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Summary

This article seeks to illustrate the variety of strategies for an adequate solid waste management process according to the situation of each of the areas analyzed -Bogota, New York, Zurich- and how external factors such as the economy, the environmental culture of the inhabitants or the population density also have an impact on the final balance with respect to the effectiveness of each method, both nationally and internationally, taking into account established minimum policies or guidelines.

Key words

Solid waste management, waste, environment, environment, development, ecocide

Abstract

This article seeks to illustrate the variety of strategies for the proper development of solid waste management according to the situation of each of the analyzed areas -Bogota, New York and Zurich- and as external factors such as the economy, the environmental culture of the inhabitants or the population density also represent an impact on the final balance regarding to the effectiveness of each method, both nationally and internationally, taking into account established policies or minimum standards.

KeyWords

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Solid waste management, waste, environment, development, ecocide

Subject

The management of waste and solid waste in the country and in the whole world, has been a major problem, which despite its continuous discussion is still in a limbo of solutions that do not arrive or are not exercised due to factors most of the time political or economic. A bad operation with the waste produced at a national level can affect both the population and the environment; the latter being more vulnerable since the ecosystems are not entirely subject to rights.

The situation on the international scene has its equivalents, there are certain territories that even stand out for their policies on waste treatment and their excellent results, such as Switzerland and the city of Zurich, who "by 2017 recycled 51% of its total urban waste according to the OFMA (Federal Office for the Environment)" (Ambiente, 2017) , there are other territorial spaces such as the USA and specifically New York City that "despite a great technological advance have problems with solid waste management". (Lohuizen, 2017) And on the other side of the sphere, speaking of the national panorama, the Colombian territory and its capital Bogota are not on the ideal path regarding waste treatment; the most important sanitary landfill 'Sanitario Doña Juana' is in crisis "According to the CAR (Corporaciones Autónomas Regionales y de Desarrollo Sostenible) the landfill has a license until 2022". (editorial, Bogota Council, 2019) . The contrasts between the subject cities are changes and improvement measures taking place both nationally and internationally.

Introduction

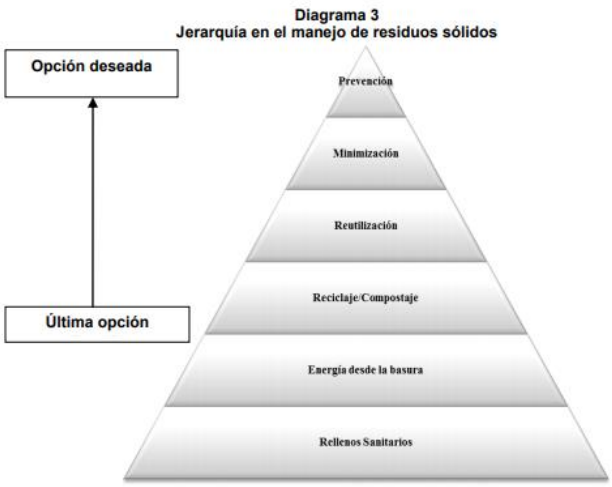
In this first instance of identification of the problem, a term that can be implemented is that of ecocide, which in recent years has increased relevance that according to the official definition of the RAE, Royal Spanish Academy, means: destruction of the

environment, especially intentionally; although taken literally this definition would prevent the application of the term in this topic, ecocide has been discussed since the late twentieth century "The term ecocide was first used in 1970 at the "Conference on war and national responsibility in Washington", by Professor Arthur W. Galston, head of the botany department at Yale University". Galston, head of the botany department at Yale University." (Fernandez, 2017, p.3), and since then it has raised conflicting opinions on how it should be assimilated; a year later, ecocide is defined as the crime of destroying "the life-support system of our planetary vessel, the death of our environment" (Ehrlich, Holdren,1971, p. 45). In recent years, ecocide seeking to enter the margin of international law is defined as "the extensive damage, destruction or loss of one or more ecosystems of a given territory, whether by human intervention or otherwise, to such an extent that the peaceful enjoyment by the inhabitants of that territory is severely limited, now or in the future" (Ehrlich, Holdren, 1971, p. 45). (Higgins, 2012) .

