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SOLID WASTE MANAGEMENT AND THE PRACTICE OPEN DUMPING IN BRAZIL: LESSONS LEARNT FROM THE STATE OF SANTA CATARINA

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Abstract. In the context of several complex global issues that challenge modern societies, the large-scale generation of solid waste and its inadequate disposal are rather intricate problems that threaten not only human livelihoods but also the life on the planet. More specifically, the practice of open dumping, which concerns to the illegal use of irregular sites for waste disposal, characterized by the absence of adequate environmental and health standards, is considered a global health an environmental emergency, demanding urgent action from Governments and individuals. Given that, this paper aims at providing a brief overview of the solid waste management scenario in Brazil, giving emphasis to the issue of open dumping and the challenges in tackling this problem. More specifically, it seeks to analyze the case of the State of Santa Catarina as a success story of deactivation of irregular dumpsites. The paper is therefore divided into three main sections. The first contextualizes the issue of solid waste and open dumping in Brazil. The second, explores the Brazilian framework for solid waste management, especially the National Policy for Solid Waste. Finally, the third discusses the successful case of Santa Catarina. All in all, it was possible to conclude that the Brazilian legislation on waste management is very progressive and address the issue with a systemic approach, which is one of the essential elements to achieve a sound waste management. Reforming the Brazilian infrastructure to better manage the waste produced, closing all open dumpsites and building proper landfills, are other crucial elements in transforming the country's system, being the case of Santa Catarina an empirical proof of the fundamentality of the adoption of a systemic approach.

Keywords: waste management, open dumping, Brazilian National Policy for Basic Sanitation, Santa Catarina.

1. INTRODUCTION

The 21st Century has been marked by several complex global issues that pose new challenges to modern societies and demand urgent action. Amongst these issues, we can highlight the widespread of unsustainable consumption patterns, the large-scale generation of solid waste and its inadequate disposal, which threaten not only human livelihoods, but also the planet's well-being.

In this context, a major current concern is the case of *open dumping*, which is lamentably still a problem that affects both the developing and the developed worlds, although being more typical in the former. Having this problem in mind, this paper aims to outline a brief overview of the solid waste

production and disposal scenario in Brazil, emphasizing the country's open dumpsites and its main policy on the matter.

Moreover, it seeks to critically analyze the case of the State of Santa Catarina and its success story of deactivation of irregular dumpsites, to identify what lessons could be learnt from it towards implementing cleaner and more sustainable solid waste disposal facilities in other Brazilian States.

The Issue of Solid Waste in Brazil: from High Generation to Inappropriate Disposal

Any species, including humans, extract resources from the environment and generate waste. However, when the extraction of resources or generation of waste is greater than the ecosystem's capacity to reproduce or recycle them, depletion and/or pollution of the environment will occur. This, in itself, is characteristic of an environmental crisis (Foladori, 2008).

In addition to the empirical evidence of the biophysical limits of the Earth, the resources of which are not infinite, there are several reports from reliable sources that document the extrapolation of these limits by the modern process of civilization, which could wipe out all the conditions necessary for maintaining human life.

According to Moran (2006), in the last fifty years, human's impact on the Earth, that is, on a global scale, has been of unprecedented severity. Evidence of this is provided by scientific studies that show the exponential growth of carbon dioxide, the exponential reduction of the ozone layer; the exponential concentration of nitrous oxide in the atmosphere; the accelerated loss of tropical forests; increases in the frequency of natural disasters; the extinction of many species, among others.

Alongside these problems, especially since the end of the twentieth century, a new issue has arisen. Due to the rise in world population, the indiscriminate increase in consumption and industrial innovation, we are now confronted with our inability to efficiently and sustainably manage the waste produced in increasing quantities and of increasingly dangerous qualities.

Waste management has been gaining prominence in international politics due to the great amount of environmental, social, political and economic problems that arise from poor and illegal waste management practices, such as biodiversity loss, the increase of social inequalities and the degradation of human health.

2. ANALYSIS AND DISCUSSION

The *United Nations* (UN) document entitled *The Future We Want*, one of the most important outcomes of the *UN Conference on Sustainable Development* (Rio +20), stressed in 2012 the relevance of implementing and developing policies for resource efficiency and environmentally sound waste management (United Nations 2012, 41). At this opportunity, the Nations committed "*to further reduce, reuse and recycle waste (3Rs), and to increase energy recovery from waste*", calling for *"the development and enforcement of comprehensive national and local waste management policies, strategies, laws and regulations*" (United Nations 2012, 41).

