

A look at the management of municipal solid waste in Latin America. A systematic review

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Abstract

In Latin America we still have deficiencies in terms of the integral management of urban solid waste in each of its stages, such as generation, street sweeping, collection, segregation, reuse and final disposal. This is a function of competence of the municipal governments of each country, therefore, if we want to contribute from this region to sustainable development, as well as to the fulfillment of the Sustainable Development Goals, especially goal number 11, the same one that seeks to achieve sustainable cities and communities. We can affirm that there is still pending work to be carried out in Latin America, but we cannot fail to mention that some progress has been made from the point of view of having promulgated interesting regulations and especially environmental policies that have begun to bear fruit. There are great advances in the formulation of projects in different cities of Latin America on the issue of the implementation of sanitary landfills. There are countries where laws have been implemented regarding the reincorporation of recyclers into the business chain, countries such as Perú that has enacted the Recycler Law, which is associating these so-called street and landfill recyclers. We also have great advances in the issue of segregation at the source, that is, promoting the culture of recycling from the same source of generation of the waste and thus extending the useful life of either landfills or landfills. The issue of reuse of both organic and inorganic matter that is a component of solid waste to generate energy, biogas and compost is another of the great advances in recent years in some Latin American countries.

This article analyzes the relationship and correlations that exist between the different variables that are associated with the management of urban solid waste in Latin America, see the advances in the search to achieve sustainable development, the circular economy, environmental quality, but above all the conservation of the planet for future generations. We will also analyze some referential pictures of these advances and how they are having a positive or negative impact on the environment of the region and the planet. Some approaches to successful experiences will be proposed to raise awareness of the importance of the three factors, such as the efficient management of urban solid waste, the reuse of organic and inorganic matter and recycling, in addition to promoting environmental education, environmental governance and tax awareness of environmental citizens to ensure environmental sustainability.

Keywords: Solid urban waste, reuse of solid waste, recycling, sustainable development and solid waste management.

Introduction

Our main variable in this case the management of municipal solid waste today has become one of the biggest problems in Latin America, based on the enormous volumes that are generated per day of solid waste of a municipal nature, due to the growing urban expansion added to the formation of human settlements that by increasing demographic expansion grow exponentially. Other factors that add to this problem is the lack of extended responsibility of producers with respect to their products in terms of their final disposal after use, also has its degree of contribution to this problem changes in consumption levels, the improvement of the quality of economic life of the population that makes their consumption levels higher which generates more waste of nature urban and major problems of proper management to large cities in terms of their efficient management.

On the other hand, the growing urbanization in large cities, makes or favors so that the generation of waste or waste of an urban nature is greater and often complex to manage properly. Families every day throw discarded materials, as well as industrial waste and commercial nature, therefore, directly affect the issue of public health which in most cases presents a serious problem for its management, in addition to affecting the environment and the economy of each city. We can observe and corroborate that the generation of municipal solid waste, the density of the same garbage and the multiple sources of waste are very similar anywhere on the planet. In addition, their generation is intimately associated with the level of economic income. to lifestyles, production patterns and mass consumption patterns, traditions of yesteryear, location of cities and space weather. (Harir, Kasim, & Ishiyaku, 2015, p. 2).

Today it is said that there is "the garbage crisis" this translates into a considerable increase in the generation of municipal solid waste, which often exceeds the rate of population growth. This is even more noticeable in cities with a high rate of population density which export their common waste to different places. We will also denote the great decrease in available landfills, adding to the environmental risks to health that is a constitutional right caused by poor management of solid waste, especially at the stage of final disposal. (as cited in Jimenez, 2017, p. 173). The

problem of waste management not only depends or is a matter of seeing the quantity, because it is also to analyze how the garbage is composed through its studies, characterization, and from it look for the mechanisms to make minimum potential risks to health and the environment.

In 2014, the total generation of municipal solid waste in the country exceeded 37 million tons, and in terms of the average per person an estimated proportion of 0.92 kg of waste per capita (INEGI, 2015b). These figures somehow placed the country of Mexico within the top ten generators of municipal solid waste in the countries that are part of the Organization for Economic Cooperation and Development (OECD, 2018). We can then summarize the increase in the growing tension and convergence of factors that, associated with the generation of municipal solid waste, it is concluded that it is urgent to try to reduce this hard problem, with the sole purpose of preventing affecting the health of the population and irreversible damage to the environment.

