Organic Waste Management in Latin America: Challenges and Advantages of the Main Treatment Options and Trends

Technical report with contributions from the Seminar "Management and utilisation of municipal organic waste: the challenges of Latin America"

Organization

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Table of Contents

1 Introduction

1.1 Regional context

The Latin America and the Caribbean region has one of the highest urbanization rates in the world, an estimated 500 million people live in cities (80 per cent of the population)[1], facing various challenges with regard to mobility, safety, health, wellbeing, sanitation and adequate municipal solid waste (MSW) management on a daily basis. As for the latter, around 354,000 tonnes[2] are generated every day by inhabitants with diverse consumption habits, cultural characteristics and purchasing power.

An estimated 50 per cent (or more) of the MSW generated in the region is food waste and materials of organic origin. Despite having a great potential for recovery through different technological options, this fraction of MSW is generally disposed of in landfills and dumpsites, with different impacts, such as the generation of greenhouse gases, whose treatment requires additional action and costs.

On account of its volume (half of the total MSW) and impacts, municipal organic waste should be the object of specialized management, since, aside from minimizing costs and environmental consequences, it produces important by-products such as energy, fertilizers and fuels. The demand for actions aimed at reducing food waste, promoting sustainable consumption and food security in major urban centres is also growing every day.

1.2 Rationale

In this context, the purpose of this document is to provide reference information for decision-makers, managers and other key actors in the waste sector from the countries of Latin America on the main trends and the state of organic waste management in the region. This document is not intended as a thorough review of existing practices in the region, its purpose is to provide summarized information to encourage a discussion about the systems, practices and solutions used for the treatment and recovery of organic waste, along with awareness strategies and the search for investment and financing instruments for these activities.

All of these contribute to achieving the Sustainable Development Goals (specifically 11.6, 12.3 and 12.5[3]) and were discussed in person by representatives of some of the countries of Latin America in the Seminar "Management and utilisation of municipal organic waste: the challenges of Latin America" held in São Paulo on 22 and 23 November, 2017. During those two days, aside from exchanging in panels where the current situation and actions of their countries and municipalities in connection to organic waste were debated, participants met with finance institutions and other experts in order to give suggestions for a possible proposal for a regional organic waste management project or initiative. The outcomes of the meeting are detailed in Chapter 5 of this document.

2. The organic fraction of municipal solid waste

According to a simple definition, municipal organic solid waste (MOSW) is the fraction of biodegradable waste from gardens and parks, as well as kitchen and food waste from

[1] UN-Habitat (2017). World Cities Report: https://unhabitat.org/un-habitat-launches-the-world-cities-report-2016/.

[2] UNEP (In Press) Regional Outlook on Waste Management in Latin America and the Caribbean.

[3] **11.6** By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management; **12.3** By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses; **12.5** By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse.

households, restaurants, catering companies, hotels and markets or street fairs. It can be divided into three large categories, with the following characteristics and generation sources:

	**Food waste[4].** Combination of cooked and raw leftovers from the preparation and consumption of food. The origin can be households or commercial activities such as restaurants, canteens, bars, etc. *Examples: fruit and vegetable peels, and eggshells; cooked scraps; meat and fish; tea bags, coffee filters, etc.* It is highly putrescible and has a high moisture content, which requires the adoption of specific collection tools, systems and frequencies in order to ensure the selective collection system is clean, convenient and easy to use. Food waste does not tend to have significant seasonal variations.
	**Waste from gardens and green areas.** Combination of waste from private gardens (households) or public areas such as parks, playgrounds, etc. *Examples: grass; yard clippings and trimmings, leaves; wood (untreated); dead plants and flowers.* It doesn't require intensive collection schemes (it does not smell bad or attract flies and rodents in the same way food waste does, and it does not lead to a fast generation of leachates; in fact, most of it can be treated easily). However, the variability in the generation of garden waste has implications for collection schemes and treatment systems.
	**Waste from markets and street fairs.** Combination of different types of raw vegetables and wood containers produced in public and street markets. These are classified as food losses. *Examples: waste from raw and fresh vegetables and fruit; wood chips and baskets; jute bags, etc.* Similar to food waste, but includes little or uncooked foods, therefore, it is less putrescible, moist and has less bad smell problems.

Other flows of organic wastes, such as those from agro-industries, the processing of animal feed or the processing of agricultural products for other purposes, are not included in the assessments that concern MOSW. Therefore, they are outside the scope of this document, despite which, synergies can be found when it comes to organic waste and treatment options.

[4] Thirty per cent of the food produced in the world is lost or wasted. This happens in a global context where one out of nine people go hungry and two out of ten are obese. The above shows a clear potential for moving toward more sustainable consumption and production patterns, and cities can promote more sustainable diets that guarantee an adequate nutrition while the environmental impacts are reduced, awareness is raised and behaviour patterns related to eating, are changed. More effective urban planning, housing and transport policies can help in the development of low-carbon food systems such as community gardens and urban agriculture.

3. Technologies and strategies for managing MOSW

The organic fraction of MSW indisputably has a volume and characteristics which represent a great concern for society – whether due to the space they take up in landfills, the wasted potential of its properties or the emissions of pollutants which make climate change worse. In view of this, the objective of this chapter is to briefly present the technological options most recognized around the world for the recovery of organic waste, the strategies necessary for planning, implementing and successfully operating a treatment option; and governance issues at the different decision-making levels.

3.1 Technologies

Composting

Its main objective is to convert municipal organic waste segregated at source into a valuable solid organic fertilizer that meets the legal standards for compost through an aerobic biological process. It is considered as a well-understood and accepted treatment option by municipal managers and a summary of the stages of the process is shown in the following diagram:

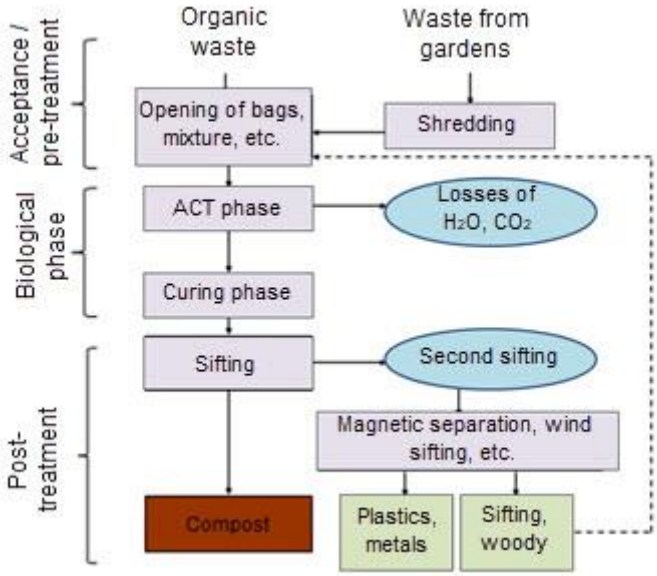


Figure 1. Adapted from RICCI, 2016.