ECLAC (Economic Commission for Latin America and the Caribbean) in its 2016 General Guide for Household Solid Waste Management already showed its concern about solid waste management and ecocide. In one of its manuals, the commission proposes integrated solid waste management plans (PGIRS), within which it proposes various strategies where

> An integrated solid waste management plan (ISWMP) covers all stages of solid waste management, as well as related technical, environmental, economic, institutional and legal aspects. The PGIRS arises from the need to solve environmental problems and the negative impact of urban solid waste on water bodies and sanitation systems. (ECLAC, 2016, p.31).

The most well known of the Guiding Principles of the integrated solid waste management plan



Fuente: En base a Peterson, 2009.

(PGIRS) is the "Principle of hierarchy in waste management: the first purpose of integrated management is to avoid generation; if avoidance is not possible, minimization should be sought using the concept of the 3R's11 (reduce, reuse, recycle) (ECLAC, 2016, P.32).

However, there are also other proposed principles which seek a favorable waste management such as

> *Principle of integrated management*: Indicates that adequate waste management requires a set of tasks and infrastructures, taking into account that a single infrastructure is not capable of managing the complexity of waste management. Advanced management consists of coordinated activities within all levels and areas responsible for waste management to achieve a properly functioning management and enable continuous improvement of the system (FICHTNER - LKSUR Associates, 2005). *Extended producer responsibility:* Product manufacturers, importers and distributors are responsible for the environmental impacts of their product throughout its life cycle, including impacts inherent to the selection of materials, impacts of the production process, as well as impacts related to their use and disposal (CYMA Program, 2008). This elementary principle is nothing but the practical realization of the old and obvious saying "the polluter pays". (ECLAC, 2016, p.33)

The World Bank Group in its 2018 report What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050, reveals that over the course of the next 30 years global waste generation,

driven by urbanization and growing populations, will increase from 2010 million tons recorded in 2016 to 3400 million tons by 2050.

> The world generates 2.01 billion tons of municipal solid waste annually, with at least 33 percent of which - extremely conservatively - is not managed in an environmentally safe manner. Worldwide, waste generated per person per day averages 0.74 kilograms, but ranges widely from 0.11 to 4.54 kilograms. Although they account for only 16 percent of the world's population, high-income countries generate about 34 percent, or 683 million tons, of the world's waste. (World Bank, 2018, p.23)

Although the situation is referred to in the international framework, not much is done about it equally around the world and the example is in three cities completely separated one from the other Bogotá D.C., New York city and Zurich; which act as parallels with different paths that do not seem to seek congruence.

Problem

Just as there are territories in which waste management practices and the implementation of initiatives to combat the problem, such as the promotion of recycling, there are also high contrasts with territories that manage to give a second chance to 50% or more of their waste and raise the balance a little. Despite the improvement, the proportionality between consumption and waste control is not even an international guideline; there is a minimum demand, but not enough to match the rate of consumption and waste.

Although in this research the city of Bogota as a national referent and the cities of Zurich and New York as international referents are going to be established as main subjects; the general world situation must be at least mentioned as "only 16% of waste is recycled. Worldwide, more than 2.1 billion tons of waste are produced each year, which could fill more than 800,000 Olympic swimming pools." (Semana, 2018) .

Waste management should have a higher position on the domestic and global agenda, "the 6,000 tons of garbage that arrive at Doña Juana is EVERYONE'S RESPONSIBILITY!" (editorial, Bogota Council, 2019) expresses the Bogota Council on the situation; in a global context The Washington Post also reflects its concern "the world generates at least 3.5 million tons of solid waste, 10 times more than a century ago. And at this rate, by the end of the 21st century, the figure will reach 11 million tons. (Lohuizen, 2017) . The cities with external contrasts -New York and Zurich- also require the continued attention of the scheme in general due to the complicity of the decisions and their consequences in the Colombian State and the international framework.