This document is a compilation of available sectoral data on the state of solid waste management in Latin America and the Caribbean (LAC).ⁱ The following is a brief description of the most relevant data: The regional average per capita generation of Household Solid Waste (RSD) and Municipal Solid Waste (MSW) is 0.6 kg/inhabitant/day and 0.9 kg/inhabitant/day, respectively. RSDs represent, on average, 67% of the MSW generated in the region. The regional average MSW collection coverage is 89.9% (measured as a percentage of the population). Compared to the global average of 73.6%, LAC has a high level of coverage, which reflects the priority that the region has given to this service. LAC has a higher-than-average coverage level for Africa (46%), South Asia (65%) and the Middle East and North Africa (approximately 85%). Argentina, Chile, Colombia, Dominican Republic, Trinidad and Tobago, Uruguay and Venezuela have MSW collection levels close to 100% (universal coverage). Approximately 53% of the population of LAC receives the collection service between 2 and 5 times a week, while 45.4% has a daily collection frequency. 1.8% receive the service on a weekly basis. Differentiated MSW collection, commonly referred to as selective collection, is still low. However, there are cases such as Brazil, where

62% of municipalities implement selective collection programs, that is, selective collection at source with MSW recycling programs. Average unit costs of collection are estimated at USD \$34.2 per ton collected, with high-cost variability between countries. The cost in Argentina, for example, is USD \$54, while in Paraguay it is USD \$6.6 (USD \$47 difference). These variations generally reflect differences associated with the (highest-lowest) quality of service.

Within the management of solid waste, we have the following well-defined stages, the same that constitute the integral management of solid waste and these are: generation, storage, collection, transport, transfer, treatment and final disposal (Ochoa, 2009).

In the case of Latin America and the Caribbean, a serious problem has been generated because the management of waste has prevailed under the scheme of "collection and final disposal" that are part of the integral management, but the reuse, recycling and treatment of waste has been left behind, which help a lot to sustainable development, as well as the sanitary and environmentally adequate final disposition (AIDIS-IDRC., 2006). The reality is that in several countries of the region landfills and / or open dumps are used without the proper technical specifications which generates a great pollution due to the presence of methane; the practice of collection without classification and/or separation of wastes from source and source is continued; there is a huge number of waste pickers working in the streets and in landfills, seeking to survive from the use of recyclable materials despite the risk to which they expose their health and physical integrity, and if we look at the deficiency in municipal administrations or both public and private sector are aspects that reveal the crisis presented in the region by the management of urban solid waste (AIDIS-IDRC., 2006). The development of this work was carried out with the purpose of describing the current situation of solid waste management for Latin America. To achieve this objective, a systematic review of the documentary of scientific articles was carried out comparing and analyzing the realities presented, but more than that exposed by the different authors in the management and management of solid waste.

We can observe that in this systematic review it was detected that the way and systems how solid waste is managed in the aforementioned countries is similar and similar in terms of its problems and difficulties, the system is still in an incipient state to be considered as integral and sustainable, with which we are far from achieving true sustainable development. Achieving improvements in the management and management of solid waste in Latin America requires an enormous will on the part of municipal governments, implementation of environmental regulations, strong investments and continuous education of citizens plus environmental governance, as well as more emphasis on the issue of the use of waste, as well as recycling with which it would be possible to reach the circular economy model.

On the planet, great strides have been made in order to improve and optimize the management of urban waste in order to achieve sustainable development and the improvement of the quality of life of the inhabitants, not to mention that this contributes to the quality of the health of the population plus one in times of pandemic. This article analyzes as main variables the management of municipal solid waste, framed within three concepts that are part of the integral management of the same as: the management of solid waste, the reuse of solid waste to produce several components and recycling, tangentially these issues are also related to environmental governance, appropriate final provision, environmental education, circular economy and sustainable development.