Nevertheless, critical technological variations can be pointed out for each stage of the process according to the type of material accepted, the location of the plant and/or its scale of treatment. The following table shows quite a brief comparison between two types of composting plants:

Characteristics	Medium-high technology, 50 t/d up to 600 t/d	Low technology, up to 50 t/d
Input materials	The three flows of organic wastes described above are accepted	The three flows of organic wastes described above are accepted; however, caution is required when organic waste from cooked foods is used.
Conditions	Segregated at source	

Pre-treatment	Requires care regarding the physical condition of the material (granulometry, moisture, mix, etc.) and the elimination of pollutants and very large pieces. Some equipment, such as shredders and mixers, is necessary.	Requires care regarding the physical condition of the material (granulometry, moisture, mix, etc.) and the elimination of pollutants and very large pieces. The work can be done manually or using simple equipment, such as wheelbarrows.
Biological phases - ACT (Active Composting Time) or thermophilic, in which there are spikes in oxygen uptake and high temperatures, with intense microbial activity; - maturation or mesophilic, in which organic components are converted to humus.	Regarding hygiene conditions and environmental protection, some technologies are usually required: covering of the area and the compost piles; air ventilation and filtration, equipment for mixing/turning the piles, leachate drainage and treatment system, temperature and oxygen control, among others.	Mainly based on open, unventilated systems where the oxygenation of the pile can be provided by a combination of passive air convection and periodical turnings with equipment, or just with a wheelbarrow. Temperature and moisture can be measured using manual tests or simpler equipment.
Post-treatment - the material resulting from the composting process needs to be sifted, in order to remove larger pieces of woody waste and pollutants such as plastics and metals	Requires the use of equipment such as rotary sieves, magnetic belts, ventilation units for plastic segregation, among others.	It can be done manually.
Product	Compost	Compost

A third option is **home composting**, which, unlike the other two options described above, does not take up an area for the installation of the plant and equipment. It requires vermicomposting bins or specific units for the thermophilic process, and the investment required is mainly for distribution, and communication and engagement actions aimed at the population who adheres to this activity. One aspect that can be deemed critical is the quality control of the process carried out in each home and the numbers that refer to the amount that is actually treated and diverted from sanitary landfills, data that is important for municipalities.

Anaerobic Digestion

It is a process of controlled decomposition of biodegradable materials under anaerobic conditions in the absence of free oxygen, at temperatures that are appropriate for the natural mesophilic or thermophilic anaerobic phases, and species of facultative bacteria which convert organic matter into biogas and digestate. The following diagram shows a simplified basic treatment process:

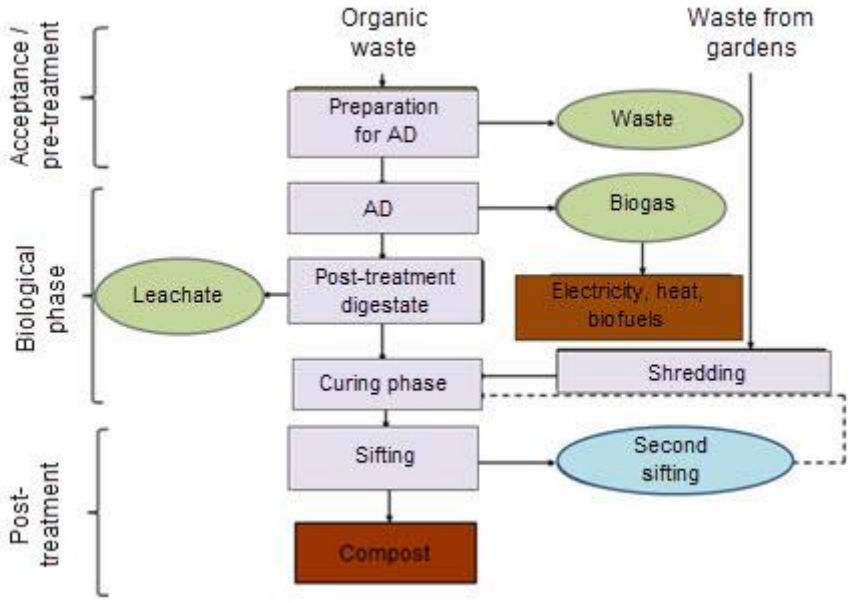


Figure 2. Adapted from RICCI, 2016.

For the purposes of this document, which is not intended as a description in technical detail of the anaerobic digestion process, the following aspects are important to have a basic understanding of the process:

- Input material: the three flows mentioned before, but also livestock wastes, wastewater and sewage sludge from the food industry;
- Segregation at source is preferable, however, there are systems which allow for mixed wastes to be input (see previous comment);
- In addition to organic wastes, fermentation inside the bio-digester requires the addition of substances that aid this process, such as flocculating agents, precipitants, enzymes, emulsifiers, among others, up to a maximum proportion of 2 per cent;
- There are different technological techniques and approaches to carry out the biodigestion of organic waste, with the following three being the most significant:
  - *Wet system*: requires intensive preparation of the input materials that includes maximum shredding and the addition of water (which can be reused or leached as a result of the process) in order to achieve a paste-like consistency;
  - *Dry system*: does not require the addition of water during preparation and consists of the continuous movement of waste inside the tank and the recirculation of the leachate;
  - *Extra-dry system*: most recent technology which allows for mixed wastes to be input in batches, which are enclosed in horizontal modules with leachate circulation from the decomposition itself.
- It is important to note that there is a more intense requirement for equipment in the preparation of the input material in the first two systems described above, but they all require care in the maintenance of biodigestion tanks and the treatment of wastewater;
- A composting step for the solid fraction resulting from the anaerobic digestion can be added to any of the systems;
- The products generated by AD are: biogas (which can be converted to electricity, thermal energy, vehicle fuel, or gas for domestic or industrial use); liquid fertilizer and compost derived from the digestate.

Mechanical biological treatment

The mechanical biological treatment (MBT) is generally designed to recover recyclable materials and stabilize the organic fraction of the mixed wastes collected from homes and commercial establishments. The following diagram shows the basic stages of an MBT plant including AD and composting.

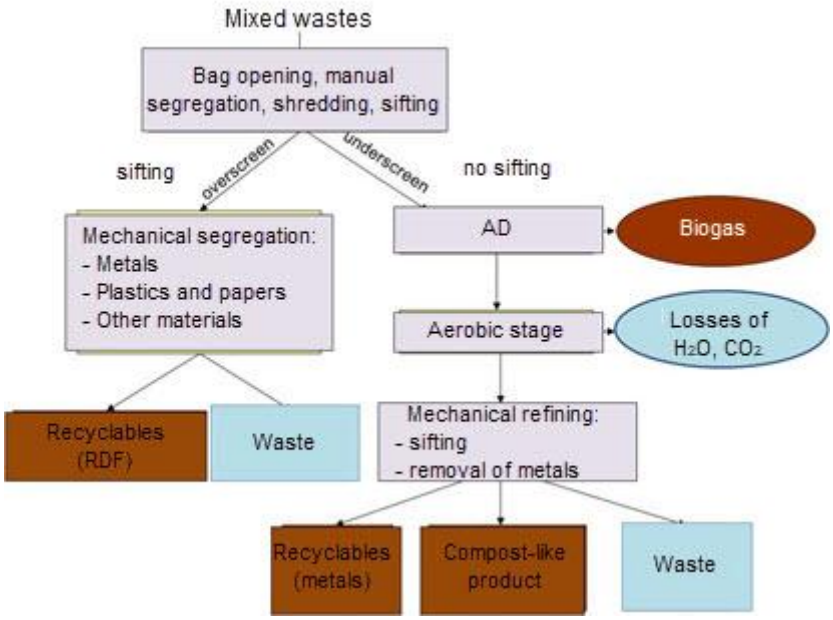


Figure 3. Adapted from RICCI, 2016.

The practical advantages of MBT plants are, above all, the reduction of:

- The volume and weight of treated waste, disposing of previously treated and biostabilized material in landfills, characterized by lower environmental impacts in the short term (less attractive for rodents, birds, insects, etc.) and in the long term (less GHG and leachate generation);
- The putrescible organic matter content of the mixed wastes which, in turn, becomes useful for recovering a "compost-like" fraction suitable for certain controlled applications, such as environmental restoration, sealing of landfills and other non-food agronomic purposes.
- In addition, the system selects and recovers the dry materials to be sent for recycling (plastics, metals, paper/cardboard, etc.) and/or increases the calorific value of waste by converting it into Refuse-Derived Fuel (RDF).