In 2012 roughly 1.3 billion tonnes of municipal solid waste were produced all over the world, according to the World Bank's estimates (World Bank 2012, 8). The Organization predicts that this figure will increase up to 2.2 billion tonnes by 2025 (World Bank 2012, 8).

Statistical studies by the European Union show that the amount of solid household waste generated per person in European countries in the last decade has been relatively steady. According to Eurostat[1], the average waste generated among European countries in 2004 was 512 kilos per inhabitant, while in 2015, this figure dropped to 476 kilos. However, analyzing the data of each country separately, it is evident that the average of Western European countries is much higher (in many cases the double) than of other European countries (Central and Eastern) and of most of the developing countries.

[1] For further information, see: http://ec.europa.eu/eurostat/tgm/table.do?tab=table&plugin=1&language=en&pcode =tsdpc240

For example, while Denmark had an increase from 695 kilos per inhabitant of waste generation in 2004 to 789 kilograms in 2015, Poland, which generated 256 kilos per person in 2004, rose this number to 286 kilos in 2015. Switzerland also presented a growth in the generation of waste, from 660 kilos per inhabitant in 2004 to 725 kilos in 2015, but such numbers fall by half when related to Latvia, which generated 318 kilos per person in 2004 and 433 kilos in 2015.

In Brazil, research indicates that, in 2000, around 125,281 tonnes of solid household waste were generated every day, equating to the disposal of more than 45,727,565 tonnes of this type of waste per year. Also, more than 30% of the waste collected in this period did not have the correct destination. These surveys report that, in Brazilian towns and cities with up to 200,000 inhabitants, 450-700 grams of solid waste were collected per person per day, while in cities with more than 200,000 inhabitants, this amount was between 800 and 1,000 grams per person, showing increased generation of household waste in large urban areas (IBGE, 2001).

Surveys conducted by *Brazilian Institute of Geography and Statistics* (IBGE) and *Brazilian Association of Public Cleaning and Special Waste Companies* (ABRELPE) show that, by 2015, the amount of solid household waste generated in Brazil on an annual basis had increased to over 79,9 million of tonnes, with 390.91 kg of solid waste generated per inhabitant during the period (ABRELPE 2015). That is to say, in just 15 years, the generation of solid household waste in Brazil increased by nearly 34,2 million of tonnes per year, and the annual generation of solid waste per inhabitant rose from 255.5 kilos to 390.91 kilos, i.e., each Brazilian inhabitant produced 135.41 kilos more solid waste than they had 15 years before.

All these numbers are very concerning and illustrate why solid waste has been a recurrent topic in the international debates held over the past years. Additionally, the state of civilization in which we find ourselves has been unable to prepare risk management tools capable of responding effectively to this new facet of the environmental crisis and keeping pace with the production of these risks.

Testimony to this are the creation and proliferation of irregular sites, commonly known as *open dumpsites*, illegally utilized for waste disposal, whose most common characteristic is the absence of adequate environmental and health safeguards (IBGE 2010, 214). This term is used to characterize a "land disposal site where the indiscriminate deposit of solid waste takes place with either no, or at best very limited measures to control the operation and to protect the surrounding environment" (ISWA 2016, 19).

Open dumpsites have nothing to do with *sanitary landfills*, which are on the contrary "an acceptable waste management method, with controlled emissions and limited health environmental impacts" (ISWA 2015, 10). According to ISWA (2016), such irregular sites receive several types of waste, from many sources and with diverse compositions. The waste in open dumpsites is completely exposed, meaning there is no coverage and compaction, leading to the risk of open burning. The lack of engineering is often seen in these sites, with no leachate management and landfill gas collection.

The presence of scavengers or waste pickers collecting recyclables without any protection measures is also very common. Sometimes such communities live within dump sites and even scavenging for food leftovers. This, together with poor control on accepting incoming materials or record keeping, shows how badly managed are open dumpsites (ISWA 2016).

In 2016, the International Solid Waste Association (ISWA) published a report on dumpsites, called *A roadmap for closing waste dumpsites: the world's most polluted places*. This was a follow up report of three major reports published between 2014 and 2015 related to dumpsites and the conditions of waste management in the developing world, namely: the *Waste Atlas Report*, on the 50 world's biggest dumpsites, published by D-Waste in partnership with ISWA and other institutions; the *Global Waste Management Outlook* (GWMO), a comprehensive assessment of global waste management published by the UNEP and ISWA; and the *Wasted Health Report*, about health impacts posed by dumpsites, also published by ISWA.