Problematic variables

This document will address three issues and each of them will be equivalent to each of the cities mentioned according to the strategies applied for solid waste management with the reference framework of ECLAC's improvement plans for waste management and the principles it sets forth.

The first problem will revolve around the city of Bogota and the levels of risk it possesses, taking into account the preferred procedures for waste treatment and a parallel with respect to the other two cities and their level of alert or tranquility according to the protocols promoted by ECLAC, taking into account the Colombian territory as a member country of the institution.

The second problem will focus on New York City and will be developed according to the behavior of the territory and the public policies imposed for the management of solid waste in a cosmopolitan city and host of people from all over the world, as well as managing the parallel with the other two subject cities.

The last problem variable will use the city of Zurich as a focus and will expand on one of the most important factors for proper waste management and this refers to the commitment and involvement of citizens in waste management both in their territory and worldwide.

To achieve this task, we seek to identify the environmental problems of each subject city so that the first cause-consequence links can be established for each situation according to its current management. With a general mission established, it is also expected to categorize the levels of environmental and population risk and thus have a clear idea of the urgency of the situation and the need for attention; likewise, it will also be possible to state the actions taken by each government acting in response to the situation and how it has responded according to the *international* framework.

Finally, the performance of citizens in each area and their commitment to the situation will be compared in order to justify the adoption of measures that, when put into practice, improve and safeguard the problem. These three being the specific objectives of the research project seek to deepen on the management of solid waste in each of the stipulated cities.

It is for this reason that there is a need to question the processes of solid waste management in different areas, how the dynamics of waste handling is developed and how effective it is; the practicality and operation of environmental laws in the territory and those of the international framework. Thus allowing an analysis of the performance of the country, and of other actors in the foreign panorama that take importance by the globalized world that continues to expand.

With an established framework of the situation in each of the three cities with their problems and/or methods of solution, it is now possible to evaluate how they have reacted to the international landscape guideline and correlations between the three cities.

Risk levels

Beginning with the national territory, the procedures available for waste management must be established; in general throughout the country and later in the capital city.

> According to a report by the Superservicios, Colombia has 275 sites for depositing garbage (between adequate and inadequate). Of these,158 sanitary landfills, 6 treatment

> plants, 13 contingency cells, 54 open dumps, 34 transitory cells, 7 burial sites and one burning site. In terms of landfills alone, 7.5% have already reached the end of their useful life, 15% have less than three years left, 28.1% can last between three and 10 years, and only 35.6% could remain for more than a decade. (Semana, 2018)

Colombia is succumbed to the more than 11.3 million tons of waste produced annually according to data from a report coming from the General Comptroller's Office on environmental management policy in 2018 and the implementation of the Integrated Solid Waste Management Plans -PGIRS, as an articulating instrument of the solid waste management policy-as of June 2018, of the 1066 municipalities only 136 (this is 12.8%), have carried out the update of the PGIRS; In addition to this scenario, 715 municipalities of the same 1066 reported (67%), do not comply with the provisions of Resolution 754 of 2014, which establishes the methodology for the formulation, implementation, evaluation, monitoring, control and updating of the PGIRS. (República, 2018) .

Keeping on the development of the term ecocide in the country, if we talk about the destruction of the environment, the methods used in waste management would be a valid subject violating the principle of environmental care. Sanitary landfills at the top or with a useful life of less than three years would be the main actor to highlight, being these operations under the government being a public service - capital sanitation service, for example, in Bogota - and the government knowing then the situation and not acting imminently but giving passing aids to mitigate the situation and giving deadlines for the delivery of solutions.

> In addition to the problem of sewage, there is the problem of solid waste. Bogota is the city that generates the most garbage, with 2.2 million tons per year, of which only 78,616 tons are being utilized. This means a utilization rate of 3.5 percent. The Doña Juana landfill is the landfill that receives the most waste in Bogotá, with 2.1 million tons per year. This landfill has 19.29 percent of the waste generated in the whole country, since in Colombia the amount of waste per year is about 11.3 tons. The problem with the Doña Juana landfill is that its capacity, according to the Comptroller's Office, will be full according

> to its environmental license in 2022. In addition, the agency verified that the Centro de Gerenciamiento de Residuos Doña Juan S.A. "presents non-compliance with both the obligations set forth in the environmental license, granted by the CAR to the Uaesp, as well as the clauses of the 2010 concession contract". (Duque, 2018)

Taking as an example the capital city and the most important landfill, the lack of proposals illustrate a precariousness in the matter for decision making, a lack of awareness of the effects that could result from a lack of knowledge about the state of the site and, therefore, a lack of attention to the environment that both in the territory and in the surrounding areas would end up being victimized.