The MBT is basically a segregation system and, since mixed wastes from different sources of generation are received, it requires more care in the maintenance of the equipment and the wastewater treatment systems. The biological phase can combine both AD and composting treatments, and receive input materials segregated at source directly as a supplement to the input of mixed wastes at the beginning of the process.

The products generated are the same as those indicated in the two types of treatments described above: biogas, compost and fertilizers, in addition to the recovery of some recyclable materials of value to the market, such as metals and plastics, and production of RDF for industries from the drying of waste.

3.2 Strategies and actions that are important for the success of treatment plants

Selecting one or more treatment options for municipal organic waste is just a small step in a series of decisions and strategies for the successful operation of an integrated waste management system. It is one of the five pillars on which the municipality stands in the path toward effectively reducing greenhouse gas emissions from the solid waste sector.

The following topics describe the other four pillars and their strategic role in the success of the system planned by a municipality.

Segregation at source by generators

It is an initial action that ensures the quality of the products generated by the treatment of organic waste, especially compost, which has a better applicability in the production of food and, as a consequence, a higher market value.

Compost of mixed waste from an MBT plant. Picture: Marco Ricci

Compost of waste segregated at source from a composting plant. Picture: Marco Ricci

The following three large aspects must be taken into account when planning a system that begins with segregation at source of organic waste:

- Types of generators in charge of this segregation: home; small stores and services; large private generators such as supermarkets, shopping malls and hotels; large public generators, such as municipal markets and free-trade fairs;
- Flows of organic waste that will be the object of segregation at source and, consequently, selective collection: food waste, waste from gardens, fresh organic waste;
- The logistics of the selective collection of the waste flows that are included in the system, according to the selected generators: this will result from the decisions made for the two previous aspects and will add others, such as the equipment used for the segregation at source and collection, from small individual bins to collective containers appropriate for collection trucks.

As mentioned above, this is a complex decision and it takes time, but the start-up of a selective collection for organic waste segregated at source can follow the sequence presented below:

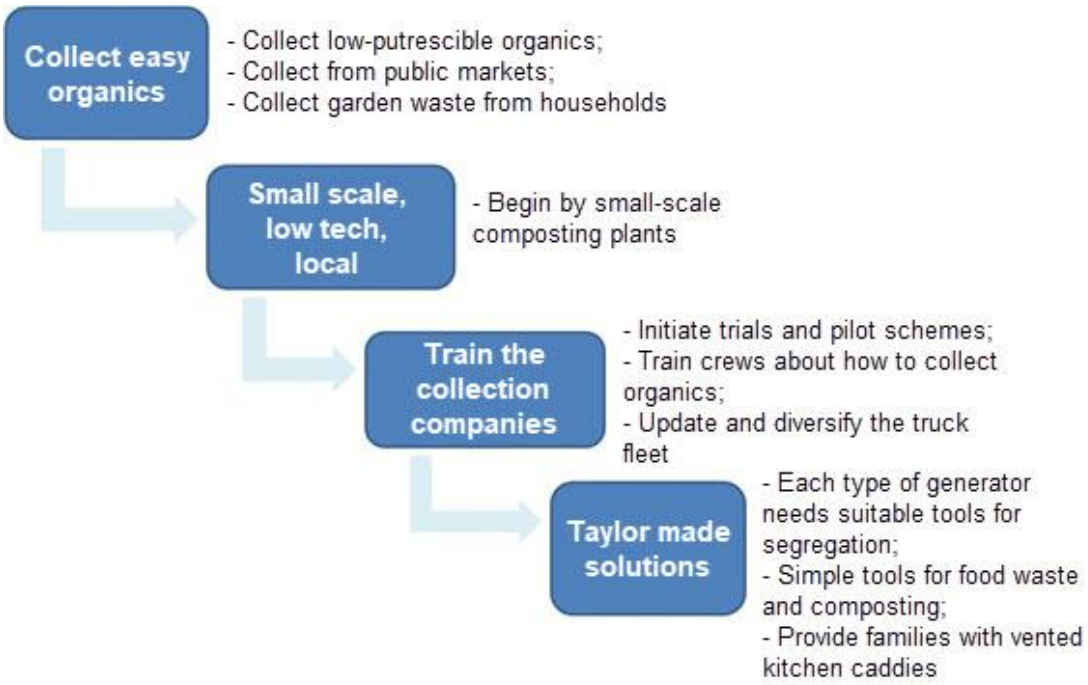


Figure 4. Adapted from RICCI, 2016.

Aside from the environmental and technical benefits regarding the quality of the treatment process with waste segregated at source, the act of separating the fractions makes citizens more aware of the impact of their actions on society. There are countless testimonies from people who got involved in the separation of their organic waste and started, by themselves, composting at home and even a vegetable garden, thus improving their eating habits and those of their families.

The incentive to segregation at source must be ongoing, which is why the municipality needs to strengthen the next pillar, communication.

Communication and social participation

Each actor of society plays a different role in the integrated management of municipal solid waste, and when the focus is placed on the organic fraction, there are changes in the routine and a need to break paradigms. Consumer behaviour, separation and disposal cannot be transformed only with “top-down” messages –a vertical communication model is not capable of generating the engagement necessary for achieving the goal of changing the relationship between each citizen and their waste, starting from the separation of the different fractions.

The first question, then, is how to make communication and the process for generating solutions to make society work jointly “horizontal”, which allows for society to take ownership of the problem and the solutions –in this case, how to motivate each member to adequately segregate organic waste. Below are some ideas about ways of improving communication for the management of organic waste:

Having a clear understanding of the difference between doing your part and being part

On the issue of MSW we should transcend the idea of "saving the planet", which refers to everything which has already been damaged by human action and brings a feeling of sadness and guilt, and move toward the notion of "smart cities", which alludes to the future, brings optimism and is in line with new urban phenomena. For example: it is important to make it clear that citizens are the beginning of the integrated system with valuation of organic waste.

It's possible to begin with those who are the most interested

The generation and disposal of waste are cultural features and habits which have formed over many years. A cultural shift needs to re-create the culture, which requires time and action from society itself, which is why it is more interesting to focus on those who have a certain affinity with the issue or who are already willing to examine their habits and start new practices. Young people, educators, householders and cyclists ensure success and good reviews in the pilot phase, aside from helping build the culture.

Internet is a far-reaching, low-cost tool

Thematic groups in social media become powerful tools for encouraging the exchange of suggestions and solutions among communities of users and the municipality, and #hashtags help disseminate ideas and concepts, such as #recycling, combined with images of positive attitudes such as replacing plastic or reusing food scraps.

At a slightly higher cost, it is also possible to use tools such as online games, produce web series with stories that refer to the best waste management practices and the position of digital celebrities on the issue.

Financing for the management of MOSW

"The accounts don't add up" is a very frequently heard maxim when discussing investments and operations of treatment plants for separate MSW fractions; numbers can be even more troubling in the municipalities of developing countries that don't have adequate budgets for basic services, such as collection, transport and final disposal of waste in landfills. In developing countries, waste management services can account for 20 to 50 per cent of the recurrent budget of a municipality, and 80 to 90 per cent of that is spent in waste collection only.

Unfortunately, just like in many countries in other continents, open dumps are still a reality in Latin America and show that, among other factors, the lack of financial resources is an aggravating factor for this situation and all of the social and environmental impacts that follow.

In order to start an integrated MSW system with collection and treatment of the organic fraction, the municipality must take into account the need to obtain financial resources for sustaining it:

- **Waste fee from households:** even though the municipal authority may use budgetary resources for basic sweeping, waste collection and disposal services in general, a system that includes selective collection and specific treatments requires additional resources. A fee applied according to the waste generated per household/number of residents/socioeconomic stratum of the area can help finance the new collection systems and the operation for the composting/DA plants. Discounts can be offered in cases where there is composting at home or there are community initiatives to reuse organic waste.