In its last report, ISWA brought updated information on the impacts caused by open dumpsites and proposed several recommendations and steps to close the world's most polluting sites. Considering them as a global health and environmental emergency, this Association reported that in only seven

months between 2015 and 2016, more than 750 deaths related to poor waste management in dumpsites, with more several incidents, were recorded (ISWA 2016).

According to ISWA (2016), dumpsites currently receive around 40% of the world's waste, serving about 3-4 billion people. The projections for this scenario are not very optimistic since urbanization and population growth will continue. Without a model shift, dumpsites will account for 8-10% of the global anthropogenic GHG emissions by 2025.

Based on reliable information from an extensive research, the report *Waste Atlas: the world's 50 biggest dumpsites* indicated that most of dumpsites are in Africa, Latin America, the Caribbean and Northern Asian countries, in areas with the highest population density in the world, with more than two third of the world's population. They have been affecting more than 64 million people and their total waste volume is 0.6-0.8 km3, therefore, cannot be considered as simply local problems (D-Waste 2014, 12).

Eight of these 50 biggest dumpsites are in Latin America, one of them in Brazil, called *Estrutural*. This biggest Brazilian dumpsite located in the Brazilian capital occupies an area of 136ha, keeps from 21 to 30 million tonnes of mixed solid waste, and houses around 2,500 waste pickers, who live and work there. According to the report, environmental damages are visible in and around the site, as well as the social and health impacts, since many accidents and deaths have been reported within and related to this dumpsite (D-Waste 2014, 97).

According to the survey *Panorama 2015*, although the solid waste collection in Brazil had improved in the last years, only 58,7% of the collected solid waste generated in Brazilian cities was sent to landfills in 2015. This means that more than 30 million tonnes of collected solid waste was improperly destined to open dumpsites and to other illegal destinations in that given year. Added to this, more than 7 million tonnes of solid waste generated in Brazil in 2015 was not collected by the public sector and, therefore, did not have a proper destination (ABRELPE 2016).

This survey also points out that in 2015, 1,552 Brazilian cities were still using irregular sites as final destination for the solid waste collected by them. The Northeast Region registered the highest number of cities using open dumpsites, 834 cities. On the other hand, the South Region had the lowest number of cities using such sites, 119 cities (ABRELPE 2016).

The State with the most precarious scenario was Rondônia (North), which had 80,4% of its solid waste sent to open dumpsites. Although the State of São Paulo (Southeast) has sent only 7,9% of its solid waste to such sites, it had the highest volume of waste inadequately destined in the whole country, i.e. this Brazilian State sent almost 5,000 tonnes of solid waste per day to irregular dumpsites. In contrast, the State of Santa Catarina (South) presented the best scenario, with only 10,9% of its solid waste destined for open dumpsites, representing 516 tonnes of waste per day (ABRELPE 2016)

IBGE stresses that although the percentage of waste inadequately disposed of in irregular dumpsites had decreased over the years, these numbers put into evidence a concerning historical scenario of inadequate solid waste destination in the country (IBGE 2010, 60).

Regarding the problems associated with open dumping, the *United States Environmental Protection Agency* (EPA) lists: the proliferation of rodents, insects and other assimilated living species, specially of disease-carrying mosquitoes that find in scrap tires and ideal breeding ground; the easy accessibility to open dumpsites and, consequently, to the physical and chemical hazards posed by the accumulated waste; the property damage and the evacuation of neighborhoods caused by dumpsites that caught fire; the flooding occasioned by the accumulation of wastes in ravines, creeks, culverts and drainage basins; the soil erosion; and the decrease of property values and of the amount of investments in communities in which open dumping is verified (EPA 1998, 3)

The *Waste Atlas* report indicates that most common environmental issues for dumpsite are surface water, groundwater, and soil contamination from toxic elements; air pollution from open surface burning of materials, underground fires fuelled by landfill gas, and gas leakage; and biodiversity problems as fauna can consume the solid waste exposed in these sites or contaminated plants and animals contaminated from leakage and waste and affected by the gas emissions (D-Waste 2014, 13).

All these environmental problems, in the long run, may cause considerable impacts in geological/hydrogeological and climatic conditions (ISWA 2016).