Drawing a line to contextualize the international scenario, as of July last year, the British organization Verisk Maplecroft denounces a rise in waste production that is not being addressed.

> The specialized risk analysis group revealed that globally, more than 2.1 billion tons of waste are produced each year, which could fill more than 800,000 Olympic-size swimming pools.
>
> Only 16% (323 million tons) of this waste is recycled.
> The United States produces the most waste per person in the world: three times more than the global average. (World, 2019)

Since before the change of mayor at the end of 2018, different pilot plans have been proposed for the management of the Doña Juana landfill, among them the expansion of the sanitary area or the purchase of another extension of land that would be much better managed by the Ministry of Environment; However, the most congruent and, for some, futuristic solution would be the decision to move towards the elimination of sanitary landfills and with the waste obtained from daily garbage collection to carry out the corresponding recycling processes both at home and in processing factories, to give the leftovers the maximum possible use and with the remaining waste to carry out the process of garbage destruction in an environmentally responsible manner, as was

decided by the European Union 30 years ago when they suffered the same crisis due to the total occupation of sanitary landfills.

But we are less than two years away from the city's landfill reaching its limit and no formal proposals have been presented that highlight innovative and environmentally friendly features, a further expansion of the area or the transportation of waste for management to other locations, where the problem would only be avoided while the populations surrounding the landfill and other deposits are ignored despite the increase in the rates of respiratory diseases and complaints about poor air quality.

Awareness must be raised about these populations, which despite being small, require attention due to the fact that they live in places that are not very vulnerable. The levels of risk lie both in the process used and its consequences, as well as in external factors such as citizens.

Imposed policies for waste management in the Big Apple

Turning to the international arena and starting with generalities about the United States, the millions of tons produced by the great American power have no equivalent in terms of environmental replenishment; Americans produce on average three times more waste than a person living in China and seven times more than a resident of Ethiopia. Other countries such as Indonesia and Brazil, which represent a similar proportion of the global population as the United States, produce about 10% less waste than the world's leading power.

> The United States ranks low compared to other developed countries. "When you look at the relationship between recycling and performance with respect to how much waste a country generates, that's where the U.S. falls below the mark," said Niall Smith, one of the study's lead analysts.

According to the report, the U.S. only recycles about one-third of its solid waste. The British research group defines these types of waste as garbage collected by local authorities from residential, institutional or commercial sources. (World, 2019) .

Delving into the cosmopolitan city of New York, the situation is contradictory, "In most places in the world, growing wealth is associated with an increase in garbage production. But here, too, the poorer population contributes a considerable amount of waste, much of it fast food wrappers." (Lohuizen, 2017) . However, the city has high-level environmental policies and programs; paper, plastic bottles and cans are separated for proper recycling processes; despite these practices the imbalance remains and the recovery industry is so small that the rest of the waste, which makes up the bulk, ends up in out-of-state landfills or incinerators.

> For decades, the issue of garbage management in the Big Apple has become a constant reminder of life in the "Big City". For many, the mountains of garbage on the sidewalks are part of the "attraction" of this metropolis, to the point of being the protagonist of Hollywood movies and television series.
>
> As night falls, however, other players join the already heated New York traffic. While the Department of Sanitation (DSNY) collects trash and recycling from residential buildings, more than 90 different private collection trucks roam the city each night to service the 100,000 commercial businesses that annually generate more than 3,000,000 tons of garbage. (Martinez, 2018)

Moving on, in New York City the amount of waste is so large that waste is handled by two separate systems - one public and one private. The public one - New York City Department of Sanitation (DSNY) - services residential buildings, government agencies. Private commercial businesses do not receive free garbage collection by the city government. They must pay private companies to

dispose of their solid waste. The private waste disposal system is composed of a small group of waste disposal companies that are regulated by the city's Business Integrity Commission.