- **Income** from the sale of products such as compost, fertilizers and biogas by-products to local consumers: regulation and economic stimulus at the federal level are, to a large extent, crucial in encouraging this relationship; however, municipalities can begin mapping the market and even set an example by promoting the use of compost and fertilizers in public initiatives.

Governance

All of the pillars described above must be based on the solid foundation of governance, and aligned with the policies and regulatory frameworks at all levels, in order to support the integrated management of MSW and, especially, the use of separated fractions: recyclable materials, organic and dry waste.

National governments have the role of adopting framework policies that establish the guidelines, concepts, tools, goals, and financial and fiscal incentives for a system for the adequate management of MSW: beginning with sustainable purchasing and reducing waste, going through the recognition and valorisation of different waste fractions, up to the full closure of open dumps. Specifically, in the case of organic waste, the national sphere can set progressive goals for its valuation (percentage of generation) and even forbid disposal in landfills, and regulate the quality and application of compost. Subsidies for the production of electricity with biogas from MSW also stimulate investments in AD and MBT plants.

Municipal governments, on their part, are responsible for providing solid waste management services at the local level, which usually include waste collection, transport and treatment and/or disposal. Municipalities must also develop their own local policies, plans and programmes, bringing them in line with the framework at the national level, but instrumentalizing objectives that are tailored to their realities: definition of fractions, separation and collection dynamic, current and future types of treatment, role of each generator in the city, among others.

The existence of this regulatory environment at all levels is fundamental, but governance becomes present through the building alliances with industry actors and objective compliance control. National and municipal levels must also keep an open communication channel with civil society for receiving suggestions and criticism.

And because it is multi-sectoral, the waste sector and its policies need to be tied together with policies relating to food security, public health, climate change, family agriculture, education, social inclusion, water and energy security, and environmental protection in general.

4. Examples of successful practices and cases in Latin America

Even if slowly (considering the scale of the organic fraction of MSW), sustainable management is gaining growing attention in Latin America. There are two distinctive, yet complementary, approaches which show, according to a brief review and consultation with an expert[5] from the region:

[5] Digital communication with Marco Ricci on 04 November 2017.

- **Local bottom-up initiatives**, that are small-scale, aimed at conducting pilot projects that show that MOSW can be diverted from sanitary landfills and open dumps. There are hundreds of these initiatives, mainly based on local composting initiatives and where the capacity for effective participation of the local population is maximized;
- **Top-down initiatives** that have large scales, centred around cities and the urban situation, with the main goal of diverting organic products from final disposal and, often, with the goal of separating mixed organic waste from MSW. In this case, the participation of the population is minimal, while the investment in facilities is maximized.

From the point of view of governance, there are also good practices in relation to regulatory environments, policies and technical standards that favour a differentiated management of the organic fraction of MSW, and stimulate the market for its products.

Below are some good practices that illustrate the aspects discussed before and which are just a sample of what is already underway in Latin America.

Brazil

Resolution of the National Environment Council (CONAMA) No. 481/2017 on MSW composting

It sets forth criteria and procedures to ensure the control and environmental quality of organic waste composting and other measurements. Article 9, Section II, states that "Organic waste from the composting process of MSW must preferably originate from **segregation at source** in at least three fractions: dry recyclables, organic waste and waste". Therefore, it is in line with the guidelines of the National Policy on Solid Waste and the recommendations made for municipal integrated MSW management plans.

Small-scale composting plant in Lapa, São Paulo

This facility, with a capacity of 3,500 t/y was built in 2015 and is currently treating organic waste segregated at source from approximately 52 fruit and vegetable markets in the city of São Paulo; it is located inside the city area (Lapa district), and showcases the optimum management of composting and the production of quality compost.

Argentina

RenovAr (Renew) Programme for promoting renewable energies

On this past August the Government made the call for participating in the **RenovAr Programme and its Round 2** official, which asked for the submission of electricity generation projects from renewable sources for 1,200 megawatts; special attention was paid to initiatives based on biomass (100 MW at USD 110/MWh) and **biogas** (35 MW from projects at USD 160/MWh and 15 MW from sanitary landfills at USD 130/MWh), aside from wind and

solar. The terms planned for the execution of the projects will be, in all cases, two years, until mid-2019[6].

Recycling Centre in the City of Buenos Aires

The first recycling education and promotion centre of Argentina was opened in 2015, the **Recycling Centre of the City** which groups four treatment plants and an educational centre. One of the plants focuses on the treatment of **waste from gardens**, with a capacity ranging from 80 to 100 t/d, and another one focusing on receiving from 10 to 20 t/d of **organic waste segregated at source** generated by restaurants, culinary events, parks, equestrian clubs and zoos. Treatment is by composting, which is done inside a closed plant with the corresponding emissions' controls.

Chile

Municipality of Futaleufu and its collection scheme for household organic waste

The organic waste collection scheme was introduced at the same time as the intensive collection of recyclable dry materials and involved all the families in the touristic municipality of approximately 2,000 inhabitants in the capital of the district of the Palena Province, in the Region of Lagos. All houses were equipped with a set of bins of 3 x 40 litres (for organic waste, dry recyclables and waste), all waste is collected mostly at the doorstep and taken to a small local classification facility for dry recyclables and a composting facility, which started operating in November 2016, and in May 2017, around 300 kg of compost were distributed among the local population. The municipality has currently reduced the amounts of MSW found in the local landfill by 43 per cent.

"Training of Trainers: Strategic planning for waste management" Project

The Climate and Clean Air Coalition (CCAC) and the Swedish Environmental Protection Agency (SEPA) financed the "Training of Trainers[7]" programme aimed at increasing the number of cities that can undertake waste management actions in order to significantly reduce short-lived climate pollutants from the waste sector: methane and black carbon.
A course was offered under the programme to develop strategic waste management plans and train participants to assist their colleagues in the preparation of said plans, promoting interactive meetings with expert presentations, work sessions with smaller groups and tasks for participants to carry out. One of the training deliverables was a handbook that has been prepared as a tool to guide the trainers who will lead the next trainings.

[6] Information accessed at: https://biodiesel.com.ar/11611/programa-renovar-2-nueva-subasta-en-argentina-para-proyectos-de-generacion-electrica-a-partir-de-fuentes-renovables-por-1-200-megavatios-mw
[7] More information at: http://www.waste.ccacoalition.org/document/training-trainers-handbook-strategic-waste-management-planning

Colombia

"Sustainable cuisine: Promoting good sustainable production and consumption practices to reduce food waste and the generation of waste" in Bogotá.[8]

As part of the implementation of the National Sustainable Consumption and Production Policy, the Ministry of the Environment and Sustainable Development and the United Nations Environment Programme (UN Environment), through the Ten-year Framework of Programmes on Sustainable Consumption and Production (10YFP), decided to work jointly on a demonstration project with 37 restaurants in Bogotá, in order to identify the best practices in reducing food losses and wasting, one of the most important environmental and social problems for the country.

According to the diagnosis of the current state of solid waste generation, 72 per cent of it is made up by food waste, which, in turn, is mostly composed of waste from the preparation of food (71 per cent) and food scraps from clients (28 per cent). A good practices guide for reducing food wasting and reducing the generation of waste in restaurants was prepared based on the diagnosis, for the purpose of guiding restaurants in the development of an action plan for implementing the best practices in order to optimize planning, operation and management processes.

Five restaurants were selected to implement good practices regarding planning, obtainment and storage of raw materials, preparation of dishes, in the dining room, and in the management and reuse of food waste, aside from communication strategies to promote ownership by clients and raise awareness about this issue.

