006, p. 39). Thus, traditional ethics, conceived in contexts in which human power over nature was limited, prove to be insufficient to guide decisions in the face of the challenges imposed by technical progress.

Jonas's proposal is based on two main criticisms: a revision of traditional ethics and a criticism of technical advancement. The criticism of the technique highlights that the modern ideal of progress, centered on economic growth and the unrestricted exploitation of natural resources, has brought unprecedented existential risks. By significantly expanding the scope of human actions, the technique has come to represent a potential threat to the very continuity of life. According to Jonas (2006), this threat requires a new ethic, capable of guiding human action with a view to long-term consequences.

The ethics of responsibility, proposed by Jonas, requires a reassessment of social values and practices, directing technique and progress towards purposes that guarantee the preservation of the environment and sustainability. Instead of being seen only as instruments of economic development, these advances need to be guided by ethical principles that ensure the continuity of human life on the planet. In this sense, Jonas' work offers a critical and urgent reflection on humanity's ways of being and acting in the face of technological transformations and the contemporary environmental crisis (Jonas, 2006).

Therefore, the integration of an ethical and educational perspective in the management of solid waste is essential for the cities of Videira and Caçador to respond more effectively to current challenges. The adoption of sustainable practices, anchored in the ethics of responsibility, is essential to ensure that future generations inherit a healthy

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and balanced environment. The Mexican model can be inspiring and guiding sustainable practices, but it is necessary to "get your hands dirty" here and now for this to become a reality.

FINAL CONSIDERATIONS

This study highlights solid waste management as one of the greatest challenges faced by contemporary cities, especially in the context of urban development that demands sustainable and effective solutions. The comparative analysis between the Santa Catarina municipalities of Videira and Caçador and the Mexican cities of Cozumel and Salinas Victoria reveals the importance of well-structured public policies, such as the PNRS in Brazil, in the promotion of sustainable practices, including selective collection, composting and biogas production. However, it is evident that the existence of public policies, by itself, is not enough to guarantee effective management.

Although there have been significant advances, many Brazilian municipalities still face challenges related to inadequate infrastructure, limited environmental awareness, and low participation of society in the waste management process. In this sense, the good practices observed in Mexican cities offer valuable examples for Brazilian municipalities, especially with regard to the application of technologies and community engagement. The efficient implementation of the PNRS, accompanied by cooperation between government, the private sector, and civil society, can raise solid waste management in Brazil to levels more aligned with the SDGs. In particular, SDGs 11 and 12 aim to ensure more inclusive, resilient and sustainable cities, as well as encourage responsible production and consumption patterns.

Environmental education emerges as a strategic axis in the transformation of waste management practices. More than instructing the population on proper separation and disposal, environmental education fosters a cultural change that encourages practices such as reducing consumption, reusing materials and recycling. The experience of Mexican cities demonstrates how well-structured educational campaigns contribute to greater popular participation and efficiency in waste management. On the other hand, Videira and Caçador still face challenges related to community engagement, which suggests the need for deeper investment in continuous and inclusive educational processes.

The philosophical perspective proposed by Hans Jonas (2006), in The Principle of Responsibility, offers an essential ethical foundation for these practices. Jonas argues that,

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in the era of modern technology, the human capacity to alter the environment has reached unprecedented levels, putting the very continuity of life at risk. In this context, he defends an ethic of responsibility, according to which present actions must be evaluated in the light of their long-term impacts, especially on future generations. The application of this ethic to solid waste management suggests that public policies and consumption practices need to be guided not only by immediate efficiency, but also by intergenerational responsibility.

Jonas criticizes traditional ethics for being insufficient in the face of contemporary challenges, since they were formulated in times when human power over nature was limited. He points out that modern technology has greatly expanded the capacity for human intervention, making it necessary to reformulate ethics that considers the long-term environmental and social consequences. The ideal of progress, often associated with economic growth and unbridled consumption, needs to be questioned and subordinated to ethical principles that ensure the sustainability and preservation of natural resources (Jonas, 2006).

This study also reinforces that proper solid waste management is an essential pillar for sustainable development and that the promotion of a new ethic of environmental responsibility is essential. The integration of public policies with environmental education and innovative practices can create cleaner, more efficient cities that are committed to the quality of life and the preservation of natural resources. The ethics of responsibility proposed by Jonas (2006) offers a critical lens to rethink the role of technique and progress, emphasizing that sustainability must be built based on actions that ensure the well-being of present and future generations.

Therefore, it is essential that municipalities such as Videira and Caçador advance not only in infrastructure and legislation, but also in the promotion of deeper environmental awareness, involving all sectors of society because, as we have seen, the path to more sustainable and resilient cities passes through the adoption of waste management aligned with the SDGs and guided by an ethic of responsibility.

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