We have to keep in mind that it is for us the great importance of analyzing the main variables and their relative variables that are part of it, in order to take a look at the advances and what is pending to be done in relation to an issue so vital for the environment and the public health of the population. We will also seek to analyze the proposed standards and their positive effects on this issue, deepen the analysis of reuse and recycling. Waste pickers who were informally working on this issue, with which we will incorporate this reuse into the productive cycle of goods and services. This advance and policy will allow us to reach less waste to the dumps that are open sky generating great pollution and above all we will be complying with the new philosophy such as the circular economy and

fulfilling the objectives of sustainable development.

The main variable considered was the management of municipal solid waste. The research questions: 1) What is known about the integral management of municipal solid waste in Latin America? 2) What is the relationship between municipal solid waste management, recycling and reuse?

The main objective of this paper is to take a look at and investigate the advances in the management of municipal solid waste in Latin America.

1. Our review article aims to analyze the management of municipal solid waste in Latin America and its advances with respect to three dimensions such as: Solid Waste Management, the Reuse of Solid Waste and the Recycling or Recovery of both organic and inorganic matter, its impact on sustainable development and the environment.

The article compares solid waste management in Latin America for ten years and analyzes whether the variables in one way or another are related to it. Likewise, it seeks to learn from the cases in which the regulations did not remain only in the duty to be, but through particular actions achieved significant changes. Finally, analyze the progress in terms of reuse and

recycling of solid waste by comparing the advances and where the policy and regulations do not work as planned.

METHODOLOGY

A systematic review was carried out in the Database of: ScienceDirect, Scopus, ProQuest and Academic Report, consisting first of all of a total of 112 scientific articles of which all were accessed with full text, of which the range was established from 2015 to 2021 obtaining the 112 articles on the subject of solid waste, for which the recommendations of each of the scientific journals were applied to search and restrict certain conditions as established such as the use of the algorithms "and", and "not" Obtaining an initial database composed as follows: 31 were from the journal ScienceDirect, 42 from the journal Scopus, 34 from the journal ProQuest and 5 from the scientific journal Informe Académico.

Figure 1 shows the methodology used to identify the findings through a fine review in the database of scientific journals: ScienceDirect; Scopus; ProQuest and Academic Report. It had the purpose of obtaining relevant information and with the conviction that they are reliable and validated bases in all their contexts.