Municipality of Cajica and its selective collection programme for organic waste

A joint action of the Municipal Government of Cajica and the public utility company, Empresa de Servicios Públicos de Cajica S.A. E.S.P., the programme consists of segregation at source and selective collection of organic waste, trying to prevent them from mixing with the other wastes produced, enabling utilisation through composting or vermiculture processes. Users are households and schools, and the programme distributed bins through door-to-door campaigns and awareness, aside from talks in residential complexes and schools. There are seven selective collection routes on Monday and Tuesday, and organic waste is disposed of at IBICOL, a composter located at the Municipality of Tocancipa, thus preventing approximately 350 tonnes of organic waste from being disposed of in the sanitary landfill of Mondoñedo. The managers of the programme explain that the collection with segregation at source recovers up to 30 per cent of the waste generated in the municipality, aside from engaging the population in a more sustainable habit.

Ecuador

"Quito a Reciclar" Initiative

The Metropolitan District of Quito generates, on average, 2,200 t/d of solid waste, of which approximately 57 per cent is organic waste. The waste sector of Quito accounts for 13 per cent of the city's emissions, mostly from the decomposition of organic waste in the sanitary landfill El Inga. The Secretariat of Environment prepared the 2015-2025 District Environmental Plan (PAD, in Spanish) from a conceptual point of view of a sustainable Quito. One of the plans is the Integral Waste Management Master Plan (PMGIR, in Spanish), a guiding strategy for MSW management in Quito; in order to meet the goals of the PMGIR, the "Quito a Reciclar" (Quito

[8] For more information about the project: http://www.minambiente.gov.co/index.php/asuntos-ambientales-sectorial-y-urbana/sostenibilidad-sectores-productivos/seguridad-alimentaria-y-nutricional#documentos-inter%C3%A9s

to Recycle) programme has three main axes: recyclable waste, special household waste and organic waste.

The organic waste axis has several projects in different states: a) planning for differentiated collection of organic waste in 54 municipal markets and fairs to be used as input for an anaerobic digestion or composting plant. A vermiculture pilot project has been implemented and it processed 30 to 40 tonnes per month over one of the troughs of the sanitary landfill; b) a technical assistance project with the Center for Clean Air Policy (CCAP) for the creation of an Implementation Plant to reduce emissions of Short-Lived Climate Pollutants (SLCPs); c) project of the Municipal Association of Chocó Andino to promote a deconcentrated system for Decentralized Autonomous Governments of parishes (GAD, in Spanish) for the purpose of, through segregation at source, marketing recyclable material, converting organic material into compost and using it in organic orchards and others, and preventing non-recoverable wastes from being compacted and transported to be finally disposed of in the municipal sanitary landfill.

5. Toward a regional initiative: challenges and opportunities

Despite all of the environmental, social and financial opportunities in the treatment of the organic fraction of MSW, the actors involved in the municipal solid waste sector –in management, treatment, transport, final disposal – confirm that **there are still significant barriers to the development of initiatives for the recovery and valorisation of its organic fraction at the municipal, national and regional level.** Proof of this is the fact that only 8 per cent of the global generation of MSW is recovered through composting, and in Latin America it does not reach 1.5 per cent, even though the organic fraction accounts for two to four per cent of direct global GHG emissions and for up to 60 per cent of the composition of waste in the cities of the region.

In view of this, the United Nations Environment Programme (UN Environment) is promoting a joint effort with other institutions, such as ABRELPE, to understand these barriers, identify the needs and priority actions in the different countries, and promote coordinated actions in the region.

The Seminar "Management and utilisation of municipal organic waste: the challenges of Latin America", held in São Paulo on 22 and 23 November 2017 for these purposes, gathered relevant actors from the sector from different Latin American countries to debate and contribute to identifying the main elements of a future coordinated regional initiative to overcome the barriers and leverage good practices. The elements discussed on each day are described below[9]:

5.1 Conclusions from the regional seminar

Reached audience: **62 enrolled participants** representing **seven countries** [10] , **fifty municipalities, two provincial governments, 14 companies, two international organizations and four financing agencies.**

[9] The agenda is attached to this report.

[10] Brazil, Argentina, Chile and Paraguay with representatives of the national governments; Uruguay, Colombia and Ecuador with representatives of municipal governments.

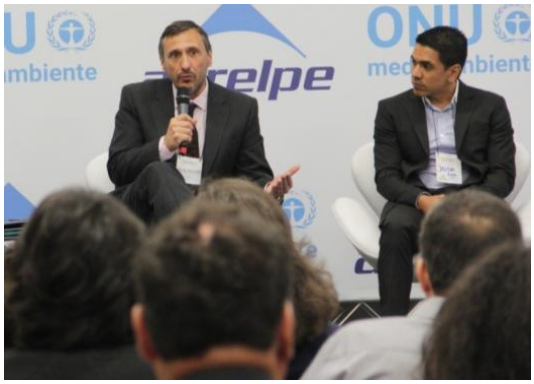
Jordi Pon, Regional Chemicals and Waste Coordinator, UN Environment

Main contributions from the three interactive sessions with representatives from national and municipal governments:

"Talk show" 1. Large cities of the region and their experiences in organic waste management

Interviewer: Carlos Silva Filho, ABRELPE

Edson Tomaz Filho, President, Municipal Urban Cleaning Authority of **São Paulo**, **Brazil**



Alejandro Cittadino, Assistant Manager, Environmental Monitoring and Assessment, State Ecological Coordination of the Metropolitan Area (**CEAMSE**), **Argentina**

José A. Hernández, University Professor, Secretariat of Environment of **Medellin**, **Colombia**

Thorben Knust, Advisor, Secretariat of Environment of **Quito**, **Ecuador**

Participants in the session

Status, challenges and barriers of organic waste management: the scenario in large cities

- There is an **issue of scale** in large cities, where some need to deal with up to 20,000 tonnes of solid waste per day, most of which is from households and mixed;
- The **very densely populated urban grid** still requires great investment in order to reach a satisfactory coverage for the regular collection service;
- Due to the scarcity of available surfaces, the intense urban occupation and rejection of treatment plants near residential areas, the structure that is needed for an integrated solid waste management is increasingly **further away from generating centres.** This makes **transport logistics more expensive.**
- Organic waste management is mostly carried out through **experimental initiatives and/or small-scale pilot projects**, precisely in order to build trust both in financial and technical terms. The greatest barrier to the transition from this pilot phase toward a broader and concrete action is the need for financial resources to make it viable.
- Another topic considered to be sensitive is the process for **obtaining the environmental permits** required according to the size and capacity of the treatment plant, which can last for many months, if not years, to be successfully processed.
- **The fractions that are easier** to obtain with segregation at source are **green waste** from the maintenance of parks and gardens, and **organic waste generated in street fairs, markets and commercial generators** such as hospitals, restaurants and others. However, the initiatives that address this are incipient, whether because the municipality needs to regulate and supervise the management done by the private generator, or requires transport to the existing municipal structure and charges for the service. Besides, in order to offer one of these two paths, a coherent management planning that endures changes in the municipal administration is required.
- Domestic segregation at source is only successful with a **consistent communication strategy** that requires constant contact with the population. And often this dialogue must be carried out door-to-door and be linked to other issues of interest for the population, such as education and health.
- A **reliable and up-to-date database** is the aspiration of many municipalities for managing MSW, nevertheless, the challenges to building one range from obtaining reliable information to the validation and consolidation in an easily accessible online system.

- No actions to promote the **minimization of food waste** and resulting generation of organic waste are carried out yet as part of an integrated management system in municipalities. But their importance is acknowledged and there are occasional initiatives that mainly work with commercial generators (restaurants, street fairs, markets) and public interest units, such as **schools**, with the latter two considered as **points for good practices** among the population.