But open dumpsites challenge not only the environment, but also public health and, ultimately, the society, mainly the most vulnerable communities. The most common human health (public and occupational) issues are diseases related to gastrointestinal, dermatological, respiratory, and genetic systems; and several other types of infectious diseases. The population living close by open dumpsites suffer from all these issues, but people who work in such sites are more vulnerable and exposed to both, public and occupational health problems (D-Waste 2014, 13).

The potential for the spread of infection is large due either to direct contact with the waste or with vectors such as rodents and insects (ISWA 2016). Adding to this list, we can also mention the inflated costs and the difficulty level of remediating the effects of open dumping, which cannot be entirely predicted (ABRELPE 2015).

Open dumpsites have not been permitted in developed countries for the last 30 years, being completely replaced by engineered sanitary landfills and complemented with other waste disposal technologies and methods. On the other hand, developing countries are discussing and trying to close or upgrade open dumpsites. This is an essential step to reduce environmental, public health and social impacts, tackling an important facet of the current socio-environmental crisis and helping to achieve many of the sustainable development goals (ISWA 2016).

All these reasons led ISWA to consider the closure of open dumpsites a "global health emergency", calling upon international actors and local authorities to work together towards the identification and closure of such sites (ISWA 2015, 6).

Brazilian Waste Management System: Legal Framework

Given this context of an increasing waste production and of the previously mentioned problems that arise from poor solid waste management and, more specifically, from irregular waste disposal, we can notice that Brazil[2] stands out as a country that still has many challenges to overcome.

Fortunately, the situation has to some extent improved since 2008 when the *National Policy for Basic Sanitation*[3] (NPBS) was published. In 2015, the percentage of solid waste improperly destined to irregular facilities decreased to 41.3%, as reported by ABRELPE (2015, 24). Behind this decrease, that might seem somewhat modest at first, lies a series of significant shifts in Brazil's political and legal scenarios, amongst which we underline those carried out by the *National Policy for Solid Waste* (NPSW) that was responsible for putting the country on the track to abolish its open dumpsites and to implement more environmentally sound waste management systems.

This new policy has its very fundaments on the Brazilian Constitution of 1988, the current constitution in force. The Charter represented back in 1988 a paradigm shift to a more democratic regime, becoming known as the "civic constitution" because of the full range of rights and guarantees that it upholds. It guaranteed the citizens' right to a more active participation in public life, setting the pluralism, the sovereignty, the citizenship and the dignity of the human person as the foundations of the Brazilian Democratic State. It also declared the environment as constitutional fundamental human right, prescribing that "*All have the right to an ecologically balanced environment which is an asset of common use and essential to a healthy quality of life, and both the Government and the community shall have the duty to defend and preserve it of present and future generations*" (Article 225). That provision implies that all

[2] Brazil is a federative republic, formed by the indissoluble union of the States, the Municipalities, and the Federal District, which have the competence to enact and to establish their respective laws and policies, provided that they obey the constitutional rules and principles and also the federal legislation.

[3] In Brazil's legal system, *public national policies* are a set of objectives, principles, guidelines plans, and instruments that shall guide the relationship between the State and its Citizens, and vice-versa. They are usually established by Federal Laws, which means that the individuals who do not comply with its terms may be held liable judicially.

individuals have the right to benefit from a well-balanced environment and the duty to safeguard it for the next generations.

It is worth of notice that the Constitution sets a series of environmental law principles – such as the sustainable development, participation, cooperation, and precautionary principles – that shall be observed by the law-making bodies, government agencies and judges in cases in which the environment is concerned. These principles establish guidelines and set boundaries to the performance of those institutions and agents, which have important roles in environmental protection.

Given this background, the NPSW (Federal Law No 12,305) was released in 2010, in consonance with what the Constitution stipulates in terms of the environment, establishing a legal framework to solid waste management in Brazil's Law. According to Milaré (2011, 855), this Policy filled a historic gap in Brazilian legislation, bringing an innovative and encompassing approach for a relevant environmental issue.

The NPSW included amongst its goals achieving sustainable production and consumption; protecting public health and environmental quality; adopting, developing and improving cleaner technologies to minimize environmental impacts; encouraging recycling and the action of recyclable materials collectors[4]; and assessing the environmental impacts of products through the implementation of life-cycle strategies (Article 7, Federal Law No 12,305).

Moreover, it set the *non-generation* of solid waste as a major priority for the country and stipulated that the reduction, reuse, recycling, treatment and adequate final destination of waste[5] should be observed and prioritized – in this given order – by public decision makers, government agents, private companies, and individuals, regarding a good solid waste management system (Article 7).