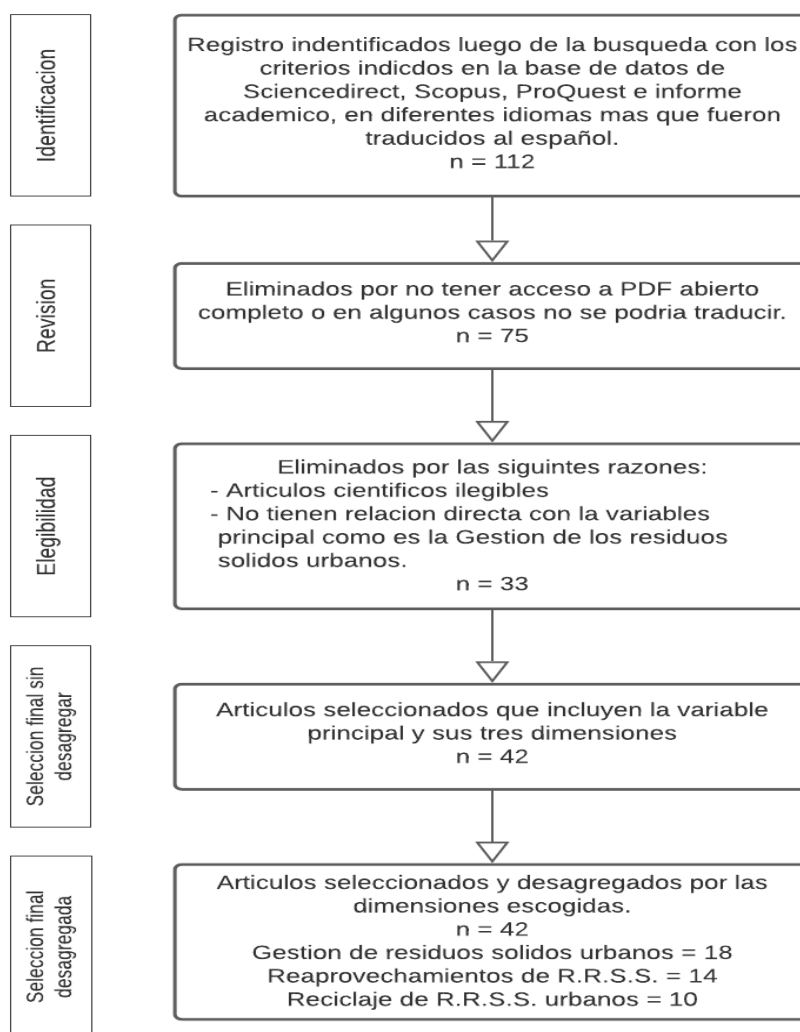


Figure 1. PRISMA diagram.

Table 1 shows the finding of 112 articles related to the topic of solid waste management, but some moved away from this topic and referred to other types of waste that were not of an urban nature or less municipal competence, so they were eliminated, and it was reduced to 75 of these articles that did talk about the issue of urban solid waste management (Table 2).

Table 1. Database of scientific articles Initially searched (Solid waste).

Scientific Journal	Central Theme	Quantity
ScienceDirect	Urban Solid Waste Management	31
Scopus	Urban Solid Waste Management	42
ProQuest	Urban Solid	34

	Waste Management	
Informe Académico	Urban Solid Waste Management	05
TOTAL		112

Table 2. Database of scientific articles after the first purification (Municipal solid waste).

Scientific Journal	Central Theme	Quantity
ScienceDirect	Solid Waste	21
Scopus	Solid Waste	31
ProQuest	Solid Waste	20
Informe Académico	Solid Waste	03
TOTAL		75

After that, a second review of the 75 selected articles was carried out, after which each article was reviewed again and a database was formed with the articles that talked about the three

variables associated with the main variable such as solid waste management, that is, those that talked about: management of urban waste, reuse of solid waste and the issue of recycling organic matter as inorganic and a new database can be developed. Finally, an exhaustive review was made on the topic and content of each article, leaving 42 articles suitable for study (Table 3). Research from various countries and languages has been considered. We have that of the 42 scientific articles all talk about solid waste management, but within the framework of the three collateral variables such as: urban waste management, reuse of solid waste and the issue of recycling organic matter as inorganic respectively. Research from various Latin American countries and different languages has been considered, many of them translated into Spanish respectively (Tables 4, 5 and 6)

Table 3. Database of scientific articles after the second purification (Municipal solid waste, but with the collateral variables: management of urban waste, reuse of solid waste and the issue of recycling organic matter as inorganic).

Scientific Journal	Central Theme	Quantity
ScienceDirect	Solid Waste	16
Scopus	Solid Waste	19
ProQuest	Solid Waste	05
Informe Académico	Solid Waste	02
TOTAL		42

Table 4. Database of scientific articles after the second purification (Municipal solid waste, but with the collateral variable management of urban waste).

Scientific Journal	Central Theme	Collateral Theme	Quantity
ScienceDirect	Solid Waste	Solid waste management	07
Scopus	Solid Waste	Solid waste management	09
ProQuest	Solid Waste	Solid waste management	02
Informe Académico	Solid Waste	Solid waste management	00
TOTAL			18

Table 5. Database of scientific articles after the second purification (Municipal solid waste, but with the collateral variable reuse of solid waste).

Scientific Journal	Central Theme	Collateral Theme	Quantity
ScienceDirect	Residuo Sólido	Reaprovechamiento de residuos solidos	05
Scopus	Residuo Sólido	Reaprovechamiento de residuos solidos	05
ProQuest	Residuo Sólido	Reaprovechamiento de residuos solidos	02
Informe Académico	Residuo Sólido	Reaprovechamiento de residuos solidos	02
TOTAL			14

Table 6. Database of scientific articles after the second purification (Municipal solid waste, but with the collateral variable recycling of solid waste).