"Talk show" 2. Small and medium-scale management: joint efforts for the wellbeing of all

Interviewer: Gabriela Otero, ABRELPE

Luiz Celso Silva, Collection Manager of the Urban Cleaning Department of **Curitiba**, **Brazil**

Mimo Ravagnani, Superintendent of **Consorcio Consimares**, **State of São Paulo**, **Brazil**

Geraldo Reichert, Technical Advisor of the Urban Cleaning Department of **Porto Alegre**, **Brazil**

Eduardo Costa, Director of Social Development and Inclusion **of Maldonado**, **Uruguay**

Participants in the session

Strengths and weaknesses that affect the management or organic waste the most

- Selective collection systems for the **recyclable dry fraction** of MSW **have already been implemented**, as door-to-door services and/or voluntary drop-off points, in some municipalities with a 100 per cent territory coverage.
- Nevertheless, the **quality of the waste collected has decreased** in recent years due to the influence of two factors mentioned in the session: an **economic crisis** which has lead people to collect the most valuable materials before the trucks of the municipality; a **lack of a** constant **communication** to reinforce what recyclable materials are and how to sort at home in order to avoid contamination and the loss of value;
- One factor that can help improve the quality of the dry fraction is the **involvement of the packaging industry as a contributor** of resources to municipalities in the context of a reverse logistics system.
- On the other hand, there is practically **no selective collection of the organic fraction from households**, even though speakers are unanimous in stating that segregation at source is essential to enable the treatment of organic waste by generating products with market value, such as compost, biofertilizers and energy in all of its different forms. In addition, **its introduction can improve the quality of the solid fraction** and, therefore, its recyclability and market value, other source of resources for the integrated waste management system;
- The **municipal budget** for urban cleaning services **is not sufficient** to cover the demands of collection, transport and proper final disposal of MSW. The need for a **specific fee** applicable to households for an integrated waste management system, including the treatment of the organic fraction, is unanimous, but **its implementation is** a major **political taboo** in the region.
- The treatment of organic waste goes **beyond techniques and technologies;** it requires "management", as one of the speakers explained. This means previous planning, even before making a decision on the type of treatment, incorporating all of the involved actors, compliance with possible environmental restrictions, the income necessary for its operation and the expected products;
- Once again, it was stressed that a **constant dialogue** with the population is **critical in organic waste management**. Not just at the time of communicating how to properly segregate at source and the collection schedule, but also to share the results achieved, as well as any possible treatment problem, avoiding reactions of opposition to a composting plant, for example, due to occasional problems with bad smells;
- The existence of **national laws and regulations** provides legal certainty to regional and municipal initiatives, and should be **improved** more and more.

"Talk show" 3. The role of national governments in the promotion of good organic waste management practices

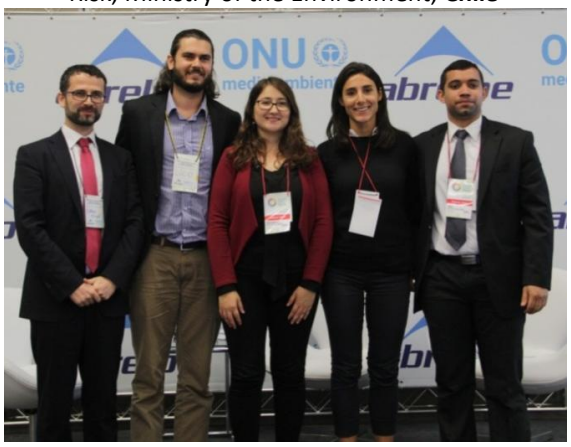
Interviewer: Jordi Pon, UN Environment

Lucio Costa Proença, Secretariat of Water Resources and Environmental Quality, Ministry of the Environment, **Brazil**

Carla Colucchio Leskow, Secretariat of Environment and Sustainable Development, **Argentina**

Carik Pinto, Office of Waste and Environmental Risk, Ministry of the Environment, **Chile**

Pablo Adrían Fernández Castillo, Secretariat of Environment, **Paraguay**



Participants in the session

Several countries with the challenge of promoting the valorisation of organic waste

- Out of the region of Latin America, **seven countries were represented in the event** and provided the audience with views from their national perspective on the issue. These views, even though they are almost the same point by point, were a sample of the **legal,**

technical and socio-environmental complexity of the region and which result in different stages for the management of solid waste and, even more so, for the use of the organic fraction;

- All of the countries in the region still have **active dumpsites**, some of which are in capital cities. In spite of the existence of national laws that forbid the operation of these sites, due to the difficulties in monitoring the territory and political issues they are allowed to continue;
- Encouraging the utilisation of organic waste is an important strategy for diverting them from environmentally inappropriate final disposal sites and contributing to their closure. This would not only eliminate a source of pollution, it also promotes job creation and the generation of revenue from new business fronts, and eliminates situations of social risk from dumpsites.
- The role of national governments must be along **four strategic axes**:
    - The **creation** (or elimination, depending on the point of view) of **fiscal and legal instruments** that encourage investments from the private sector in **businesses related** to the treatment and utilisation of **municipal organic waste**. For example, in federal tax exemptions for equipment for treatment plants, in the valorisation of the cost of the energy produced from MSW, among others;
    - In the creation of **technical standards** that regulate the products generated in the utilisation of organic waste, such as compost and biofertilizers. Countries like **Brazil** and **Colombia** are already moving forward in that direction with resolutions and regulations for compost produced from MSW;
    - **Generation of knowledge** geared toward the public and private actors of the sector for the development of projects and actions pursuant to these technical standards. Along this line, **technical guides and/or manuals** with a national scope about composting and other organic waste treatment methods can also act as encouragement for new initiatives, and they can even open a window of opportunity for financing of a pilot project based on these materials;
    - **Integrating the issue with other related policies such as food security, water resource preservation and sustainable consumption in public policy.** Composting organic waste encourages the creation of vegetable gardens which, in turn, influence new eating habits, and this, in turn, starts a movement that has significant impacts as the scale increases: from carbon sequestration through the application of compost on the soil to the mitigation of pollutant emissions from the local consumption of products, avoiding the long-distance transport of food.
- In this respect, the **sanitation areas** (where MSW management is inserted) and **agriculture** can promote **integrated actions** that mutually benefit the government and the population. Mainly in technical cooperation for eliminating the barriers to the use of compost in agricultural production;
- This issue provoked a very interesting debate on whether the **decision on one treatment must be based on the product it can generate, not the process itself.** As for the case of compost generated through composting treatment, the following question was posed to speakers: **is there enough space in your territories for the application of the compost generated by the treatment of all organic fraction?** The answers were very diverse and gave rise to a great exchange with the audience:

- The representative from **Chile** mentioned some cases in which municipalities "donate" their surplus to other neighbouring administration, since they are not able to absorb all of the compost they produce within their territory;
- For **Brazil** there would still be a need for compost, said the representative of the national government, based on studies and estimates already conducted by experts in the area. Aside from large farming areas and the growing urban agriculture movements in the country, there are areas undergoing restoration which could absorb the material;
- **Argentina** also stated that it has the capacity to absorb the material, but reflected on the fact that the issue goes beyond compost. Other alternatives, such as anaerobic digestion and composting integrated with a mechanical biological treatment, produce by-products such as the biostabilized material, digestate, in amounts greater than the demand or application possibilities. Since there are no regulations that establish quality parameters for compost, it is not applicable in agricultural activities, but mostly as coverage in sanitary landfills;
- **The demand must focus on adequately planning, the definition of the project and the type of treatment,** taking into account all logistic aspects and the characteristics of the neighbourhood of the plant. For example, it is necessary to wonder whether the main goal is producing compost or adequately disposing of organic waste, assessing the costs and benefits of the decisions. For the first option, it is necessary to consider the environmental restrictions for transport, the distances to consumer markets, among others: there is a possibility that more pollutants could be emitted than those absorbed by the application on the soil.