The NPSW likewise called attention to the shared responsibility of manufacturers, distributors, traders, consumers and waste management companies for the life cycle of products (Article 30), "from cradle to cradle". Moreover, it demanded the implementation of important mechanisms such as reverse logistics systems (Article 33) and *National and State Solid Waste Plans*, which became a requirement for accessing public funds destined to solid waste management activities (Article 16).

It is important to highlight that the NPSW has brought many other interesting features to Brazil's legal system, putting the issue of waste and its management in the spotlight of governmental actions. For instance, between 2010 and 2014, the Federal Government destined 1.2 billion of Brazilian Reais to the implementation of the Policy's guidelines, goals, plans and instruments (BRAZIL, Ministério do Meio Ambiente 2014), which certainly contributed to start tackling the problem.

We would like to stress here that one of the most interesting features of the NPSW, regarding the focus of this paper, is its objective of deactivating all open dumpsites in Brazil. The Federal Law No 12,305 established in its article 54 a period of *four years* – that started to be counted since the enactment of the policy in 2010 – for Brazilian cities to implement proper solid waste disposal facilities with the consequent deactivation of all the existent irregular open dumpsites.

Unfortunately, this goal could not be met and roughly 1,552 Municipalities remain in an irregular situation (ABRELPE 2015). Given that, there are currently multiple bills proposing an amendment to the NPSW which would allow the extension of that deadline for State Governments, exempting them from the penalties established by law. Nonetheless, no agreement regarding those bills has been reached until 2018, and the subject is still very controversial as many believe that extending the deadline would cause the NPSW to be forgotten and deemed ineffective.

This failure in accomplishing the goal illustrates that open dumping remains a preoccupying issue in many of the Brazilian States. The need of closing the still existing open dumpsites is incontrovertible. However, as well stated by ISWA (2016, 31), this is not a simple or easy task. To do so, an adequate planning, institutional and administrative capacity, financial resources, social support and political

[4] Recyclable material collectors (or waste pickers) are informal workers that earn their savings by collecting and recycling objects and materials. In Brazil, they form a social movement called *National Movement of Recyclable Material Collectors* (Movimento Nacional dos Catadores de Materiais Recicláveis, in Portuguese) that pleads for better work conditions, space in the political scenario, and a more fair and sustainable society.

[5] Here the Law referrers to that specific type of waste that cannot be recovered or treated anymore.

consensus are essential. This is fundamentally a political and social problem, a matter of administrative structures, legal frameworks and regulations, and not a simple technical or limited financial resources problem.

Therefore, a systemic perspective of the waste management may be adopted to properly understand the issue of dumpsites and to achieve the goal of closing them. According to ISWA (2016), the Integrated Sustainable Waste Management (ISWM) is seen as a great analytical framework for waste management systems.

This was one of the analytical frameworks used by the *Global Waste Management Outlook* (GWMO) published by UNEP and ISWA as a follow up to the Rio+20 summit since a sound waste management is one of the sustainable development goals internationally established. In this report, UNEP (2015, 29) stated that, for a system to be sustainable in the long term, three basic elements should be considered: the infrastructure of the waste management system (physical elements), the actors involved (stakeholders), and all the strategic aspects, such as political, institutional and environmental.

Integrated sustainable waste management brings all those three dimensions together. The first element, physical, is considered by ISWA as the "hardware" of the waste management system, providing the necessary infrastructure for solid waste management. This element is formed by waste collection, waste treatment and disposal, and the 3Rs approach (UNEP 2015, 30).

Most analytical frameworks address only the physical elements of the waste management system. However, a truly integrated and sustainable waste management system must go beyond, also addressing the governance aspects, which encompasses the two other elements: stakeholders and strategic aspects. These elements form the "software" of the waste management system and focus on the inclusivity of stakeholders, financial sustainability and sound institutions and proactive policies (UNEP 2015, 30).

Thus, the systemic approach involves both the "hardware" and the "software" of waste management and may allow a well-functioning system that works sustainably over the long term. Such approach brings the understanding that "each and every 'hardware' arrangement is functional only with specific 'software' tools and vice versa." (ISWA 2016, 29).

This means that to successfully change or upgrade the physical infrastructure of a waste management system, such as closing open dumpsites, the governance components – the "software" – of the system needs to be reformulated and vice versa. In other words, "the adoption of this framework means that closing dumpsites is a serious systemic change that affects all the dimensions of the ISWM" (ISWA 2016, 29).