Scientific Journal	Central Theme	Collateral Theme	Quantity
ScienceDirect	Residuo Sólido	Reciclaje de residuos solidos	03
Scopus	Residuo Sólido	Reciclaje de residuos solidos	04
ProQuest	Residuo Sólido	Reciclaje de residuos solidos	01
Informe Académico	Residuo Sólido	Reciclaje de residuos solidos	02
TOTAL			10

RESULTS

The results obtained after the search in the journals previously selected because of our main variable we can see that these analyses and reading of those expressed by the authors indicate that the same results or values respond to the question that we ask ourselves being one of them What is known about the integral management of urban solid waste in Latin America? What we can now say after the systematic review is that it allowed us to learn about the progress in Latin America with respect to the management of urban solid waste, However, the proper management of urban solid waste was clear to us in the almost general

position of the authors, which is a determining factor to improve the environmental conditions of cities, with favorable repercussions for all agents of society, this reengineering on the management of urban waste generates resources, generates employment and above all reduces the poverty gap, but above all it is aligned in satisfying basic needs and improving market access opportunities, that is, it will contribute to the goals of achieving sustainable development and an emerging circular economy. That is, there are great advances in the issue of the integral management of solid waste in each country of this part of the continent, the states are designing and approving policies for efficient management in each of the stages such as generation, storage, street sweeping, collection of urban solid waste, reuse and recycling, As well as the last stage that is the correct final disposal, today you can show medium and small advances in the three dimensions of our article such as the management of urban solid waste, the reuse of it with clean technologies to produce biogas, electrical energy and organic fertilizer among others, as well as the recycling of inorganic matter that is mostly plastic, cardboard, paper and glass are making large recovery plants and promoting with the associations of recyclers the capture of the same, but this is still insufficient in relation to the amount of solid waste that is generated per day in Latin America, therefore a great work is still pending.

As for answering the question: What is the relationship between the management of municipal solid waste, recycling and reuse? We can affirm that there is a great relationship both from the point of view of management that implies considering as one all the stages of the management of municipal solid waste and not as a sum of parts, but addressing the problem of the management of municipal solid waste in a more efficient way. Therefore, as the authors tell us that we must take an order and a planning, this implies being able to make the decisions rather well analyzed of the volumes and states of characterization of the waste, so that from them the impacts can be measured, but above all reduce it. After that, a reengineering must be done in terms of reuse, reuse and recycling, having as a philosophy to reuse that waste and with them we would be entering the dynamics of the circular economy and ceasing to impact with carbon monoxide that is a greenhouse gas. After

that, before finishing, as several authors agree, the treatment of municipal solid waste with state-of-the-art technology continues, through which the impact on the pollution of the planet is drastically reduced and money is recovered. Finally improve the most critical stage that is the final disposal, but trying to make this minimal what reaches the existing dumps or landfills to lower pollution levels to the surrounding populations, but above all stop contributing to the GHG planet.

DISCUSSION

In our scientific article all the information of articles collected were definitively classified in the dimensions that are related to the topic developed which is the Integral Management of Urban Solid Waste that corresponds to:

- 1.- Solid Waste Management.
- 2.- Reuse of Solid Waste.
- 3.- Recycling of organic matter as inorganic.

We seek to take a look at the time horizon in Latin America how much progress has been made on these issues, how much progress is needed, how it is affecting the environment, how it is contributing to sustainable development and the improvement of the quality of life of the population.

As far as Solid Waste Management is concerned, authors such as Sadeghian et al. (2018) are concerned. the main objective of waste management is the correct collection and disposal of waste so that costs and pollution levels are minimized. However, in this research the opinion of households was known, which are generators of solid waste and on whom the environmental policy related to this waste must direct the strategies that allow to incorporate again to different productive processes, within the framework of the circular economy, usable solid waste.