- **Communication channels between national governments and municipalities are varied**, ranging from online forms and periodical surveys, to decentralized work groups and decentralized offices that act as intermediaries in discussions. All speakers spoke of difficulties maintaining good municipal initiatives up to date, especially due to the size of their territories and the number of local administrations, which range from hundreds to thousands in some countries.
- Finally, representatives from national governments also noted the importance of **regional cooperation** for the purpose of sharing experiences, good practices, successful cases, regulatory models, etc.

5.2 Conclusions from the working group

The session on the second work day was attended by 30 representatives from municipalities, provincial governments and national governments, as well as experts from the areas of communication and organic waste treatment. Activities were divided into two modules, which provided the following information and results:

Presentation from the representative of one of the financing agencies attending the meeting.

Participants interacted in working groups in the second part of the meeting.

Part 1. Presentation with financing agencies operating at national and regional levels

Four financing agencies were invited to present the types of applications and the lines of financing/investment available for the treatment and use of municipal organic waste, which include loans, cooperation and technical advice, capital funds, guarantees and initiatives. Organic waste, however, is still not common in their portfolios. The different presentations are summarized below:

Juan Alfredo Rihm and Gustavo Mendez -Inter-American Development Bank **(IDB)**

The Inter-American Development Bank (IDB) has 16 operations connected to waste for a total of USD 515 million in 11 countries in the region, aside from technical cooperation for USD 6 million. In addition, the IDB is in the preparation stage for loan operations for a total of USD 141 million. In another line of work still under development, the IDB will seek to support

projects related to preventing food waste, using the hashtag #SinDesperdicio (#NoWaste) as a communication too.
An example of a funded project was the implementation of an anaerobic digester in the municipality of Xalapa, Mexico, used for managing organic waste. The process contributes to reducing the disposing of waste in landfills, as well as to the production of the electricity used in the city.

Cecilia Guerra, Development Bank of Latin America **(CAF)**

The CAF provides funding and support to projects that focus on the generation and dissemination of knowledge and the integral development of the region, with resources amounting to USD 20.7 billion. Aside from a financing agency, the CAF also mediates the access of cities to international funds, such as the Global Environment Fund (GEF), which focuses on the energy sector; the Green Climate Fund (GCF), which finances projects in developing countries to promote mitigation and adaptation to climate change; and the Adaptation Fund (AF), which finances adaptation projects and programmes in developing country Parties to the Kyoto Protocol. However, the bank still has no experience specifically financing projects related to organic waste management, but exhibits great potential because it works directly with the municipal sector, where the demand for the sanitation sector – including waste management– is high.

Morenno de Macedo and **Mylenne Veloso** -Caixa Econômica Federal **(CAIXA)**

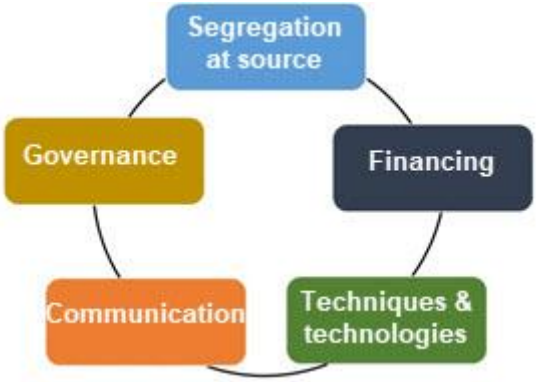
CAIXA operates in Brazil and finances projects based on corporate and government funding, whose resources are allocated to states and municipalities, as well as companies and contractors with a strategic focus on projects connected to environmental sanitation. Another financing line for the agency is the Socio-Environmental Fund, which supported social and environmental projects and actions connected to sustainable development.
One example of this was the call for the implementation of integrated projects for segregation at source and organic waste recycling in municipalities or inter-municipal consortiums in charge of managing solid waste. The non-reimbursable investment forecast is BRL 10 million distributed among 11 selected projects.

Daniela Cristina Grisa, National Economic and Social Development Bank **(BNDES)**

The BNDES finances and supports projects aimed at providing universal access to basic sanitation services. Even though waste treatment can be financed, the bank has no experience financing projects related to organic waste. Another significant line of financing granted by the BNDES, which can also help improve solid waste management is the Tax Administration and Management Modernization of Basic Social Sectors (PMAT, in Portuguese), which enables municipalities to obtain investments for strengthening the managerial, regulatory, operational and technological capacities of the municipal administration.

Part 2. Work groups on strategic axes for promotion of organic waste utilisation

The work dynamic proposed invited participants to work on issues strategic[11] for promoting the treatment and utilisation of the organic fraction of MSW generated in the region:



Taking the report distributed in advance and the discussions from previous day as reference, participants formed four groups, each working under one of the previous topics, except for the segregation at source, which, as it turned out, cuts across all of them. In order to kick start the conversations and guide the discussions toward the contributions for the regional proposal, one or more questions were suggested for each topic:

Communication	**How to make organic waste management a more attractive subject, promoting separation at source?**
Financing	What kind of **pilot projects or initiatives do you think could be promoted as priorities in your municipality or country? What regional cooperation actions would be necessary?**
Governance	What could be improved in connection to the **legal framework of your country and the local market conditions?**
Techniques and technologies	What would be the **main technical or operational doubts for implementing treatment initiatives in your country or city? What other barriers do you think should be taken into account?**

The results of each group in relation to each of the strategic topics discussed are summarized below:

Communication

Initially identified problems:	**Communication actions have the potential of:**
- The appearance of organic waste still gives people a feeling of "disgust"; - Population, governments and private sector barely recognize the recycling potential of this fraction;	- Working on a communication focused on ethical and moral issues related to citizen responsibility around action such as segregation at source and home composting; - Recover the connection with nature and, at the same time, promote a modern "Citizenship 2.0",

[11] See Chapter 3 of this document.

- This is reflected in the absence of structures that provide logistics and incentives to local initiatives.	which recognizes a more sustainable way of life as part of smart cities; - Education for promoting the self-management of solid waste, with local initiatives that are more focused on communities. Here, the benefits are manifold, such as extending the useful life of landfills, opportunities for improving the treatment techniques for organic fractions and the use of low-cost, high-impact digital tools, such as social media.

Financing

Aside from what was presented and discussed about financing in the presentations during part 1 of the meeting, this group identified other relevant issues that require investments, and what stood out the most was training for the technical teams of municipalities, specifically in:

- Diagnosis of the gravimetric composition of MSW;
- Methodological reference for the development of municipal integrated management plans;
- Development of environmental education and communication programmes for the management of MSW.

They also mentioned, in a broader sense, the creation of a good practices platform for the region (with different levels).

Governance

The group consisted of representatives from five countries of the region and concluded that there are five main topics on which to improve in relation to the legal framework of their countries, and working toward regional integration:

- Creation of a regulation/law for the valorisation of organic waste, which incorporates:
  - Graduality/increasing goals (%/year);
  - Incentives and penalties;
  - Resource investment;
  - Awareness toward a more active involvement of citizens;
  - Inclusion of fees that will enable the sustainability of waste management system;
  - Most advisable techniques and technologies for each reality.
- Suitability of the regulatory framework of each country;
- Consideration of local initiatives that are existing and successful as references;
- Promote public-private partnerships;
- Short-term actions: voluntary agreements between countries in the region; stimulus to pilot projects; support for new productive processes that encourage the utilisation of the organic fraction; linkage with current regulation; recognition of exchange opportunities among countries.