The Brazilian case is a good example of this since the enactment of a good legal framework has not been sufficient to achieve the ambitious goal of closing all dumpsites in the country. However, there are some successful cases, such as the case of Santa Catarina State, which deserves a closer analysis.

Santa Catarina State: a Successful Case

Before further analyzing the case of Santa Catarina, which has a distinguished story of deactivation of open dumpsites, we would like to make a brief remark regarding the role of the Courts in the implementation of the NPSW.

Because of this new legislation, many cases involving open dumpsites have reached the Brazilian Courts, which have been stating their opinion on the matter and recurrently declaring the Municipalities liability for damages caused to the environment and to public health by such facilities located within their territories when proved their omission in regularizing their situation.

A clear-cut example is the case *Brazilian Institute of Environment and Renewable Natural Resources v. Municipality of São Bento* (2015), in which the Municipality, located in Paraíba, Brazil, failed to abide by the Brazilian legislation for environmental protection and solid waste management through omission. The Court, therefore, stipulated a deadline for the termination of the irregular open dumpsite maintained by the Municipality and for the implementation of a sanitary landfill (Brazilian Institute of Environment and Renewable Natural Resources v. Municipality of São Bento 2015).

Another precedent is the case *Brazilian Institute of Environment and Renewable Natural Resources v. Municipality of Bezerros* (2013), in which the Municipality of Bezerros (Pernambuco, Brazil), that also maintained an open dumpsite and did not comply with the Federal laws on environmental protection, was condemned to: (1) end open dumping in its territory, (2) elaborate and present to the *Pernambuco State Agency for Environmental Protection* (SAEP) a project for the establishment of new sanitary landfill in the State, requesting the respective environmental licenses; (3) implement the project and conclude the construction of the facility within an year, making it fully operational; (4) present a project to recover the area degraded by the open dumpsite; and (5) a daily penalty of 1,000.00 Brazilian Reais for disregarding any aspects of the judicial order. The Municipality appealed of the decision and the *Regional Federal Court of the 5th Region*[6] amended it only to adjust and to extend the deadlines given to the Municipality to implement the measures determined by the sentence (Municipality of Bezerros v. Brazilian Institute of Environment and Renewable Natural Resources 2014).

Cases like these depict how relevant the role of the Judiciary is in ensuring the correct applicability and implementation of the new legislation, in special regarding its aspect related to solid waste disposal. They also depict that the Courts and judges are showing technical knowledge of the issues related to the matter, manifested in coherent decisions endowed with a proper constitutional interpretation of the Brazilian legislation, which was also an important factor in the last years' improvement in the solid waste management scenario in the country.

Yet, these cases also reinforce the idea that notwithstanding all the positive changes carried out since the enactment of the NPSW, the transition to more sustainable and environmentally sound waste management systems in the States and Municipalities and the end of open dumping in the country remain a complex task to be achieved, that demand not only a Judiciary committed to the environmental protection, but also new approaches to addressing the problem, such as the Integrated Sustainable Waste Management framework.

Fortunately, some States give us some good examples, like Santa Catarina that significantly improved its solid waste management systems over the last two decades, having the best results in Brazil, since it deactivated roughly all its open dumpsites[7].

The State of Santa Catarina, located in the South of Brazil, has approximately 6.2 million of inhabitants and a *municipal human development index* (MHDI)[8] of 0.774, which can be considered high when compared to other Brazilian States' indexes, according to the most recent published edition of the *Brazilian Human Development Atlas* (2010).

Its history of successful deactivation of open dumpsites and establishment of regular landfills dates to the year 1999, when the *Environmental Military Police* elaborated a report about the solid waste scenario on the State (Venâncio 2015, 139), denouncing amongst other facts that 56% of the 278 Santa Catarina's Municipalities maintained open dumpsites and 2% had no waste collection systems (States Prosecutor's Office of Santa Catarina 2001). Overall all, the report described a preoccupying reality marked by poor solid waste management and unsustainable waste disposal practices (Venâncio 2015, 139), which were verified in all Municipalities of Santa Catarina and demanded an urgent call for action.

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[6] Brazil's Federal Justice has five Regional Federal Courts, whose Jurisdiction is determined by their geographical location.

[7] It is important to highlight that the institutions and organizations disagree on the percentage of open dumpsites deactivation. For example, whereas the *State Public Prosecutor's Office of Santa Catarina*, the *Brazilian Association of Sanitary Engineering* and the *Santa Catarina State Foundation for the Environment* claim that the State deactivated all its open dumpsites, the *Brazilian Institute of Geography and Statistics* and the *Brazilian Association of Public Cleaning and Special Waste Companies*, as seen earlier in this paper, state otherwise (Diário Catarinense 2014). Nevertheless, it is well known that Santa Catarina made impressive achievements in closing its irregular dumpsites, constituting an example for the entire country.