This Commission authorizes waste hauling companies that dispose of commercial waste. The New York City Department of Sanitation collaborates with Sims Multi Recycling Recovery Facility (SIMS), the Department of Parks and Recreation (DPR) and Greenyc to manage the city's waste through reduction initiatives such as composting and detour of organic waste for alternative use.

So, while it may even seem quaint to New Yorkers, the DSNY plans to maintain its waste management strategies such as processing plants that compact waste for much more practical handling and a reduction in areas set aside for the treatment of waste that has no use other than disposal.

Commitment of the population

Continuing with Switzerland, one of the countries with the best waste management system, projecting every year for the inclusion of new policies and procedures.

> In 2015, 93% of glass bottles, 91% of aluminum cans, 83% of PET plastic bottles and 67% of batteries were collected for reuse. Half of the household waste recovered for recycling is made up of used paper. Each year, about 152 kilos of this paper are recovered per inhabitant. The annual volume of organic waste amounts to 1.3 million tons, of which 300,000 tons are composted by private individuals.
>
> Refrigerators, CDs and DVDs, wood waste, old oil, old oil, household appliances, medical waste, chemicals, used clothes and shoes are also recovered for reuse. (Environment, 2017)

Both the public and private sectors are committed to waste treatment and are constantly promoting recycling and waste management campaigns.

Likewise Zurich has both recycling support programs and garbage taxes, all practices being supported by the government and clearly stipulated in the law. Regarding waste management, "In order for the garbage collection service to work, everyone has to pay a "garbage tax". This tax is collected through the mandatory use of official city garbage bags, which are known as the *Züri Zack*." (Olivera, 2016) . On recycling the city's policy is also clear: "If you don't want to recycle, that's fine, you can put everything in the Züri Zack, but it will be more expensive... if you want to separate your garbage and thus save money, the city provides recycling points for different materials". (Olivera, 2016) .

Finally, the city of Zurich, which is within Switzerland one of the cities where recycling policies are best applied because according to data from the Federal Office for the Environment (OFMA) 96% of the total glass used in the territory is recycled, so there are almost no glass bottles that do not become a new one.

The government carries out many campaigns on recycling in mass media such as television, press and street advertising, informing citizens about the need and advantages of recycling for everyone.

In addition, since 2000, what cannot be recycled or composted is burned in modern incinerators that produce minimal environmental air pollution and generate electricity for approximately 250,000 households, which has reduced heating oil imports. Because no percentage of municipal waste is deposited in public landfills, 50% is recycled and the remaining 50% is transformed into energy in garbage incineration plants.

Zurich, and the complex territory in general, are the areas of greatest concordance with international policies such as those of the UN regarding environmental policy or the regulations of the European Union, as an actor the territory is aware of the impact of its regulations in the foreign scenario and of the benefit of its proposals internationally.

Effectiveness in different waste management procedures

The state of both environmental and population risk changes considerably depending on the city and the strategies previously mentioned by territory, Bogotá is the city with the highest environmental and population risk, with perhaps the highest risk rate in the inhabitants; numerous complaints have been filed with the mayor's office by inhabitants of neighborhoods such as Mochuelo Alto, in Ciudad Bolivar, who almost 200m from the district landfill live daily with bad odors, flies, rats and respiratory diseases and the propensity to cancer. Paradoxically, the inhabitants of this neighborhood and surrounding areas work in activities such as agriculture due to the fertility of the land and struggle with the contrast of contamination by what for this population is nothing more than a garbage dump.

New York City and Zurich do not have such high risk indexes compared to Bogotá, Zurich practically does not have them thanks to the policies and behavior of its citizens and New York is in a positively inclined balance where environmentally it is penalized to throw garbage into the Atlantic Ocean and at least 20% of the waste collected daily is taken to processing factories to start recycling cycles and at the population level the smell of garbage in certain areas of the city is just one of the headaches of the big apple.