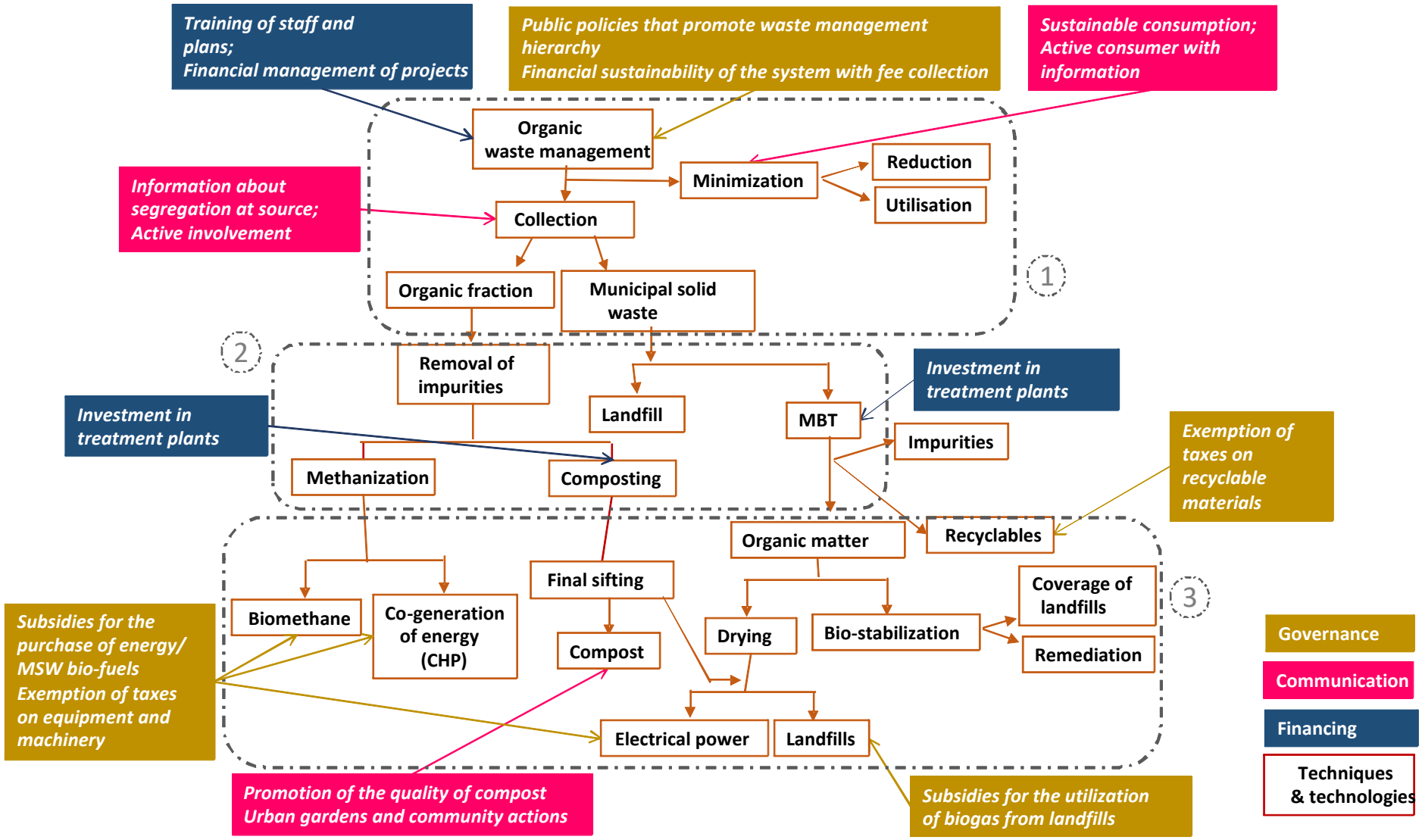
Techniques and technologies

The main result from the group was the illustration that will be used for summarizing the work from the 23rd in the following section. However, their internal discussion, as well as interactions with other participants at the time of making their presentation raised the following elements:

- Due to the characteristics of the organic fraction generated in the region, it is possible to say that, from a technical point of view, the same treatment possibilities can be applied throughout different territories.
- The treatment options presented below must be preceded by some decisions that minimize waste generation and the segregation of the different fractions at the source (1). Two possible recovery pathways (2) are then open, resulting in the generation of products, the recovery of recyclable materials and a small amount of what is considered as waste and is sent to sanitary landfills (3);
- From the point of view of regulations, there are differences in the steps taken by each country, which is reflected in the initiatives and the understanding of the process for using organic waste. The technical standards and laws that provide legal certainty to the different pathways for treating municipal organic waste appear as crucial;
- The financial resources invested, whether through public-private partnerships, financing and non-reimbursable funds, help put treatment plant projects into operation, but do not ensure the adequate management and operation of a system that goes beyond technology and equipment;
- Therefore, municipalities and solid waste management consortiums must undertake a strong commitment to: guarantee financial sustainability through a tax or other instrument; make the decision on an appropriate technological route for the composition of its waste and its budget; constant communication with the population.

Broader perspective of results

At the time of working together, it was obvious that the different strategic issues are, in fact, cross-cutting and interconnected for any system to move forward. The following illustration is thus an attempt to bring together and, in a way, position the intervention/contribution for each issue on a broader view of the management and use of organic waste in Latin America.


Training of staff and plans;
Financial management of projects
Public policies that promote waste management hierarchy
Financial sustainability of the system with fee collection
Sustainable consumption; Active consumer with information
Organic waste management
Minimization
Reduction
Utilisation
Information about segregation at source; Active involvement
Collection
Organic fraction
Municipal solid waste
1
2
Removal of impurities
Landfill
MBT
Investment in treatment plants
Investment in treatment plants
Impurities
Exemption of taxes on recyclable materials
Methanization
Composting
Organic matter
Recyclables
Final sifting
Coverage of landfills
3
Biomethane
Co-generation of energy (CHP)
Drying
Bio-stabilization
Remediation
Compost
Subsidies for the purchase of energy/ MSW bio-fuels
Exemption of taxes on equipment and machinery
Electrical power
Landfills
Promotion of the quality of compost
Urban gardens and community actions
Subsidies for the utilization of biogas from landfills
Governance
Communication
Financing
Techniques & technologies

6. Reference materials and experts

The development of this document was supported with materials prepared by experts recognized on a regional and international level:

Technical Guidance on the Operation of Organic Waste Treatment Plants and **Strategy for Organic Waste Diversion – collection, treatment, recycling and their challenges and opportunities for the city of Sao Paulo**, two reports prepared by **Marco Ricci-Jurgensen** in 2016 within the scope of the technical assistance project of the Climate And Clean Air Coalition in the Municipal Waste Initiative for the city of São Paulo, Brazil.
Available from: http://www.waste.ccacoalition.org/document

Sustainable Financing and Policy Models for Municipal Composting, publication included in the Urban Development Series of the **World Bank**'s Social, Urban, Rural & Resilience Global Practice, 2016.
Available from: http://www.waste.ccacoalition.org/document

Strategic Trends in Organic Waste Management and Treatment and its Applicability in Developing Countries - presentation from expert **Felipe Colturato** (Methanum Waste & Energy) at the CCAC Waste Initiative Global Workshop for City Leadership, Baltimore, USA, 2016.

Handbook on Communication and Engagement for Solid Waste Management – publication commissioned by ABRELPE to the expert **Guilherme Turri** in the context of the technical assistance project of the Climate and Clean Air Coalition through the Municipal Waste Initiative in the city of Curitiba, Brazil, 2017.
Available soon from: http://www.waste.ccacoalition.org/document

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