[8] The *municipal human development index* (MHDI) adapts the methodology used to calculate the *human development index* (HDI) to a State/city level. The MHDI is represented by a number that varies from 0 to 1. The closer that a given MHDI is to 1, the bigger is the human development level of its respective State or city.

Given that, the report was forwarded to the *State Public Prosecutor's Office of Santa Catarina* (MPSC, acronym in Portuguese)[9] which have then issued the recommendation No 001/2001/CPC/CME to the *State's Secretariat of Environment* (SDS, acronym in Portuguese), stating its concern with Santa Catarina's scenario and suggesting that the Secretariat should: "*support and encourage the Municipalities to develop public awareness campaigns against overproduction of waste, stimulating its reuse through recycling; and an institutional programme regarding the sustainable collection of waste*" (State Public Prosecutor's Office of Santa Catarina 2001). This recommendation, alongside with the document elaborated by the *Environmental Military Police*, was an important initial impetus for mobilizing the State Organs towards regularizing the situation of the open dumpsites in the State.

Moreover, the MPSC also created in 2001 the programme entitled *Our Daily Waste* ("*Lixo nosso de cada dia*", in Portuguese), aiming at (1) encouraging the implementation of recycling plants, landfills in accordance with the technical rules, and other regular facilities designed for solid waste disposal; (2) and recovering areas damaged by irregular dumping (Rosa 2005, 123). We can, therefore, observe that the MPSC has since then assumed an active role in the task of identifying irregular dumpsites, promoting the installation of landfills, and encouraging a better waste management in Santa Catarina.

The *Our Daily Waste* programme, which is still active currently, consists in a set of measures to be adopted by the MPSC and the State's public Organs for environmental protection, under the coordination and in cooperation with the former. Those measures include not only the already mentioned goals of the programme but also environmental education initiatives and monitoring and control actions (Rosa 2005, 132).

Between 2001 and 2004 the MPSC actively worked towards implementing the programme, through investigating the illegal and irregular solid waste management activities; assisting the Municipalities in the process of accessing public funds; and notifying their legal representatives to optimize the environmental licensing process of landfills and to speed up the recovery of areas damaged by irregular dumpsites (Rosa 2005, 140).

Besides, the MPSC has also provided full support to the State Prosecutors from Municipalities with irregularities, aiding them to set *undertakings of adjustment of conduct* and to file *public class actions* (Rosa 2005, 141).

Due to this successful coordination between the MPSC and other public agencies and bodies of Santa Catarina, the first results of the programme were impressive, given that within only four years, in 2004, the percentage of Municipalities adequately sending their waste to regular and licensed solid waste disposal facilities increased to 95.22% (Rosa 2005, 144).

Additionally, within this scenario marked by a major shift in the environmental political agenda, the *State Policy for Solid Waste* (SPSW) (State Law No 13,557/2005) was released in 2005, establishing many relevant guidelines, principles, and instruments that were only included in the federal legislation years later. The SPSW then called upon all the Municipalities to elaborate *Integrated Solid Waste Management Plans* (ISWMP) as a condition to receiving tax incentives and accessing public funds (Article 20, State Law No 13,557/2005). As a remark, we should point out that these Plans started to be formally implemented only in 2009 and it is known that more than 11 million Brazilian Reais were invested in this process in the next two years of their enforcement (Gerência de Resíduos Sólidos 2011).

Moreover, the SPSW called upon the Government to promote the coordination and integration between the Municipalities, regarding the search for regional solutions and the establishment of *consortium*s aimed at facilitating regular waste treatment and disposal (Article 6, State Law No 13,557/2005). These consortiums were fundamental to the implementation of new landfills in the State.

The NPSW also played a key role in ending open dumping in Santa Catarina. By providing in 2010 a comprehensive legal framework for solid waste management in the country, it facilitated and stimulated the development of programmes and plans aimed at closing the last open dumpsites in the

[9] The *State Public Prosecutor's Office of Santa Catarina* is a body of independent public prosecutors at a State level. They are responsible for ensuring that the law is applied by bringing criminal charges, supervising criminal lawsuits and protecting civil rights, such as those related to the consumers, elderly, health and the environment.