Integrated solid waste management minimizes environmental pollution and, therefore, can contribute to the conservation of natural resources and achieve a decrease in some bacterial and parasitic diseases (Ponte, 2008). Indeed, the integral management of solid waste has been the subject of previous studies, such as the case of Leiton and Revelo (2017), who

developed a comprehensive management plan for the management of solid waste in the company CYRGO SAS, in Colombia, which highlighted the commitment of that company to reduce negative environmental impacts, product of the inadequate management of its solid waste. From all this we can refer to the great importance of a correct integral management of solid waste that with this we achieve that all the stages of the integral management of the management of solid waste are efficient and this allows to improve the quality of the environment, comply with the government policies in environmental matters such as the efficient final disposal, the reuse and recycling chain that becomes present in the chain of the garbage business, Finally this good management goes directly to the improvement of the public health of the population the same that is a constitutional right and an obligation of the state

When it comes to the reuse of solid waste, many LAC countries are also missing out on other types of recovery opportunities. On average, more than 50% of the MSW produced in the region are organic. High organic content means there is room for recovery, for example by making compost or producing biogas. However, as waste separation is not a common tradition in the region, they lose the income-generating potential of such recovery activities. Waste-to-Energy, which refers to obtaining energy from residual resources, is also not widely implemented in the region. Some major cities such as Sao Paulo, Brazil, have shown interest in such technologies; however, no projects have been initiated except in some cases in Bermuda and Martinique.

The estimated value for the lowest calorific value of the MSW collected in the city of São Paulo was 2824.38kcal / kg; therefore, its incineration for the production of electrical energy is feasible (EPE, 2014; De Nogueira, 2015). According to ABRELPE (2014), the city of São Paulo generates 19,000 tons of MSW per day. taking into account that 98.08% of this total is organic matter, it is possible to install 13 plants with an average capacity of 1500 tons of MSW per day.

Regarding the recycling of organic matter as inorganic, based on the tests, observations and models carried out, a final model of the equipment was generated that was called Depacker DHM1 (figure VII). Its objective is to

separate food waste from its respective packaging and has a processing capacity of 3,000 kg of waste per hour. Its main dimensions are: 2400 mm long, 500 mm wide and 1200 mm high, not including the transmission system, hopper and platform. It has a total weight of approximately 500 kg. The machine has a three-phase motor of 30 kW and nominal speed of 1490 rpm. Power is transmitted to the machine shaft by a belt drive with a variable reduction that allows speeds of between 150 and 750 rpm. It is built mostly of AISI 304 stainless steel except for the breaking vanes and static blades that are made up of a high tenacity alloy steel. (14)

When comparing the criteria of various authors on recycling Castells (2012); Baptista, Concepción, Barrios, and González (2014), in relation to the main contributions in each, it can be seen that they agree that recycling is the process that aims at the collection, conditioning or transformation and use of solid waste, as new products or secondary raw materials ready to be reused in industry and commerce, with considerable savings in natural, material and energy resources and a gradual reduction in landfilled waste. It is achieved with sustainable management in accordance with the current regulatory legal framework (15)

We can refer to this discussion with respect to these three dimensions, what the aforementioned authors state, that within the integral management of municipal solid waste in Latin America, with regard to the management of solid waste, they agree that an efficient management of this solid waste would allow to have in this part of the continent a lower pollution of the environment because in its final phase they would have a correct final disposal, also agree in expressing that the improvement of the management of solid waste in that this would help a better public health of the population avoiding many diseases. With regard to the reuse of solid waste, we can indicate that the aforementioned authors agree that progress has been made on the issue of the reuse of organic matter as inorganic for the production of biogas and electrical energy due to the high content of organic matter that has the characterization of our solid waste from Latin America, it also allows to generate income for those who execute these actions. Finally, with respect to the issue of recycling within the discussion we can

indicate that their coincidence is that the issue of separation has been developed a lot based on the characterization studies of both organic and inorganic matter that leads us to a significant saving of natural resources "because by recycling the discarded products we save the production of energy that generates greenhouse gases, likewise, less waste reaches open dumps, helping the quality of the environment.