Likewise, the behavior of citizens is recurrent in the current situation of each city, the great example that is Switzerland in general and more specifically cities like Zurich is nothing more than the discipline, seriousness and commitment of the inhabitants with the environmental problems both nationally and internationally, likewise the government is constantly in charge of supporting such dynamics showing rewards for the constant conscientious behavior. On the other hand, this collective culture of concern for the environment is practically non-existent in the city of Bogotá, which, despite being the capital, shows no progressive interest in waste management at home, nor does the government provide incentives for its application beyond the minimums requested by the Ministry of the Environment or in the agreements signed with international entities. New

York continues to be the city with a midpoint where there are minimums for waste collection, whether by the public or private sector, such as the separation of waste with different bags for paper, metal, glass, plastic or non-recyclable waste; also, being New York a city of such international incidence with so many different cultures interacting at the same time, a culture of awareness is spreading little by little both in the city and throughout the United States that is expected in the coming years to begin to bear fruit while in turn the older generations may change their minds about the importance of the environmental situation both for them and for the rest of the world.

As illustrated above, within the integrated solid waste management plans (PGIRS), different principles are covered and yet the principle of hierarchy in waste management is the best known and most effective. Within the same pyramid, the categorization of strategies shows the ideal and the least desirable, but in the parallel between the three subject cities, each is at a different level.

Although each procedure responds to waste management in a given environment, the treatment proposed may be developed due to external factors such as economic factors, since cities such as Bogotá do not have the necessary budget within the Ministry of the Environment to opt for strategies such as waste minimization, reuse or recycling/composting in the highest percentage of waste management and the last option to be considered is treatment through sanitary landfills, despite being at the bottom of the pyramid and the last option that should be considered.

Other factors such as population density and the territorial extension of a space can also act; cosmopolitan cities such as New York have a high population density, talking about 138 inhabitants per km2 for the year 2018, higher than the general population density of the United States of 33 inhabitants per km2. Having so little space available to establish ideal waste treatment areas and being impossible to minimize waste production due to the same factor of inhabitants, mixed strategies are chosen such as reuse, recycling/composting of a certain

percentage of waste and what is not feasible for such strategies ends up in the last option, i.e., in landfills.

Such categorization by external factors disappears in cities like Zurich that end up complying with the protocols and action plans for waste management and yet new strategies and motivators are constantly proposed to maintain the ideal in the management options; the government provides support and practically rewards those inhabitants and even industries that are committed to the processes of recycling, reuse, energy production through waste but above all to the minimum production of solid waste.

Conclusions

The difference both in the waste management procedures of each territory and their effectiveness, together with factors such as the commitment of the population, evidence the global imbalance that exists regarding waste policies and the commitment to the environment, being the complete opposite line of acting as if it did not matter at all or having practically ideal models, although with aspects that can always be improved.

However, these aspects to be improved should be considered by all, even more in those areas of special attention, territorial spaces that with initiative could improve their situation and avoid exposing a population to a possible risk due to a consequence of poor waste management such as a collapse of neighborhoods in the surroundings of a landfill or an infestation of insects and animals that could spread viruses or diseases. By being aware of the minimum improvements and their relevance, the quality of life of both human beings and the quality of the environment would increase considerably.

Furthermore, reference frameworks such as the principles proposed by ECLAC, which are not textually binding for both member countries and non-member countries, make it possible to forge a guide of what is expected of a territory to be in accordance with the environmental situation in

general and in specific issues such as waste management, bearing in mind that the globalized universe of which all inhabitants are a part requires equivalent joint actions around the world.

Similarly, reference frameworks that seek to demonstrate the importance of the environment as a public subject in the international framework have increased and both in state and foreign policy there are interests and minimum guidelines that must be met so that each territory is a conscious actor and gives greater relevance to the joint actions of each individual that added in different territories can alter the balance of how ideal and environmentally friendly the countries are for solid waste management, taking into consideration external factors that can alter the development and fulfillment of certain strategies.

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