State. Unquestionably, all of those above-mentioned events contributed to the near extinction of open dumpsites in the State of Santa Catarina. Not denying the importance of each element, the Santa Catarina State case, especially the *Our Daily Waste Programme*, shows that closing open dumpsite is not only a matter of having good legal frameworks or of attracting funds. It is, as well highlighted by ISWA (2016), mainly a challenge to create sustainable operational entities in all the governance levels and human resources that will undertake the long-term improvement of the local waste management system.

3. CONCLUSIONS

Following the Integrated Sustainable Waste Management framework presented in this paper, it is possible to conclude that the practice of open dumping is directly related to other structural and governance problems faced by Brazil.

The Brazilian legislation on waste management is very progressive and address the waste issue with a systemic approach, respecting the general rules imposed by the Brazilian Constitution. However, having a good legal framework and regulation is only one of the essential elements to achieve a sound waste management. To successfully reform the Brazilian infrastructure to manage the waste produced in the country (the system's "hardware"), closing all open dumpsites and building proper sanitary landfills, it is crucial to transform the system's "software", having good administrative structures, financial sustainability, sound institutions with proactive policies and inclusivity of stakeholders. The case of Santa Catarina State is an empirical proof of the fundamentality of the adoption of this systemic approach to achieve a sound waste management system. After analyzing the paths taken by such State, we can argue that achieving a very high percentage of deactivation of open dumpsites in its territory, having the lowest amount of waste destined to such sites, stems from multiple factors.

Among them we underline: the "protagonism" of the MPSC, a sound institution which can be considered as the major driver of this process. This institution assisted the Municipalities in accessing public funds to close open dumpsites, replacing them with sanitary landfills. MPSC also helped in the improvement of environmental education on waste management, including and engaging different stakeholders all through its proactive programme *Our Daily Waste*.

The cooperation and coordination between the public and private sectors, mainly through the establishment of consortiums were important for the establishment of good administrative structures. The public investments made provided financial sustainability to deactivate irregular dumpsites, recovering damaged areas and implementing landfills. At last, the enactment of extensive and coherent regulations, together with the control and monitoring role played by the Courts were also important to the success of the Santa Catarina State in closing open dumpsites.

Cases like Santa Catarina give us new insights and hopes, proving that the end of open dumping is an achievable goal in a not-so-distant future. However, it is also important to stress that, in a national level, while the Government does not compromise to implementing more effective economic and social policies that seek to promote sustainable consumption practices and to reduce the number of people who live in poverty and precarious conditions, the promising NPSW will not be able to accomplish its goals. In a broader sense, this is a matter of improving public health whilst protecting the environment.

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Венанчіо Марина Демарія, Папа Каміла. Реалізація норм по поводженню з твердими побутовими відходами в Бразилії із аналізом досвіду штату Санта-Катаріна. *Журнал Прикарпатського університету імені Василя Стефаника*, **5** (2) (2018), 178–189.

У контексті складних глобальних проблем великомасштабне виробництво твердих відходів та правове регулювання поводження з ними є значною проблемою. Досліджується проблема незаконного використання місць для утилізації відходів, що характеризується відсутністю належних екологічних та медичних стандартів, яка часто супроводжується надзвичайною екологічною ситуацією, що вимагає термінових дій урядів та окремих уповноважених осіб. З огляду на це, стаття має на меті короткий огляд регулювання поводження з твердими побутовими відходами в Бразилії. Зокрема, зроблено аналіз правового регулювання у штаті Санта-Катаріна як історію успішної дезактивації нерегулярних звалищ побутових відходів. Тому стаття розділена на три основні частини : контекстуалізація проблеми твердих відходів та відкритого демпінгу в Бразилії; бразильська структура поводження з твердими побутовими відходами та національну політику щодо поводження з твердими відходами; практику успішної реалізації відповідних правових норм у штаті Санта-Катаріна. У цілому зроблено висновок, що бразильське законодавство у сфері поводження з відходами є дуже прогресивним і вирішує цю проблему за допомогою системного підходу, який є одним з найважливіших елементів для досягнення раціонального поводження з відходами. Реформування бразильської інфраструктури для вдосконалення управління відходами, закриття всіх відкритих звалищ є іншими важливими елементами трансформації системи країни, оскільки досвід штату Санта-Катаріна є емпіричним підтвердженням фундаментальності прийняття системного підходу.

Ключові слова: управління відходами, споживання, бразильська національна політика з управління відходами, Санта-Катаріна.