Recommendations of the authors extracted from the articles

The strategies alone will not be effective if in the future it is still cheaper to bury waste instead of recycling it, if it is more expensive to comply with the institutionality than not to do so (Martínez Alier and Roca, 2013), if technological and social innovation research is not developed, if the logistics to transport usable solid waste to the industry entails excessive transaction costs for the latter and if the information system of the sector remains deficient. (16)

The benefit obtained from saving electrical energy was compared with the cost of a study that includes three important aspects (Chong et al., 2005) cost of investment, operation and maintenance, and decommissioning with a total cost of 8.89 USD (17)

Brito et al. (2016) proposes the implementation of ecologically efficient manuals for the integral management of solid waste from its generation to its final disposal, in order to propose solutions that improve the quality of life of the population. (18) In this sense, Sánchez (2016), considers that ecological awareness and greater citizen participation should be promoted in the construction of strategies to reduce environmental problems, levels of degradation, among others, in order to achieve true sustainable development.

In this sense, all the inhabitants of the planet generate waste such as plastics, glass bottles, organic matter, paper, cardboard, among others; that without an adequate disposition can cause environmental and human health effects (Zapata and Zapata, 2012). For this reason, the recycling and proper final disposal of waste is important since these increase over the years and according to the World Bank (2018).

Methodological proposals found within reviewed articles.

After the systematic review it is necessary to mention that the proposals of emerging methodologies are several, among them the Flipped Classroom stands out, having as allies social networks and platforms such as Zoom and Blackboard Collaborate. These tools are used for the attention of the student body synchronously and / or asynchronously, since they are used in the feedback process.

CONCLUSIONS

From the findings analyzed, it was possible to identify and above all conclude that, in order to minimize environmental pollution, the integral management of municipal solid waste must be improved and optimized, and that this is directly linked to the reduction of waste sent to landfills, composting, reuse and recovery of solid waste. Here also as indicated by several authors plays a fundamental role environmental education, environmental governance, environmental control, but above all a commensurate and sustainable environmental policy

We can also conclude that the different articles reviewed after selection took us to the frontier of the approach towards the knowledge of new technologies with respect to the reuse of solid waste taking into account its richness in organic matter to process them and obtain biogas and electrical energy, as well as fertilizer for green areas. All this using clean energy and technology recognized as components to achieve sustainable development. Not to mention that several authors highlight that it is still an urgent need to deepen in several Latin American countries, based on the large volume of solid waste generated per day and its characterization studies that show that they are rich in organic and inorganic matter.

Another of the accurate conclusions to transform the postulates of the system into actions and achieve efficiency in recycling, reuse and valuation of waste, requires motivation, knowledge and capacity for innovation. Successful projects are supported by research and involve experienced professionals in various subjects, engineers, technologists, microbiologists, architects, ecologists, sociologists and educators, among other Latin

American countries on all those that are developing. Here we could see that several authors mention the eminent need to repower segregation at the source, inserting recyclers into the business value chain, which some countries such as Peru until the Waste Picker Law we have.

It was also agreed in several articles that every day in the countries of Latin America based on growth and economic prosperity there is a considerable increase in the generation of urban solid waste that many times some municipalities do not have the capacity for its management. There is a lack of storage, temporary collection centers, sorting stations, reuse, recovery that does not allow optimizing the issue of recycling and reuse. All this generates that we continue to prey on environmental resources and these materials can remake the packaging with which we would be entering the dynamics of the circular economy. If we add to all this a common pattern in South America the lack of citizen awareness, lack of environmental education and tax culture, which complicates much more the solutions that in some cases there are successful experiences that we must try to replicate logically with the adaptations to the reality of each country.

As a final conclusion we can express that from the review of the different articles seen we can infer that the total lack of historical systematized information of the evolution, as well as the generation of solid waste in each country, therefore it is recommended as you can hear and read from those investigated, that within the management plans of urban solid waste management can be defined and established the variables and the respective indicators that can be constructed from the qualitative but above all the quantitative, so that the best decisions and adjustments of environmental public policy can be made in each country, reinforcing the issue of environmental education, environmental governance and creating ecological citizens who see recycling and reuse as a new way of life, to ensure the sustainability of the planet. If all this is achieved, we can build even mathematical models and superior inferential analysis that led us to the true causes of the generation and thus establish public policies according to the previously calculated and simulated reality, with which this public and private problem would be solved in an integral way.

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